
REPORT OF THE LIGHT-HOUSE BOARD.

OFFICERS OF THE LIGHT-HOUSE BOARD.

[Light-house Board of the United States, organized in conformity to the act of Congress approved August 31, 1852.]

LIGHT-HOUSE BOARD.

HON. GEORGE S. BOUTWELL, Secretary of the Treasury, *Ex-officio* President.

REAR-ADMIRAL W. B. SHUBRICK, United States Navy. PROF. JOSEPH HENRY, LL.D., Secretary Smithsonian Institution. BREVET MAJOR GENERAL A. A. HUMPHREYS, Chief of Engineers, United States Army. BREVET MAJOR GENERAL J. G. BARNARD, Colonel of Engineers, United States Army.	REAR-ADMIRAL C. K. STRIBLING, United States Navy. PROF. BENJ. PEIRCE, LL. D., Superintendent Coast Survey. REAR-ADMIRAL THORNTON A. JENKINS, United States Navy. MAJOR GEORGE H. ELLIOT, Corps of Engineers, United States Army.

CHAIRMEN OF COMMITTEES.

Finance.—GENERAL HUMPHREYS.
Engineering.—GENERAL BARNARD.
Experiments.—PROF. HENRY.

Lighting.—PROF. PEIRCE.
Floating Aids.—REAR-ADMIRAL STRIBLING.

The Chairman and Secretaries are *ex-officio* members of all committees.

MEMBERS OF THE BOARD EMPLOYED IN THE OFFICE.

REAR-ADMIRAL W. B. SHUBRICK, United States Navy, Chairman.
REAR-ADMIRAL THORNTON A. JENKINS, United States Navy, Naval Secretary.
MAJOR GEORGE H. ELLIOT, Corps of Engineers, United States Army, Engineer Secretary.

CLERKS.

ARNOLD B. JOHNSON, chief clerk. WILLIAM D. O'CONNOR, corresponding clerk. FRANK BAKER, accountant.	BRUCE SMALL, examining clerk. SAMUEL STONE, recording clerk. JOSEPH McMAKIN, draughtsman.

REPORT OF THE UNITED STATES LIGHT-HOUSE BOARD.

TREASURY DEPARTMENT,
Office Light-house Board, October 31, 1870.

SIR: By your direction, the following report of the operations of this board during the last year is respectfully submitted:

The detailed statements under the heads of the respective districts, based mainly upon the annual reports of the engineers and inspectors, embrace the work which has been done; that which has been laid out for the current year; and the present condition of all the aids to navigation, with such remarks and recommendations in regard to improvement of existing and the establishment of such new aids as seem to require the attention of Congress at this time.

The light-houses, and light-vessels, (so far as the exhibition of efficient lights is concerned,) are, it is believed, equal to any in the world, and those beacons and buoys actually in position are efficient day-marks to guide clear of the obstructions for which they were established. For those light-stations at which extensive repairs and renovations are needed, special appropriations are recommended. The annual estimates submitted for the fiscal year ending June 30, 1872, show a small aggregate increase over those of the last year, but not in excess of the aggregate increase in the number of new aids established and authorized to be established during the present year.

A large number of additional aids to navigation have been authorized, which have been established during the present or will be completed during the next fiscal year, which must be provided with keepers and supplies, &c. For the last two years the appropriations for the support of the light-house service have been considerably less than the detailed estimates submitted by the board, and for the current year the difference was \$99,104, to which add the sum of \$99,214, which reverted to the treasury under the operations of the fifth section of the act of July 12, 1870, making appropriations "for legislative, executive, &c., expenses of the Government for the year ending June 30, 1871," giving an aggregate sum (within a few dollars) of \$200,000, which is, so far as calculations could be relied upon, and independently of the thousand casualties arising out of freshets, storms, running ice, &c., to which this service is daily liable, a clear deficit of necessary funds, although not such in the legislative sense, inasmuch as no indebtedness has been, or will be, incurred for which ample funds have not been previously provided. With the balances of last year's appropriation, it was expected, as soon as the appropriations for the current fiscal year were made, to be able to provide a number of spare buoys to replace the many large and expensive ones which have been lost during the last two or three years; to repair vessels greatly needing attention at this time; and to put such light-stations as are suffering for want of repairs at this time in good

order. To have used these supposed available balances before the passage of the appropriation, (July 15, 1870, for the ensuing year,) would have left the board without available means to meet any demand, however pressing and important, which might have been made in the interim, on account of accidents or storms. It has always been the custom of this office, in preparing the annual estimates for supporting the existing and authorized aids to navigation, to make as close a calculation of items, quantities, and prices, as the information at command would allow, and to endeavor to so manage the disbursements as at all times to have ample funds available to supply any losses and repair any damage, however serious, to which this service is so peculiarly liable during the winter months. The estimates for special objects are in many cases simply reappropriations of funds for authorized aids, which have reverted to the treasury under the act of July 12, 1870, and in others, for objects of sufficient importance to justify their being brought to the notice of Congress.

Over one million of dollars reverted to the treasury under the operation of the fifth and sixth sections of the act of July 12, 1870, on account of appropriations for *special objects*. Many of these sums were for light-houses on new sites, which had to be purchased, titles approved by the Attorney General, and cession of jurisdiction granted by the legislatures of the States in which they were to be placed, before the work could be commenced; others whose completion was delayed for want of time by the breaking out of epidemic diseases, or the inability to carry on work during certain months of the year, on those parts of the coast where they were authorized to be established.

Light-house works of construction cannot be carried on safely and economically north of Chesapeake Bay during the winter months, nor can they be economically carried on, on the southern coast, during the months when epidemics almost always prevail, more or less severely. Besides these drawbacks and difficulties, these works, from their greatly exposed positions on the sea or lake coast, require not only to be built of the best and most durable materials that can be procured, but those materials ought not to be put together too hurriedly, and hence, as a rule, the large and expensive structures require a much longer time than one year to commence and complete them properly.

Under the act of March 3, 1795, all special appropriations for light-houses ran two years until July 25, 1848, when the following joint resolution was passed:

A JOINT RESOLUTION extending the time for the erection of certain light-houses.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That so much of the sixteenth section of the act approved March three, seventeen hundred and ninety-five, entitled "An act making further provision for the support of public credit and for the redemption of the public debt," as requires that sums remaining unexpended for two years after the year of appropriation shall be carried to the account of the surplus fund, shall not apply to the act approved March three, eighteen hundred and forty-seven, entitled "An act authorizing the erection of certain light-houses, and for other purposes," until two years after the first meeting of the legislature of those States in which said light-houses are to be located.

Approved July 25, 1848.

And a similar proviso has been attached to many subsequent appropriation bills, among which may be cited those of March 3, 1849, March 3, 1851, August 31, 1852, and March 3, 1853. It is respectfully submitted that a similar clause ought to be attached to future appropriations for light-house works, and made retroactive so far as to embrace those appropriations contained in the bill for light-houses approved July 15, 1870.

It not unfrequently happens, that appropriations are made in the absence of estimates from this board, or information as to the real requirements, and in such cases frequently a second appropriation is asked for before commencing the work. In cases of this sort, it appears that it will be necessary hereafter to add the words, in all cases of additional appropriation for any object, "*in addition to former appropriations or balances,*" to render the former ones available.

Last year an estimate was submitted for completing the light-house at Race Rock, Long Island Sound, of \$110,000, (for which \$90,000 had previously been made,) but concluding, from new developments at the locality, that so large a sum would not be needed for that work during the year, (and if at all, not for some time after,) the Committee on Appropriations was requested to reduce the estimate to \$10,000, which was done; but as the words "*in addition to former appropriations*" were omitted, the sum of \$90,000 (which amount only could be of any use economically during the working season in carrying on the works) was unavailable after June 30, and the appropriation of \$10,000, made July 15, 1870, only could be used, and the work was practically arrested for the year. Unless balances of appropriations are made available for continuing authorized works to completion, which cannot be safely and economically carried on during the summer season at the South and the winter season at the North, and allowed to be expended during the succeeding fiscal year, the efforts to complete works in too short a time may result in the introduction of bad materials, slovenly work, and higher prices paid for both than a true economy and the interests of the public service would justify.

The following changes in the members of the board have been made since the date of the last annual report: Brevet Major General Richard Delafield, Brigadier general of engineers, and Brevet Brigadier General Hartman Bache, colonel of engineers, retired from the board, February, 21, 1870, and were succeeded by Brevet Major General A. A. Humphreys, Chief of Engineers, and Brevet Major General J. G. Barnard, colonel of engineers. Brevet Brigadier General O. M. Poe, major of engineers, was relieved April 12, 1870, by Major George H. Elliot, Corps of Engineers.

The board has to deplore the loss by death of two of the engineer officers of the Army in charge of light-house works, while in the midst of their arduous labors, during the past year. Brevet Major George Burroughs, Corps of Engineers, in charge of light-house works in the sixth district, died suddenly at Charleston, South Carolina, January 22, 1870, and Brevet Brigadier General C. B. Reese, major of engineers, in charge of light-house works in the eighth district, died of yellow fever at Mobile, Alabama, September 22, 1870.

While the board recognizes the great value of the services of both of these officers, who had a short time previous to their deaths entered upon light-house duties assigned to them by the War Department, it is especially due to the memory of the late General Reese to bear testimony to the great zeal, energy, and ability which he invariably displayed in the performance of his duties, and in his intercourse with this office.

FIRST DISTRICT.

The first district extends from the northeastern boundary of the United States, (Maine,) to and including Hampton Harbor, New Hampshire.

Inspector.—Commodore J. B. Hull, United States Navy, to October

1, 1870; Commander A. E. K. Benham, United States Navy, present inspector.

Engineer.—Brevet Brigadier General J. C. Duane, lieutenant colonel of engineers, United States Army.

In this district there are:

Light-houses and lighted beacons	48
Day or unlighted beacons	50
Buoys actually in position	323.
Spare buoys for relief and to supply losses	236
Tender, steamer <i>Iris</i>	1
Tender, (sail) schooner <i>Wave</i>	1

The following numbers, which precede the names of stations, correspond with those of the "Light-House List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

8. *Petit Menan, coast of Maine.*—At this light station a steam fog signal has been provided and placed during the last year. A cistern has been built and a well dug to supply the necessary fresh water for the use of the keepers and for running the fog-signal engine.

Prospect Harbor, Maine.—The light at this old station was reëxhibited during the last year, to serve as a guide to the harbor of refuge which it marks. The tower, lantern, and keeper's dwelling were thoroughly renovated and repaired and the necessary out-buildings erected. A new lens apparatus was provided and the light exhibited, for the benefit of mariners, on the night of May 15, 1870.

Burnt-Coat Harbor, Swan's Island, coast of Maine.—An estimate of \$10,000 has been submitted in the annual estimates for the next fiscal year, for the establishment of two small lights to mark the approach to, and serve as a range for entering this important harbor of refuge at night, when threatened with such weather as to make it necessary to seek a safe anchorage. This harbor is commodious and safe, and is distant 36 miles from the nearest place of safe anchorage on that coast.

20. *Matinicus Rock, off Penobscot Bay, Maine.*—A steam fog signal has been provided for and placed at this light station during the last year. A cistern and well for supplying the necessary fresh water have also been provided.

21. *White Head, entrance to Penobscot Bay, Maine.*—A steam fog signal has been provided for and placed at this station during the last year, and the necessary cistern built and well dug to provide fresh water for the use of the station.

30. *Manheigan Island, coast of Maine.*—A fog signal, with a six-inch Ericsson engine and a ten-inch Daboll trumpet, has been placed on Manana Island, half a mile to the westward of the light-house tower at this place during the last year, to take the place of the fog bell at that place.

36. *Seguin Island, off the mouth of the Kennebec River, Maine.*—The work preparatory to the establishment of the steam fog signal at this important outlying light station was begun last year, and a well dug, for providing the necessary water for the engine.

Halfway Rock, in the Atlantic, off Casco Bay, Maine.—The appropriation bill for the light-house service, approved March 3, 1869, contained an appropriation of \$50,000 for the establishment of a light on this rock lying in the arc of the outer approaches to Portland Harbor, Maine, and to vessels passing along that dangerous coast. The site is isolated, and consequently the landing of materials and the employment of laborers were necessarily more than ordinarily difficult and expensive. The tower will be of granite, the masonry of which was nearly completed,

when the balance of the appropriation, which was ample for all purposes connected with the station, reverted to the treasury under the operation of the fifth and sixth sections of the act of July 12, 1870, and thereby making it necessary to discharge the mechanics and await a reappropriation of funds thus turned into the treasury, before the work can be completed and the light exhibited. Although the sudden abandonment of the work, and materials which had been collected for completing it, will be attended with loss, as the quarters for the workmen and other accessories of construction will be swept off by the waves which cover the rock in the storms of winter, yet it is believed the whole may be completed within the original estimate and appropriation.

37. *Cape Elizabeth, coast of Maine.*—The westerly tower of the two, at this light station, was built in 1828 of rubble stone, and is now in such a state as to render it necessary to rebuild it in a better manner, for which an estimate has been submitted in the annual estimates. The station is one of the most important on the eastern coast, serving the double purpose of a sea-coast light station, and as a mark for the entrance into Casco Bay and to Portland Harbor.

43. *Whale's Back, entrance to Portsmouth Harbor, New Hampshire.*—The granite pier erected in 1829 on which the light-house tower now stands had become so much injured by the heavy seas, to which it is constantly exposed, that Congress, by act of 15th of July, 1870, granted an appropriation of \$70,000 for a new tower, which will be placed on the reef near the old pier. The position is one of the most difficult to work upon on the coast, as the rock is covered by the waves except at low water and is exposed to the full force of the Atlantic. The new structure will be a masonry tower, solid to a height of 20 feet above low-water mark, and the blocks of granite which will form a facing for the interior mass of concrete will be tied together by dovetail joints, as is usual in similar sea structures. The diameter of the tower at the base will be 27 feet, and height of focal plane above the sea will be 68 feet. The surface of the rock is now being prepared for the foundation, but as the work can only be carried on at low water, the progress is necessarily slow, so that it is not expected to finish the structure within the fiscal year, and it is therefore recommended that the balance of the appropriation remaining on hand on the 30th of June, 1871, may be made available for finishing the work.

44. *Portsmouth Harbor, New Hampshire.*—The keeper's dwelling requires to be rebuilt at this light station, at an estimated cost of \$2,000, which has been submitted with the annual estimates.

At each of the following named light stations there have been repairs and renovations more or less extensive during the last year, viz:

1. *St. Croix*, on Docket's Island, St. Croix River, Maine.
2. *West Quoddy Head*, entrance to Eastport Bay, Maine.
4. *Libby Island*, entrance to Machias Bay, Maine.
5. *Moose Peak*, on Mistake Island, coast of Maine.
6. *Nash's Island*, at the mouth of Pleasant River, Maine.
7. *Narraguagas*, or *Pond Island*, entrance to Narraguagas Bay, Maine.
8. *Petit Menan*, coast of Maine.
- Prospect Harbor, Maine*, (extensive.)
9. *Winter Harbor*, Maine.
10. *Mount Desert*, on Mount Desert Rock, Maine.
11. *Baker's Island*, entrance to Frenchman's Bay, Maine.
12. *Bear Island*, coast of Maine.
13. *Bass Harbor Head*, coast of Maine.
14. *Edgemoggin*, on Green Island, Blue Hill Bay, Maine.

17. *Deer Island Thoroughfare*, coast of Maine.
18. *Eagle Island*, head of Isle au Haut Bay, Maine.
20. *Matinicus Rock*, off Penobscot Bay, Maine.
21. *White Head*, entrance to Penobscot Bay, Maine.
23. *Brown's Head*, Fox Rocks, entrance to Penobscot Bay, Maine.
35. *Pond Island*, entrance to Kennebec River, Maine.
36. *Sequin Island*, off the mouth of Kennebec River, Maine.
39. *Portland Breakwater Light-house*, Portland Harbor, Maine.
42. *Boone Island*, off York Harbor, Maine, (extensive.)

The following-named light stations require repairs to be made during the current and ensuing year, viz :

2. *West Quoddy Head*, entrance to Eastport Bay, Maine.
3. *Little River*, mouth of Little River Harbor, Maine.
11. *Baker's Island*, entrance to Frenchman's Bay, Maine.
15. *Saddleback*, entrance to Isle au Haut Bay, coast of Maine.
20. *Matinicus Rock*, in the Atlantic, off Penobscot Bay, Maine.
21. *White Head*, entrance to Penobscot Bay, Maine.
22. *Owl's Head*, entrance to Penobscot Bay, Maine.
30. *Manheigan Island*, coast of Maine.
31. *Franklin Island*, entrance to St. George's River, Maine.
33. *Burnt Island*, entrance to Townsend Harbor, Maine.
34. *Hendrick's Head*, mouth of Sheepscot River, Maine.
36. *Sequin Island*, off the mouth of Kennebec River, Maine.
40. *Wood Island*, entrance to Saco Harbor, Maine.
45. *Isles of Shoals*, off Portsmouth Harbor, New Hampshire.

The following are the names of light stations in this district not mentioned elsewhere :

16. *Heron Neck*, Penobscot Bay, Maine.
19. *Pumpkin Island*, Isle au Haut Bay, Maine.
24. *Negro Island*, entrance to Camden Harbor, Maine.
25. *Grindel's Point*, entrance to Gilkey's Harbor, Penobscot Bay, Maine.
26. *Dice's Head*, near Castine, Maine.
27. *Fort Point*, mouth of Penobscot River, Maine.
28. *Tenant's Harbor*, Southern Island, entrance to Tenant's Harbor, Maine.
29. *Marshall's Point*, St. George, coast of Maine.
38. *Portland Head*, entrance to Portland Harbor, Maine.
41. *Goat Island*, entrance to Cape Porpoise Harbor, Maine.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the first district :

No. 1. *Jerry's Point*, Portsmouth Harbor.—Iron beacon. In good condition.

No. 2. *South Beacon*, Portsmouth Harbor.—Stone beacon. In good condition.

No. 3. *North Beacon*, Portsmouth Harbor.—Wooden mast. In good condition.

No. 4. *Willey's Ledge*, Portsmouth Harbor.—Iron spindle. In good condition.

No. 5. *York Ledge*, off York River.—Iron spindle. In good condition.

No. 6. *Fishing Rocks*, Kennebunk Port.—Iron spindle. In good condition.

No. 7. *Stage Island Monument, entrance Saco River.*—Stone tower 40 feet high. In good condition.

No. 8. *Sharpe's Rocks, entrance Saco River.*—Spindle. Spindle broken off. Spar buoy temporarily placed to mark the danger.

No. 9. *Back Cove Beacon, Portland Harbor.*—Pile beacon. In good condition.

No. 10. *White Head Ledge, in White Head Passage to Portland Harbor.*—Iron spindle. In good condition.

No. 11. *Trott's Rock, same as above.*—Broken.

No. 12. *Mark Island Monument, Casco Bay.*—Square stone tower. In good condition.

No. 13. *Black Jack Rock, Kennebec River.*—Wooden spindle, with wooden cage on top. In good condition.

No. 14. *Seal Rock, Kennebec River.*—Spindle with copper cylinder painted black. In good condition.

No. 15. *Lee's Rock, Kennebec River.*—Iron and wood. In good condition.

No. 16. *Ram Island Ledge, Kennebec River.*—Iron and wood. In good condition.

No. 17. *Winslow Rocks, Kennebec River.*—Iron and wood. In good condition.

No. 18. *Ames Ledge, Kennebec River.*—Iron and wood. In good condition.

No. 19. *Beef Rock, Kennebec River.*—Iron and wood. In good condition.

No. 20. *Lime Rock, Back River.*—Iron and wood spindle. In good condition.

No. 21. *Carlton's Ledge, Back River.*—Iron and wood spindle. In good condition.

No. 22. *Clough's Rock, Sheepscot River.*—Iron and wood spindle.

No. 23. *Merrill's Ledge, Sheepscot River.*—Iron and wood spindle.

No. 24. *Yellow Ledges, Penobscot Bay.*—Iron spindle, copper cylinder on top. In good condition.

No. 25. *Garden Island Ledge, Penobscot Bay.*—Iron spindle like above, with red ball on top. In good condition.

No. 26. *Otter Island Ledge, Penobscot Bay.*—Iron spindle. In good condition.

No. 27. *Ash Island Point, Penobscot Bay.*—Iron and wood. In good condition.

No. 28. *Dodge's Point Ledge, Penobscot Bay.*—Wooden mast, 12 feet long. In good condition.

No. 29. *Potterfield's Ledge, Penobscot Bay.*—Stone beacon. In good condition.

No. 30. *Lowell's Rock, Penobscot Bay.*—Iron spindle. In good condition.

No. 31. *Seal's Ledge, Penobscot Bay.*—Iron spindle. In good condition.

No. 32. *Harbor Ledge, Penobscot Bay.*—Stone beacon. In good condition.

No. 33. *Shipyard Ledge, Penobscot Bay.*—Iron spindle. In good condition.

No. 34. *Fiddler's Ledge, Fox Island Thoroughfare.*—Stone beacon. In good condition.

No. 35. *North Point of Northeast Ledge, Camden Harbor.*—Iron spindle. In good condition.

No. 36. *Morse's Point Ledge, Camden Harbor.*—Iron spindle. In good condition.

No. 37. *Hosmer's Ledge, Castine Harbor*.—Stone monument. In good condition.

No. 38. *Steel's Ledge, Belfast Harbor*.—Square stone beacon. In good condition.

No. 39. *Fort Point Ledge, Penobscot River*.—Square stone beacon. In good condition.

No. 40. *Odom's Ledge, Penobscot River*.—Square stone beacon. In good condition.

No. 41. *Buck's Ledge, Penobscot River*.—Iron spindle. In good condition.

No. 42. *Ship and Barges, Blue Hill Bay*.—Wooden spindle, 30 feet high, cask on top, (new.) In good condition.

No. 43. *Bunker's Ledge, Mt. Desert*.—Square stone beacon. In good condition.

No. 44. *Half-tide Ledge, Narragausus Harbor*.—Iron socket, wooden spar, cask on top, (new.) In good condition.

No. 45. *Norton's Reef, Pleasant River*.—Iron tripod and shaft, ball on top, whole 35 feet high, (new.) In good condition.

No. 46. *Snow's Rock, Moose Peak Reach*.—Wooden spindle, cask on top, (new.) In good condition.

No. 47. *Gilchrist Rock, Moose Peak Reach*.—Iron spindle, cask at top, (new.) In good condition.

No. 48. *Moose Rock, Moose Peak Reach*.—Iron tripod, 35 feet high cage on top, (new.) In good condition.

No. 49. *Western Bar, Lubec Narrows*.—Wooden beacon filled with stones. Nearly all washed away in heavy gale last year. Will be rebuilt this year.

No. 50. *The Ledge, St. Croix River*.—Wooden beacon. In good condition.

There are no light-vessels in this district.

The steam tender *Iris* is a small tug; needs extensive repairs, and is too small for effective service in the fall or winter and spring, on that boisterous and dangerous coast.

The small schooner *Wave* is used for transporting materials and small working parties for making repairs at light-stations during the working season.

The large number of light-houses, day beacons, spindles, and buoys in this district, embracing the entire sea coast and interior navigable waters of Maine, and the annually increasing number authorized by Congress, as dangers on that coast are developed and accurately defined by the survey now in progress, it has become a matter of considerable importance in regard to economy and efficiency of the same that a small steam tender be provided, and for which an estimate has been submitted in the annual estimates. The winter storms and spring freshets are always more or less damaging to all the aids in this district, and as there are but few that can be reached by public conveyance, even in the summer months, for ordinary repair or for those caused by casualty, it is almost indispensable that the engineer should have a vessel with which to dispatch labor and materials to any point needing them at all times.

SECOND DISTRICT.

The second district extends from Hampton Harbor, New Hampshire to include Gooseberry Point, Massachusetts.

Inspector.—Commodore George S. Blake, United States Navy, to October 1, 1870; Commander John J. Walker, United States Navy, present inspector.

Engineer.—W. A. Goodwin, esq., (acting,) to May 31, 1870; Brevet Brigadier General J. C. Duane, lieutenant colonel of engineers United States Army, present engineer.

In this district there are—

Light-houses and lighted beacons	55
Day or unlighted beacons	49
Light-vessels, (including two for relief)	10
Buoys actually in position	491
Spare buoys for relief and to supply losses	378
Tender (steam) Verbena	1

The numbers preceding the names of stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

47. *Newburyport, mouth of the Merrimac River, Massachusetts.*—This light station was first established in 1790, and the beacon-light, designed to serve as a range for entering the harbor, (or for reaching a safe anchorage at night,) was erected in 1816. The tower of the main light is a low, octagonal, wooden structure, with a fifth-order lens apparatus in the lantern. The beacon, the position of which was changed during the last year, rendered necessary by the change in the direction of the channel, must necessarily be so constructed as to allow it to be moved from one side to another, in front of the main light, as changes take place on the bar and in the outer channel.

Newburyport is a place of sufficient importance to justify the establishment of a more powerful light than the present one, and the erection of buildings of better materials than wood. The frequent and very marked changes in the shore-line, bar, and channels by the heavy winter storms and gales have prevented the formation of any very definite plans for improving this light station; but new buildings must be erected at no very distant day, when a more powerful light will be substituted for the present harbor light.

52. *Cape Ann, on Thatcher's Island, off Cape Ann, Massachusetts.*—A fog-signal has been in operation at this important outlying light station since 1861. One of greater power has been placed there during the last year; and, in consideration of the vast number of vessels which pass that point daily and nightly, and the great necessity for marking it during fogs and thick weather, a duplicate steam fog signal should be kept there at all times, so that in case one gets out of order (as all steam machinery is very liable to do) the other will be in readiness for sounding its blasts.

55. *Baker's Island, entrance to Salem Harbor, Massachusetts.*—Efforts have been made during several years past to render the range-line, designed to be formed by the main and beacon lights at that station, more marked than it is; so that the outlying rocks and reefs, outside of which this line was originally designed to pass, might not be a terror to navigators passing along that part of the coast. The beacon-light was originally placed (1797) only 40 feet from the main light, a distance entirely too short to make a well-defined range line to guide clear of the southeast breakers, the chief object in having two lights. The character of the ground belonging to the United States, and the ownership of the land adjoining the light-house site being in a person unwilling to sell, have prevented the desired change of increasing the distance between the two lights. It is hoped that at no distant day the serious defect in this light station may be remedied.

Salem Harbor, Massachusetts.—An appropriation was made at the last session of Congress (July 15, 1870) for the establishment of three lights

to mark the main channel leading into this anchorage, with the view to its becoming a harbor of refuge which may be safely entered at any time. Negotiations for the purchase of the proper sites have been in progress since the adjournment of Congress, and the works will be commenced as soon as the titles are perfected and approved by the Attorney General in conformity to law.

Duxbury Reef, entrance to the harbors of Duxbury, Plymouth, and Kingston, Massachusetts.—An appropriation of \$17,931 was made at the last session of Congress (July 15, 1870) for the erection of a light-house on this point. An examination of the reef has been made by means of borings, and plans have been adopted for the site.

The structure will be a tower 25 feet in diameter at the base, with a height of 50 feet focal plane. It will be founded in two feet of water at low tide, and will be of concrete, faced with iron. The run of ice is very severe from Plymouth Harbor, and to resist it, and the heavy seas by which it will be assailed, the tower will be built in one solid mass to a height of 15 feet above the water. It is expected that the entire work will be completed by the end of the current fiscal year.

62. *Plymouth, "The Gurnet," entrance to Plymouth Harbor, Massachusetts.*—The beacon-light at this station was placed originally (the stations established in 1769) too close to the main light to serve the purpose effectually as designed, viz., "to serve as a range to clear Brown's Bank." Efforts have been made to remedy this defect, but owing to the character of the ground, and difficulty of obtaining a site for extending the distance, this defect cannot easily be remedied until new structures are built, which must be done at no distant day, as the present buildings are merely wooden ones.

66. *Billingsgate Island, entrance to Wellfleet Bay, Massachusetts.*—During the month of March last the sea broke through the beach on the northwesterly point of the island and flooded a part of the light-house lot, but there has been no recurrence, and no immediate danger to the structure is apprehended.

80. *Nantucket Beacon, Nantucket Harbor, Massachusetts.*—This beacon, originally established on the southerly side of the harbor, prior to 1861, to serve as a range with Brant Point light-house for entering the harbor at night, was reestablished and relighted December 1, 1869, on the north side of the light-house, and removed to its original site April 20, 1870. A dwelling for the keeper of this light is required, and will be built as soon as a site can be purchased and valid title obtained.

86. *Cape Poge, Martha's Vineyard Island, Massachusetts.*—Rapid and continued encroachment by the sea on this site made it necessary to purchase more land, adjoining that of the present one, so that the buildings may be removed to a safe distance from the brink of the diminishing bluff bank. The purchase has been completed, and the land can be paid for and possession taken of it so soon as the legislature of the State passes the usual act of cession of jurisdiction, and which it is expected will be done at its next session.

92. *Tarpaulin Cove, Naushon Island, Massachusetts.*—It having been represented that, possibly, the fixed light at this station might be mistaken for some other light of the same kind, a fixed light, varied by flashes every half minute, was substituted in April last, thereby giving increased power, as well as a more marked distinction, to the station.

A severe gale, in September 1869, did much damage along the sea-coasts in this district. At each of the following named stations there have been repairs more or less extensive during the last year, viz:

46. *Newburyport Harbor, mouth of Merrimack River, Massachusetts.*

47. *Newburyport Beacon*, mouth of Merrimack River, Massachusetts.
50. *Annisquam*, Wigwam Point, Annisquam Harbor, Massachusetts.
51. *Straitsmouth*, Straitsmouth Island, coast of Massachusetts.
52. *Cape Ann*, Thatcher's Island, off Cape Ann, Massachusetts, (extensive.)
53. *Eastern Point*, entrance to Gloucester Harbor, Massachusetts.
54. *Ten Pound Island*, Gloucester Harbor, Massachusetts.
55. *Baker's Island*, entrance to Salem Harbor, Massachusetts.
56. *Marblehead*, entrance to Marblehead Harbor, Massachusetts.
57. *Egg Rocks*, off Nahant, Massachusetts.
58. *Minot's Ledge*, entrance to Boston Bay, Massachusetts.
59. *Boston*, Little Brewster Island, entrance to Boston Harbor, Massachusetts.
60. *Narrows*, entrance to Boston Harbor, Massachusetts.
61. *Long Island Head*, Boston Harbor, Massachusetts.
62. *Plymouth*, "The Gurnet," entrance to Plymouth Harbor, Massachusetts.
63. *Race Point*, Cape Cod, Massachusetts, (extensive.)
64. *Long Point*, entrance to Provincetown Harbor, Massachusetts.
66. *Billingsgate Island*, entrance to Wellfleet Harbor, Massachusetts.
67. *Sandy Neck*, entrance to Barnstable Bay, Massachusetts.
68. *Cape Cod Highlands*, Massachusetts.
69. *Nausett Beach Beacons*, Eastham, near Cape Cod, Massachusetts.
70. *Chatham*, Chatham Harbor, Massachusetts.
72. *Monomoy Point*, Cape Cod, Massachusetts.
78. *Gay Head*, Martha's Vineyard Island, Massachusetts, (extensive.)
80. *Nantucket Beacon*, Nantucket Harbor, Massachusetts.
83. *Bishop and Clerks*, Vineyard Sound, Massachusetts.
88. *Edgartown*, Edgartown Harbor, Massachusetts.
91. *Nobsque Point*, Wood's Hole, Massachusetts, (extensive.)
92. *Tarpaulin Cove*, Naushon Island, Massachusetts.
97. *Clark's Point*, entrance to New Bedford Harbor, Massachusetts.
98. *Palmer's Island*, New Bedford Harbor, Massachusetts.
99. *Ned's Point*, Mattapoissett Harbor, Massachusetts.
100. *Bird Island*, Sippican Harbor, Massachusetts, (extensive.)

The following named light stations require repairs to be made during the ensuing year, viz :

48. *Ipswich*, entrance to Ipswich Harbor, Massachusetts.
52. *Cape Ann*, Massachusetts.
55. *Baker's Island*, entrance to Salem Harbor, Massachusetts.
56. *Marblehead*, entrance to Marblehead Harbor, Massachusetts.
60. *Narrows*, entrance to Boston Harbor, Massachusetts.
63. *Race Point*, Cape Cod, Massachusetts.
65. *Mayo's Beach*, head of Wellfleet Bay, Massachusetts.
69. *Nausett Beach Beacons*, Eastham, near Cape Cod, Massachusetts.
75. *Nantucket Great Point*, Nantucket Island, Massachusetts.
78. *Gay Head*, Martha's Vineyard Island, Massachusetts.
79. *Brant Point*, Nantucket Harbor, Massachusetts.
83. *Bishop and Clerks*, Vineyard Sound, Massachusetts.
88. *Edgartown*, Edgartown Harbor, Massachusetts.
95. *Cuttyhunk*, entrance to Buzzard's Bay, Massachusetts.
99. *Ned's Point*, Mattapoissett Harbor, Massachusetts.

The following are the names of stations, in this district not mentioned elsewhere :

49. *Ipswich Beacon*, entrance to Ipswich Harbor, Massachusetts.

76. *Sankaty Head*, Nantucket Island, Massachusetts.
81. *Nantucket Cliff Beacons*, Nantucket Island, Massachusetts.
82. *Bass River*, Vineyard Sound, Massachusetts.
84. *Hyannis*, Massachusetts.
89. *Holmes's Hole, West Chop*, Martha's Vineyard, Massachusetts.
90. *Holmes's Hole Beacon*, Martha's Vineyard Island, Massachusetts.
96. *Dumpling Rock*, Buzzard's Bay, Massachusetts.
101. *Wing's Neck*, head of Buzzard's Bay, Massachusetts.

SURVEYS.

Surveys and plans of light-house sites in this district have been completed during the year, as follows, viz:

Hyannis, and Cuttyhunk.—Surveys have been made, but plans not completed at Brant Point, Cliff Beacons, Great Point, Sankaty Head, and Nausett.

Plans have been completed from last year's surveys of Ipswich, Boston, and Narrows, Plymouth, Sandy Neck, Long Island Head, Billingsgate Island, Cape Poge, West Chop, Long Point, Race Point, Cape Cod Highlands, and Nobsque Point, the latter including Wood's Hole Light-vessel and Buoy Depot.

All the beacons in the following list are in good condition, unless otherwise stated:

1. *Old Cock, Buzzard's Bay*.—Iron spindle 36 feet high, with open work cage at top.

2. *Egg Island, Buzzard's Bay*.—A granite cone, with iron spindle, having vane at top.

3. *Range beacon on Fair Haven, Fort Point, Buzzard's Bay*.—A boiler iron triangular pyramid, 40 feet high.

4. *Cormorant Rocks, to the southward of the entrance of Mattapoisset Harbor, Buzzard's Bay*.—An iron spindle 26 feet high, with cage at top.

5. *Lone Rocks*.—Iron spindle, with cage on top, marks northeast entrance to Wood's Hole, Massachusetts.

6. *Collier's Ledge, to mark the entrance to Centerville Harbor, Vineyard Sound*.—A granite base, with iron spindle, having at the top a ball and vane.

7. *Great Rock*.—Iron spindle bearing a cage at a height of 26 feet. It marks the edge of the flats making off to the west of Point Gammon, Vineyard Sound.

8. *East end of breakwater*.—A wooden spindle, having at top four arms and a cask. East end of Hyannis breakwater requires repair of day mark.

9. *Sunken Pier*.—A wooden spindle, with cask on top, on northeast part of Bass River Bar.

10. *Spindle Rock*.—An iron spindle, with cask on top, marks a rock awash at high water, at entrance to Edgartown Harbor.

11. *Billingsgate Shoal, old site*.—A pyramidal open-work timber beacon, 12 feet square at base, 15 feet high, with mast having 15 feet additional height; and day mark formed of slats crossing at right angles, is in process of erection, to be known as old site.

12. *Egg Island Rock*.—A wooden spindle, with cask at top, entrance to Wellfleet Harbor.

13. *Duxbury Beacon*.—Granite, square, surmounted by a granite post, 4 feet high, painted red. Out of repair; will not be required after completion of light-house on Duxbury Reef.

14. *Breakwater Beacon*.—Square, open-work granite, with wooden spindle surmounted by a cage; all painted black. Requires new spindle

15. *Hogshead Beacon*.—An iron spindle with prong cask on one arm; and basket on the other.

16. *North Beacon*.—Iron spindle with two rounds, one above the other, and at right angles, is placed on the point of the flats at entrance to Scituate Harbor.

17. *South Beacon*.—Iron spindle with two lozenges, one above the other, and at right angles, stands on point of shoal at entrance to Scituate Harbor.

18. *Londoner*.—On Londoner Rock, off Thatcher's Island (Cape Ann) is an iron spindle 45 feet high, with an octagonal cage on top.

19. *Point Alderton*.—A square granite pyramid, surmounted by a black cone of stone; it is placed on the shoal which makes out from Point Alderton, about 200 feet from the shore at low tide.

20. *False Spit*.—Granite base, with iron spindle and square cage.

21. *Spit Beacon*.—Square granite pyramid.

22. *Nix's Mate*.—Large, square, granite base, with octagonal pyramid.

23. *Great Fawn Bar*.—Square granite base, and granite cone, with iron spindle and cage on top.

24. *Deer Island Point*.—Square granite pyramid, painted red, on extreme point of Deer Island.

25. *Bird Island Beacon*.—Iron spindle with cage on top: stands on southeast point of Bird Island, on rocks bare at low water but covered at two-thirds flood.

26. *Sunken Island*.—Open-work granite base wooden spindle, with small square cage on top.

27. *Pig Rock*.—Square granite pyramid; small wooden staff with small square cage.

28. *Half tide Rock*.—A wooden spar 40 feet high, with barrel day mark, has been set, and secured to the stub of the stone beacon formerly marking the danger, and braced with four iron braces.

29. *Cut Island Beacon*.—Wooden spindle. Requires renewal of day mark.

30. *Marblehead Rock*.—Of granite, in the form of a truncated cone with wooden spindle. Requires renewal of spar.

31. *Little Aquaviva*.—A wooden spar, with two prongs at top, stands on a rock which is dry at half ebb.

32. *Great Aquaviva*.—Granite surmounted by a wooden staff and cage. To be left on starboard hand in going up South Channel to Salem.

33. *Hardy's Rock*.—A wooden spindle with iron braces, has two triangles at top. Rock dry at half tide.

34. *Bowditch Beacon*.—Large, triangular pyramid of granite, bearing a wooden spindle, with black cage on top. The condition of this beacon has not changed since the date of last annual report. The displaced stones seem to be firmly held in the work. No repair can be effected short of tearing down and rebuilding the whole beacon. Although in its present condition the structure looks badly, yet it is quite as efficient an aid to navigation as if a large sum had been spent in its repair. It is not proposed to take any steps in the matter so long as the beacon remains as it is.

35. *Halfway Rock*.—All gone except foundation, which shows above the water. The beacon was destroyed some years ago, and it is not proposed to rebuild it.

36. *Little Haste*.—A 35-foot wooden spar, with cask on top, marks this rock; dry at low-water. It is off the northwest side of Great Haste Ledge.

37. *Abbott's Monument*.—Square, granite, surmounted by a wooden staff, with open-work square cage on top, painted red.

38. *Monument Bar*.—Square crib-work filled with granite, with a wooden shaft, bearing a square cage, painted black.

39. *Ramshorn*.—Square crib-work filled with granite; wooden staff, painted black; top like a sugar-loaf.

40. *Lobster Rocks, Beverly Harbor*.—Stone, with a wooden spindle.

41. *Black Rock, Gloucester Harbor*.—An iron spindle with oblong cage.

42. *Harbor Rock, Gloucester Harbor*.—An iron spindle with open-work ball; all painted black.

43. *Five Pound Island, Gloucester Harbor*.—Granite base, with iron spindle and ball, painted red.

44. *Lobster Rock, Annisquam*.—Square open-work, granite beacon; top black.

45. *Lane's Point*.—Square wooden beacon.

46. *Point Neck Rock*.—Iron spindle, painted red; ball on top.

47. *North Pier, Newburyport Harbor*.—Is built of hewn timber laid up as a lozenge-shape crib and filled with stones; shows about four feet above high water.

48. *South Pier, Newburyport Harbor*.—Exactly like the preceding.

LIGHT-VESSELS.

94. *Hen and Chickens light-vessel, Buzzard's Bay, Massachusetts*.—This vessel has been ordered into port as soon as she can be relieved by another vessel, to undergo necessary repairs to encounter the coming winter gales.

Relief light-vessel, (No. 38,) was built last year and is kept at the station, Wood's Hole, in readiness to take the place of any damaged or removed light-vessel in the district.

Relief light-vessel, (No. 9,) requires very extensive repairs which are now being made.

BUOY AND RELIEF LIGHT-VESSEL DEPOTS.

Wood's Hole Depot.—The fencing and shed for protecting the buoys at the Wood's Hole Depot have been completed. The dredging was only partially done last season.

Gulf Island Depot.—This depot for spare buoys is also the place of residence of the light-keepers and families belonging to Minot's Ledge light station.

TENDERS.

Steam tender Verbena.—This tender was built during the last year and sent to the second district to relieve the *Cactus*, which had become unfit for further service.

Sailing schooner Wave.—This tender was transferred July last to the engineer of the first and second districts for use in transporting materials and labor to light stations requiring them either for construction or repair. Sailing vessels cannot be employed economically to attend upon buoys, especially on such a coast as that of Massachusetts and Maine in the winter season. An estimate was submitted last year for a steam tender for this coast, but the appropriation having been deferred, it has been renewed this year.

THIRD DISTRICT.

The third district embraces all aids to navigation from Gooseberry Point, Massachusetts, to include Squam Inlet, New Jersey, as well as the Hudson River, Whitehall Narrows, and Lake Champlain.

Inspector.—Rear Admiral Charles S. Boggs, United States Navy.

Engineer.—Joseph Lederle, esq., (acting) to June 16, 1870; Brevet Brigadier General I. C. Woodruff, lieutenant colonel of engineers United States Army, present engineer.

In this district there are—

Light-houses and lighted beacons.....	105
Day or unlighted beacons.....	42
Light-vessels.....	8
Buoys actually in position.....	387
Spare buoys for relief and to supply losses.....	345
Tenders (steam) Cactus and Putnam.....	2

The numbers preceding the names of stations correspond with the Light-house Lists of the Atlantic, Gulf, and Pacific Coasts, and the Northern and Northwestern Lakes of the United States, issued January 1, 1870.

Castle Hill, Rhode Island, east side of entrance to Newport Harbor, Narragansett Bay.—In the report of this board last year it was stated: "Applications have been made at various times in the past, and renewed this year, for a light-house and fog signal on Castle Hill, to guide vessels, especially in thick and foggy weather, into Newport Harbor and Narragansett Bay. After a careful examination of the locality, and a full consideration of the whole subject, it is recommended that an efficient fog signal be authorized for this point, which it is believed will, with the existing lights and other aids to navigation in the immediate vicinity, subserve the desired purpose. The land upon which this fog signal must necessarily be placed, if authorized, being held at a certain value, an estimate for an efficient fog signal, including the cost of the land, is submitted in the annual estimates." The applicants for this aid to navigation are still urging its establishment. With the price asked by the owners for the land upon which the keeper's dwelling and fog signal must be placed, if authorized, the sum of \$18,000 will be required—the amount estimated and submitted last year.

103. *Beaver Tail, Rhode Island.*—A new fog signal has been provided and placed at this light station as a substitute to the old one, which was worn out.

106. *Rose Island beacon-light, Rhode Island, near Narragansett Bay.*—The light authorized to be placed on this island has been completed this season, and the light exhibited on the 20th of January last.

108. *Poplar Point, Rhode Island, Narragansett Bay.*—The work of renovations and improvements authorized for this light station are in progress.

Hog Island Reef, Rhode Island, Narragansett Bay.—In the report from this board last year it was stated that "a reef runs out from Hog Island to the main channel, rendering navigation difficult and dangerous. To prevent, as far as possible, loss of life and property at this place, the steamboat company owning and running a regular line of steamers between New York, Newport, and Fall River, keep a light-vessel stationed there at the cost of the company. Should Congress see fit to relieve this company of this unusual expense, which it incurs for the benefit of others as well as for itself, by authorizing the building of a light-house with a protecting pier, in about six feet water on the reef, the estimated

cost would be \$45,000." As no appropriation was made last year it is deemed proper to refer to the facts contained in the previous report.

112. *Conimicut Point, Rhode Island, entrance to Providence River, Narragansett Bay.*—When the light on the shoal off Conimicut Point was lighted as a substitute for the light on the main land, at Nayat Point, (distant about one mile,) the only available means of attending upon it were to allow the keepers to retain the dwelling at the old light station, and for them to visit the new light by boat. The land constituting the site of the old light station at Nayat Point is valuable, and would bring, at public sale, a good price. The old tower is not worth the cost of tearing it down, and the dwelling not having been repaired, in expectation of an appropriation for completing the buildings at Conimicut Point, to include a proper dwelling for the keeper, it now becomes necessary either to make considerable expenditure upon the Nayat Point dwelling, or ask for a special appropriation for the necessary protection pier against running ice, and for a dwelling at that light-house. The estimated cost of the work is \$30,000. The only accommodation for the keeper now is in the tower, placed on the foundation of the old day beacon, which is close to the deepest water of the channel, and the only suitable place for the light to guide clear of the shoal.

Saben's Point, Rhode Island, Providence River.—In a special report, made in compliance to a call of Congress last May, a light-house and keeper's dwelling were recommended for this place. The foundation is in 8 feet water at mean low tide, and will require an appropriation of \$42,000 to construct the pier of protection and the other buildings.

Pumham Rock, Rhode Island, Providence River.—An appropriation was made July 15, 1870, for the erection of a light on this rock, which will be commenced as soon as valid title and cession of jurisdiction are obtained in conformity to law.

Fuller's Rock, Rhode Island, Providence River.—Congress made an appropriation July 15, 1870, for a beacon-light to mark this rock. Work will be commenced as soon as valid title and cession of jurisdiction are obtained.

Sassafras Point, Rhode Island, Providence River.—An appropriation was made July 15, 1870, for a beacon-light at this place, which it is expected may be commenced at an early day.

115. *Watch Hill, Connecticut, near Stonington.*—The renovations and improvements authorized by the appropriation act of July 15, 1870, are in progress and will be finished during the present season for work in that vicinity.

120. *North Dumpling Island, Fisher's Island Sound.*—The renovations and improvements for this station authorized in the appropriation bill of July 15, 1870, are in progress, and will be completed this working season.

Race Rock, main entrance to Long Island Sound from the eastward.—Congress appropriated July 28, 1866, \$90,000 "for a new light-house on Race Rock, or on the southwest end of Fisher's Island, entrance to Long Island Sound, as may be approved by the Light-house Board." After due consideration of the requirements of navigation, it was deemed necessary to locate the new light on the nest of boulders called "Race Rock," nearly a mile southeast from Race Point, on Fisher's Island. A careful and minute survey of this locality has developed the fact that the reef on which the light-house is proposed to be built consists of an accumulation of boulders of various sizes, packed solid, overgrown with sea-weed, and in about 12 feet of water. The estimated cost for carrying this project into effect is \$200,000, of which \$90,000 were then

available, leaving \$110,000 to be provided for by Congress. Of this amount only \$10,000 were asked for and appropriated July 15, 1870, "for continuing the construction of a light-house on Race Rock, Long Island Sound." This amount in addition to the former appropriation, would have been sufficient to carry on the work for at least a season, and to bring it safely above high water. By an act of Congress of the 12th of July, 1870, the balance of the first appropriation reverted to the treasury, leaving only \$10,000 with which to commence the construction. An appropriation of \$150,000 is recommended for continuing this important work and included in the annual estimates.

123. *Little Gull Island, main entrance to Long Island Sound from the eastward.*—The new tower, keeper's dwelling and building for fog signal are completed. The new second-order light was exhibited for the first time on the 15th December, 1869. The cellar of the old keeper's dwelling has been converted into a cistern for the service of the steam fog signal. The Wilcox patent steam generator which operates the Siren, has proved unreliable and will be replaced by a horizontal steam boiler. This being a very important station on Long Island Sound, the fog signal should be of the most reliable character and in duplicate, as the station is not easily reached, in case the signal should give out. The estimated cost for a duplicate signal is \$5,000, and is included in the estimates for this year.

124. *Gardiner's Island, Long Island Sound.*—The alterations in the lantern required at this station and for which an appropriation was made July 15, 1870, are progressing, and will be completed during this season. A fog bell will be placed at this station before winter.

125. *Plum Island, Long Island Sound.*—The rebuilding of this station, which was commenced last year, will be completed during the present season.

Long Beach Bar, New York, Long Island.—The erection of a lighted beacon at this station has been provided for by special appropriation of July 15, 1870. Plans and estimates have been prepared and the work will be commenced at as early a day as possible.

132. *Horton's Point, New York, Long Island, Long Island Sound.*—The repairs and renovations provided for by the appropriation of July 15, 1870, are progressing and will be completed during this season.

133. *Faulkner's Island, off Guilford Harbor, Long Island Sound.*—The authorized repairs and renovations will be commenced during this season, and will be completed if possible before winter sets in. As reported last year, the island is washing away on the east side, and an appropriation for its protection by a sea-wall is again recommended. The estimate cost is \$12,000.

134. *New Haven, Connecticut.*—The repairs and renovations provided for by the appropriation of July 15, 1870, have been commenced and will be completed during the present season. The caloric engine which operated the fog bell became worn out and has been replaced by a Stevens striking apparatus.

136. *Stratford Point, Connecticut, Long Island Sound.*—The condition of this light station is the same as at the date of the last report. It is not in a fit state for repair, and true economy requires that it should be rebuilt whenever an adequate appropriation can be obtained from Congress. An estimate of \$50,000 was submitted last year, but no appropriation was made.

138. *Bridgeport Beacon, Connecticut.*—The reconstruction of this beacon is authorized by the appropriation made July 15, 1870. The work

will be commenced at an early day and will be prosecuted so as to insure its completion during the fiscal year.

140. *Black Rock, Fairweather Island, Long Island Sound.*—The light-house at this place is very old and ought to be rebuilt, but on consideration of other pressing wants, no appropriation is asked for that purpose this year. A reappropriation of the \$8,000 carried into the treasury by act of July 12, 1870, for a depot for buoys, &c., is asked and included in the annual estimates.

Penfield Reef, Long Island Sound.—An appropriation was made July 15, 1870, of \$30,000 "for commencing the construction of light-house on Penfield Reef, near Bridgeport, Connecticut, Long Island Sound." The estimated cost of completing this structure in addition to the former appropriation is \$25,000, and is embraced in the annual estimates.

145. *Execution Rocks, Long Island Sound.*—The protection to this station against the ice and sea, for which funds have been appropriated July 15, 1870, is progressing, and will be completed during the season.

Hart Island, Long Island Sound.—An appropriation was made April 7, 1866, for the erection of a light at this point. The owner of the island being unwilling to sell the requisite quantity of land for this light station for such a sum as the board would have been authorized to give, proceedings were instituted, in conformity to law, for condemning the land. The award of the appraisers for five acres of land was \$25,000, a sum far exceeding the entire appropriation, and, in the opinion of the board, far beyond its intrinsic money value. Having made further examinations, it is found that the south end of the island, upon which the light would necessarily be placed, if placed on the island at all, is continually washing away, and unless it is protected by an expensive sea wall, a light-house could not remain there very long. The end of the reef, (in 6 feet water,) which runs out from the southern end of the island, would afford a good foundation and proper site for the erection of a stone structure similar to those already erected at points on the Hudson River. The estimated cost of the proposed structure and apparatus, complete in all respects, is \$50,000, and is included in the annual estimates this year.

155. *Sandy Hook, east beacon, entrance to New York Bay.*—The effect of the heavy gales of last winter upon the north point of Sandy Hook, on which this beacon is located, was such that the removal became necessary. The whole building was moved 500 feet south, retaining its former range with the main light. It was placed on oak piles, and is now considered out of danger. The fog signal at this station is in good condition, and gives general satisfaction. It is to be feared that the tubes of the boiler may give out at any time; should this happen, this most important station would be without a fog signal until new tubes could be inserted. A station of such importance to navigation as Sandy Hook ought to have two complete fog signals, for the same reason as two, and in some cases three sets of lamps are furnished to light-houses, and an appropriation is asked therefor of \$5,000 for this purpose.

One or more permanent beacons in the lower bay of New York.—Last year's report contained the following on this subject, which has been very often brought to the notice of Congress by parties in New York and elsewhere, interested in over-sea commerce: "An appropriation was made March 2, 1867, by Congress, of \$45,000 'to enable the Light-house Board to erect in the lower bay of New York one or more permanent beacons.' This sum is wholly inadequate to the accomplishment of the purpose for which this appropriation was made. An appropriation of \$200,000 was made March 3, 1837, 'for a light-house on Flynn's

Knoll, near Sandy Hook, to be built under the direction of the Engineer Department.' On the 3d March, 1851, Congress made another appropriation of \$30,000 'for a light-house on Flynn's Knoll.' For reasons heretofore communicated to Congress by those charged with the erection of the proposed light on Flynn's Knoll, the light has not been built. It is believed that Flynn's Knoll is the only obstruction to navigation in the lower bay of New York which is not properly marked; and as Congress has, by three separate and distinct appropriations, manifested its desire for the erection of a light-house there, the board has no doubt but a suitable structure, to serve as a range with the Princess Bay light, and also to mark this dangerous shoal, which lies between the two principal channels leading up New York Bay, can be built for the sum originally appropriated in 1837, viz., \$200,000 in addition to the \$45,000 now available. This light, placed so as to make a range with Princess Bay light for the deepest water in Gedney's Channel, would enable vessels of the heaviest draught to cross the main bar, and reach a safe anchorage at night in the lower bay, in addition to its usefulness in marking a shoal upon which there is only 9 feet of water at low tides."

In recurring to this subject it may be repeated that it is likely a proper light may be erected on Flynn's Knoll for \$200,000, the amount originally appropriated in 1837, and in that view an estimate of \$100,000 for commencing the work has been embraced in the estimates.

157. *Conover Beacon, New York Bay.*—In the appropriation of \$13,400 made March 3, 1869, "for repairs and renovation at Throgg's Neck, Highlands of Navesink, Sandy Hook, Conover Beacon, and Fort Tompkins light stations," \$2,500 were intended for repairs and renovations at this station. The necessary repairs to the tower and keeper's dwelling were intended to be made during this season, but the appropriation, under the act of Congress, reverted into the treasury. The repairs are much needed and are again recommended. Estimated cost, \$900.

161. *Elm Tree Beacon, New York, Staten Island.*—The sea has washed away over 50 feet in front of this station and behind the jetty, which had so far protected this side. The jetty requires to be extended 60 feet toward the shore and filled in with stones. The estimated cost is \$1,800.

163. *Princess Bay, New York, Staten Island.*—An appropriation of \$12,000 was made July 15, 1870, for the protection of this site against the encroachments of the sea. Plans and estimate of cost have been made, and it is intended to commence work at an early day.

164. *Fort Tompkins, New York, Staten Island.*—The repairs and renovations authorized at this station by the appropriation made March 3, 1869, have not been carried into effect, it being doubtful whether the buildings (tower and keeper's dwelling) can remain in their present positions, on account of the want of the ground for fortifications. No recommendation in regard to this station can be made until this question is settled.

196. *Elbow Beacon, New Jersey, Newark Bay.*—A beacon has been erected at this place and fitted with a lens of the sixth order, in place of the former stake-light.

171. *West Point, New York, Hudson River.*—It is proposed to erect a suitable structure for a beacon, to be fitted with a sixth-order lens, at this point, to take the place of the present stake-light, for which an estimate of \$1,500 is inclosed in this year's estimates.

172. *Esopus Meadows, New York, Hudson River.*—The appropriation of July 15, 1870, which was made for rebuilding the tower and dwelling

at this station, became available at too late a day in the working season to safely commence the work this season and get it far enough advanced to resist the winter storms and ice of the spring. The work will be commenced as early next spring as it may be safe to do so, and have it completed by the closing of the river in the fall. The entire appropriation will be required to complete the work, and, therefore, any balance that may remain on June 30, 1871, must be made available for the next fiscal year.

174. *Saugerties, New York, Hudson River.*—The works of reconstruction at this light station have been completed during the past summer.

Hockdaling's Point, New York, Hudson River.—A beacon-light is required on this point, which is near "Four-mile Point," to guide vessels at night from the "outer" into the "narrow" channel. The estimated cost is \$700.

177. *Stuyvesant, New York, Hudson River.*—As the portable beacons placed on this river must be removed to prevent their destruction by ice and freshets, owing to the close of navigation, this point has been selected for storing those above it; and the old dwelling for the keeper will be converted into a storehouse for their preservation.

178. *New Baltimore, New York, Hudson River.*—Owing to the frequent losses of the beacons on the Hudson River by heavy freshets during the navigating season, it is found necessary to place them on crib foundations filled in with stone and of sufficient height above the highest stages of the river to save them from destruction, to do which will require an appropriation of \$1,000 each.

Lower end of Baltimore Dike, New York, Hudson River.—This dike has recently been completed by the Government, and a beacon is necessary to mark its lower end. It is proposed, if the necessary appropriation is granted, to place the beacon on a crib 6 feet high, filled with stone and properly secured to the dike, at an estimated cost of \$1,000.

179. *Five-Hook Island, New York, Hudson River.*—A beacon, placed on a crib filled with stone, similar to the one at New Baltimore, is required for this place, in lieu of the small light now there, which is frequently washed away. Estimated cost \$1,000.

180. *Coeyman's Bar, New York, Hudson River.*—This station requires to be put in the same condition as is proposed for New Baltimore, &c., at estimated cost of \$1,000.

181. *Roha Hook, New York, Hudson River.*—It is proposed to protect this small light against the effects of running ice and spring freshets by the construction of a crib foundation of sufficient height, at an estimated cost of \$600.

182. *Schodack Channel, New York, Hudson River.*—It is proposed to apply the same remedy at this light station as at Roha Hook, at an estimated cost of \$600.

183. *Nine-mile Tree, New York, Hudson River.*—The main ship channel runs close along the edge of the dike at this point. It is proposed to construct a crib inside of the dike for the foundation of a new portable beacon, at an estimated cost of \$1,000.

184. *Cow Island, New York, Hudson River.*—The stake-light at this place should be replaced by a portable beacon placed on a crib-work foundation filled with stone, at an estimated cost of \$1,000.

185. *Parada Hook, New York, Hudson River.*—A permanent beacon has been built at this place during the present working season.

Upper end of Stone Dike, New York, Hudson River.—The steamboat companies in the Hudson River have placed, and now keep, a stake-light at this place; private lights are, in every way, objectionable.

They are liable to mislead strangers, and there is no responsibility on the part of those who establish them for the proper care and management. That this light is a necessary aid to the safe navigation of the river is quite apparent, and therefore an estimate has been submitted for its establishment, amounting to \$1,000.

187. *Cuyler's Dyke, New York, Hudson River.*—A portable beacon was placed at this point last year, but it having been run into and destroyed by a tow, a stake-light was placed as a temporary expedient until means are provided for the erection of a suitable structure for exhibiting a light of the proper order. The estimated cost of a suitable structure of crib work and stone is \$1,000.

WHITE HALL NARROWS.

378. *Opposite Chapman's Dock.*—This stake-light is to be replaced by a portable beacon fitted with a suitable illuminating apparatus, similar to others in these waters.

379. *South of Snoddy's Dock.*—This stake-light is to be improved in the same way that others have been in the vicinity.

At the following stations in White Hall Narrows portable beacons have been established in place of former stake-lights, viz:

380. *Steam Mill Point.*

381. *Head of Two Channels.*

382. *Maple Bend.*

383. *Lower end of Two Channels.*

384. *Opposite Belden's Wharf.*

385. *Above Pulpit Point.*

386. *Lower end of Four Channels.*

By authority of a special appropriation of March 3, 1869, portable beacons have been established on crib-work foundations at the following points in White Hall Narrows, viz:

Benjamin's Place.

Carey's Camp.

Long Reach.

Chisolm's Bend.

Old Maid's Place.

In continuation, and to complete the entire system in these waters, appropriations were asked for last year for Red Hook and Pulpit Point. These two beacons should be erected on land, the sites for which can be purchased for \$100 each, and the whole estimated cost is \$1,300 for both sites and works.

Barber's Point, New York, Lake Champlain.—An appropriation was made July 15, 1870, for a light-house at this point. The site has been surveyed, and negotiations for the purchase of the land are entered into. If successful, the cession of jurisdiction will be applied for as soon as the legislature of the State of New York is in session. Plans and estimates are in course of preparation. It is expected that work at this station can be commenced at the opening of next spring and completed during the ensuing summer; but to do this any balance of the appropriation which remains June 30, 1871, must be made available for completing the work.

389. *Juniper Island, Vermont, Lake Champlain.*—A landing wharf and a boat-house for the protection of the boat necessary for this station are greatly needed, and an estimate of \$3,500 has been included in the annual estimates.

390. *Burlington, Vermont, Breakwater beacons, Lake Champlain.*—The

beacon on the north end of this breakwater was destroyed by fire during last summer. A temporary light was immediately exhibited, which will be superseded by a proper structure and a proper light before cold weather sets in this fall. The breakwater is now being constructed by the Government further north, and when the work is finished a new beacon must necessarily be built, under existing law, if means are available. In the spring and fall these beacons are reached by the keeper with great difficulty, not to say sometimes at the risk of his life. To fail to light them at any time would be a very serious business for those navigating the lake, but especially so when the weather is such as to render it hazardous to go to the breakwater by boat. It is therefore deemed of considerable importance to provide a dwelling for the keeper on the spot, for which, and the rebuilding of the beacon on the extended part of the breakwater, an estimate of \$7,500 has been submitted.

Colchester Reef, Vermont, Lake Champlain.—An appropriation was made July 15, 1870, "for building a light-house at Colchester Point or in its vicinity, Lake Champlain." After a careful examination and survey of the locality, it was found that the rock called "Middle Bunch" was the proper place for the new light-house. This rock is in the middle of the channel, with 7 feet water at low-water over it, and deep water on either side. With a light thereon a vessel can pass on either side close to the rock. The work has been commenced and will be carried above water (and further if possible) this fall, and will be completed next season.

Bluff Point, Valcour Island, Lake Champlain.—An appropriation was made by act of Congress approved July 15, 1870. A proper site has been selected and surveyed. As soon as the land can be purchased, and the jurisdiction ceded to the United States, work will be commenced, with the hope of completing the construction during the next summer, provided the balance that may remain June 30, 1871, is not carried to surplus fund.

392. *Cumberland Head, New York, Lake Champlain.*—As reported last year, this light is obscured by trees in the direction of Plattsburg and toward Point aux Roches. The owners of the adjoining land offer to remove the trees for a compensation of \$100 per acre, or to sell the land and remove the trees for \$200 per acre. The number of acres necessary to be cleared is 15. It is recommended to purchase the land and to sell it after the obstructions are removed, and turn the purchase-money into the treasury, which it is probable will be equal to the original sum paid and the cost of removing the trees.

The following are the names of light stations in this district not mentioned elsewhere:

105. *Newport Harbor, Rhode Island, on Goat Island.*
110. *Bristol Ferry, Rhode Island, entrance to Mount Hope Bay.*
117. *Stonington, Connecticut.*
119. *Morgan's Point, Connecticut, near Mystic.*
126. *Cedar Island, New York, Long Island, entrance to Sag Harbor.*
128. *Calves' Island, Connecticut, Connecticut River.*
136. *Stratford Point, Connecticut, Long Island Sound.*
141. *Eaton's Neck, New York, Long Island, Long Island Sound.*
143. *Norwalk Island, Long Island Sound.*
144. *Great Captain Island, New York, Long Island Sound.*
146. *Sand's Point, New York, Long Island, Long Island Sound.*
148. *North Brother Island, New York, East River.*
149. *Great West Bay, New York, sea-coast of Long Island.*
154. *Sandy Hook, entrance to New York Bay.*

- 156. *Sandy Hook West Beacon*, entrance to New York Bay.
- 158. *Chapel Hill Beacon*, entrance to New York Bay.
- 159. *Point Comfort Beacon*, entrance to New York Bay.
- 160. *Waakaack Beacon*, entrance to New York Bay.
- 162. *New Dorp Beacon*, entrance to New York Bay.
- 166. *Bergen Point*, New Jersey, Newark Bay.
- 167. *Corner Stake*, New Jersey, opposite Elizabethport.
- 173. *Rondout*, New York, Hudson River.
- 176. *Coxsackie*, New York, Hudson River.
- 373. *Opposite Chapman's Dock*, New York, Whitehall Narrows.
- 379. *South of Snoddy's Dock*, Vermont, Whitehall Narrows.
- 387. *Crown Point*, New York, Lake Champlain.
- 391. *Plattsburg Beacons*, New York, Lake Champlain.

LIGHT-VESELS.

102. *Brenton's Reef light-vessel*, (No. 11.)—Stationed to mark Brenton's Reef off the eastern entrance to Newport, Rhode Island. A complete gang of iron-wire standing rigging has been ordered for this vessel, and to be placed before winter sets in.

151. *Sandy Hook light-vessel*, (No. 16.)—This light-vessel has been eight years on her station without repairs, mainly owing to the want of a proper relief vessel and the demands for repairs of other vessels. A relief light-vessel will be available soon, and this vessel will be hauled up and put in thorough repair.

152. *Wreck of Scotland light-vessel*, (No. 20.)—It is understood that the work of removing the wreck of the *Scotland* has been completed, and as the authority for placing this vessel there ceases upon the completion of the removal of that wreck, this board has no authority to retain her there, although it has been represented that it is desirable to allow her to remain; that, however, must be decided by Congress. The other light-vessels have received such small repairs and fitments during the year as were required and could be made on their stations.

Relief light-vessel, (No. 17.)—This light-vessel has been thoroughly repaired and refitted during the present year, and will be sent to take the place of the *Brenton's Reef* light-vessel, which is to be brought in and refitted before winter sets in.

UNLIGHTED BEACONS, INCLUDING SPINDLES.

South Point, Rose Island, Narragansett Bay.—Granite structure surmounted by a spindle and cage. In good condition.

Halfway Rock, Narragansett Bay.—Spindle with square cage. In good condition.

Bullock's Point, Narragansett Bay.—Stone beacon with iron spindle and day-mark. Stone has been placed around foundation for protection.

Pawtuxet Beacon, Narragansett Bay.—Of stone; in good condition.

East Lime Rock, near Newport.—A granite structure surmounted by an iron spindle and cage.

Muscle Bed, Bristol Ferry, Rhode Island.—A stone beacon with iron spindle and day-mark has been built in place of the former stone beacon, which has been destroyed by a gale.

Bordeo's Flats, opposite Fall River.—A stone beacon with iron column and day-mark. This beacon has been rebuilt.

Castle Island.—A stone beacon surmounted by a black ball. The foundation requires repairing and protection. Estimated cost, \$500.

Allen's Rock, Warren River.—Stone beacon; in good condition.
Spindle Rock, west channel of Narragansett Bay.—Iron spindle with square wooden cage; in good condition.

White Rock Beacon, at the entrance of Wickford Harbor, Narragansett Bay.—An appropriation was made July 15, 1870, for the construction of a stone beacon in place of the former spindle. The work is progressing and will be completed during this season.

Spindle Rock, Greenwich Harbor.—An iron spindle with square cage; in good condition.

Hen and Chickens, Long Island Sound.—Iron spindle-bearing a square cage, painted black. Cage gone and will be replaced during the season.

Branford Reef Beacon, Long Island Sound.—Granite beacon surmounted by an iron shaft, bearing a black day-mark; in good condition.

Black Rock Beacon, Long Island Sound.—An iron pile beacon, with cage on top; in good condition.

Watch Hill Spindle, Long Island Sound.—Stands on a rock which is bare at low water, and is surmounted by a cage; in good condition.

Sugar Reef Beacon.—Iron pile beacon with cage work, day-mark in the form of a cone. The day-mark is gone and is to be replaced.

Lord's Channel.—Iron spindle, square cage-work day-mark. Day-mark is gone and will be replaced.

Catumb Reef, Fisher's Island Sound.—An iron pile beacon with square cage-work; day-mark in good condition.

Latimer's Reef.—An iron spindle bearing a square cage-work. The cage-work has been carried away and will be replaced.

Ellis's Reef.—An iron spindle with a square cage-work. In good condition.

Groton Long Point.—An iron spindle bearing a cage-work in the form of an inverted cone; in good condition.

Sea-flower or Potter's Reef Beacon.—Remains as reported last year. It is a very important mark in Fisher's Island Sound and recommended for immediate reconstruction. It is proposed to build a granite structure for the purpose of upholding the spindle and cage of the old beacon. Estimated cost, \$4,200.

Black Ledge.—An iron shaft, bearing a cage-work day-mark, formed by two cones connected at the vertices. In good condition.

Whale Rock.—An iron shaft bearing a globe cage-work day-mark. In good condition.

Crook's Spindle.—Is an iron spindle with a keg on top; in good condition.

Spindle on the Whale, entrance to the Mystic River.—As reported last year, this spindle was carried away by ice and will be replaced as soon as there are available funds.

Saybrook Beacon.—Stone beacon on Saybrook Bar. It was rebuilt on a granite foundation and properly protected by stone placed around it.

Quixe's Ledge.—An iron spindle, with a cask on top. Stands on a rock which is dry at half tide. It is in good condition.

Southwest Ledge Spindle.—A wooden mast resting on iron socket and bearing a square wooden cage-work day-mark. The mast has again been carried away and is now marked by a second-class buoy, which will be replaced by the proper spar.

Stratford River Beacon.—The construction of this beacon having been authorized by act of Congress, approved March 3, 1869, the work has been carried out in a very substantial manner.

Outer Beacon, Bridgeport Harbor, Connecticut.—A frustum of a square pyramid of wood, surmounted by a wooded mast, with a cask, painted

black. This beacon was damaged by a vessel running into it. The damage will be repaired and the beacon repainted.

Inner Beacon, Bridgeport Harbor.—The same as the outer beacon; in good condition.

Southport Beacon and Southport Breakwater Beacon.—Granite beacon; in good condition.

Norwalk Beacon, Connecticut.—A granite structure supporting a shaft and day-mark of iron. It is in good condition.

Great Reef, off Norwalk Island, entrance to Norwalk Harbor.—An iron spindle with day-mark is authorized by appropriation of July 15, 1870, and will be erected this fall.

Sand Spit, on the south point of Sand Spit, Sag Harbor.—An iron shaft with cage-work day-mark braced to four iron piles by iron braces. There is nothing left of this beacon but the shaft leaning over; the braces have been swept away by the ice. It is proposed to set the iron shaft perpendicular, and to protect it by four corners granite built around the shaft, and clamped together with galvanized iron clamps. Estimated cost, \$3,500.

Oyster Pond Point, Plum Gut, entrance into Gardener's Bay.—A reef runs out into Plum Gut, which is bare at low water. It is proposed to erect a stone beacon upon it to guide vessels running into Gardener's Bay, clear of this danger. Estimated cost, \$5,000.

Romer Beacon, on the west side of Romer Shoal, entrance to the Bay of New York.—It is built of cut granite, conical in shape, and supports a square wooden cage-work. It appears that a portion of the foundation on the east side has been undermined by the sea and has settled. Some of the perpendicular joints in six courses from the base upward have opened from 3 to 4 inches; the structure, however, is still perpendicular. The cage-work is rotten and requires renewing. It is proposed to protect the base by placing large blocks of granite around it, especially on the east side, and to fill up the joints with concrete, and protect the same with sheet iron secured to the stone with iron clamps. A new day-mark made of iron, to resemble the present one, is to be provided. Estimated cost, \$5,000.

Mill Reef Kill Van Kull Beacon is a sheet iron beacon, filled in with concrete and secured to a granite base. It is conical in shape and supports an iron shaft with an iron cage on top. It is in good condition.

Success Rock, Long Island Sound.—An iron shaft with conical cage-work, in good condition.

LIGHT-HOUSE DEPOT, STATEN ISLAND.

Building for workshops.—This building was entirely completed during this season. A steam-engine of 20 horse-power boiler has been put up, and the necessary tools and machinery for the lamp shop have been provided. The blacksmith shop is now being fitted out, a forge and a complete set of tools. There remains only the brass foundry to be provided with a set of crucibles and the necessary tools to complete the present requirements.

Building for offices.—In last year's report it was stated that the first story of this building was completed, and the iron beams of the second floor laid. Since then the second story and the iron roof were put up; the slating and tinning completed, the iron stairs set, and the stone sidewalk laid. The inner partitions are all up, and the iron beams are arched over with brick. To complete the building there are yet required the furring and plastering, flooring, sashes and shutters, heating apparatus, doors, painting, &c.

Shed and wharf.—The work authorized by the appropriation of July 15, 1870, has been commenced, and will be prosecuted so as to insure its early completion.

TENDERS.

The want of a steamer to assist in the engineering operations in this district has been reported last year. The extensive operations which are going on now and which are increasing every year in the district make frequent visits of the engineer to light-stations necessary. The ordinary means of communicating are expensive, and take up a great deal of time which could be used to better advantage to the service. The saving in the transportation of working parties and materials, and the facilities in controlling and directing operations by means of a steam tender would prove a great economy to the Light-house establishment.

The tender Putnam has been constantly employed in attending upon the buoys, carrying materials and supplies to the various stations in the district, and in transporting packages of various kinds from New York to the depot on Staten Island, and from the latter to New York for shipment to other districts.

The tender Cactus, having been used in the second district until unable to do further duty without extensive repairs, was sent to the third district, and has been, during the summer, put in thorough repair.

The schooner Sunbeam, used as a sailing tender for looking after the buoys and other light-house duties in Long Island Sound, having from age become unfit for economical use on such trying service, was sold at public auction by authority of the Department, and the net proceeds of sale turned into the Treasury.

Number of boxes, packages, bundles, cases, barrels, &c., received at and shipped from United States Light-house depot, Staten Island, from October 1, 1869, to September 30, 1870, inclusive.

	Boxes.	Packages, cases, &c.	Barrels.	Total.	Increase in 1870.
Received	1, 537	2, 609	2, 403	6, 549	1, 148
Shipped	1, 336	3, 167	2, 256	6, 759	1, 724
Total	2, 873	5, 776	4, 659	13, 308	2, 872

Lens apparatus and lanterns received at and shipped from United States Light-house depot, Staten Island, from October 1, 1869, to September 30, 1870, inclusive.

	Lens apparatus.										Lan- terns.	Total.
	1st order.	2d order.	3d order.	3½ order.	4th order.	5th order.	6th order.	Steamer lenses.	Pressed glass lenses.	Steamers running light lenses.	Canal lenses.	
Received			5	1	12	7	12	14	19	18	5	93
Shipped	3		2		7	7	5	7	18	12		63
Total	3		7	1	19	14	17	21	37	30	5	156

LIGHT-HOUSE BOARD.

353

Buoys and appendages received at and shipped from Light-house depot, Staten Island, from October 1, 1869, to September 30, 1870, inclusive.

	Can-buoys.			Num-buoys.			Spar-buoys.	Sinkers.				Ballast balls.			Total.
	1st class.	2d class.	3d class.	1st class.	2d class.	3d class.		1st class iron.	2d class iron.	3d class iron.	Stone.	1st class.	2d class.	3d class.	
Received											17		30		47
Shipped	5				5		9		8	12	1	5	18		63
Total	5				5		9		8	12	18	5	48		110

Articles manufactured or repaired in the workshop at Staten Island Light-house depot from October 1, 1869, to September 30, 1870, inclusive.

	Lenses.	Lamps.	Lamp burners.	Miscellaneous articles.	Total.	Increase.
Manufactured	26	268	180	1,029	1,503	546
Repaired	19	65	22	218	324	152
Total	45	333	202	1,247	1,827	698

FOURTH DISTRICT.

The fourth district extends from Squam Inlet, New Jersey, to and including Metompkin Inlet, Virginia. It also includes Delaware Bay, River, and tributaries.

Inspector.—Commodore William H. Gardner, United States Navy, to May 31, 1870; Commodore John P. Gillis, United States Navy, from May 31, 1870, to October 1, 1870; Commodore James H. Strong, United States Navy, present inspector.

Engineer.—Brevet Brigadier General Hartman Bache, colonel of engineers United States Army, to February 21, 1870; Brevet Brig. General I. C. Woodruff, lieutenant colonel of engineers United States Army, present engineer.

In this district there are:

Light-houses and lighted beacons	18
Light-vessels	3
Buoys actually in position	101
Spare buoys for relief and to supply losses	204
Tender (sail) Spray	1

The numbers preceding the names of stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coast of the United States," issued January 1, 1870.

188. *Barnegat, New Jersey, Barnegat Inlet.*—The semi-monthly measurements along the beach near the light-house have been continued throughout the last year, and show slight favorable changes since the last annual report. The pier at the terminus of the works at the western end, and a few of the jetties protecting the shore have been damaged, but it is thought unnecessary to make any repairs at present, as the light-station is not affected by the damage. The works for protecting the light-house lot have proved a success; they were completed on the 30th of September, 1869.

190. *Absecom, New Jersey, Absecom Inlet.*—The semi-monthly measurements along the beach in the vicinity of the light-house have been made throughout the last year. There have been several slight changes along the beach, but none of any importance, it is thought, so far as the site of the light-house is concerned. The changes for the last two months have been favorable, the low water-line having moved out. The high water-line has not changed. The large sand bar in front of Atlantic City, reported in the last annual report of the district engineer as having become attached to the beach, and moving up towards the point of the inlet, has continued to move during the year, and is now forming along the shore of the inlet, which causes the low water-line to make out all around the point. If this continues, there need be no apprehension about the safety of the light-house. The North or Brigantine Channel out of the inlet has deepened considerably during the year, and from present appearances the chances are that this channel will shortly be better than the southern channel, which has become quite narrow. It is probable that the southern channel will, at no very distant day, be filled up by the sand bar between it and the north channel. If this proves to be the case, the fears for the safety of this fine light-house will be at an end; but in view of the danger that the sea may again encroach on the light-house site, in which case it will be necessary to defend it, the board recommend that the appropriation of \$4,000 which has reverted to the treasury under the act of 12th of July, 1870, be reappropriated, and that the balance of the existing appropriation of \$10,000 be continued, neither amount to be used till the emergency requires it.

Correspondence has been had with the authorities of Atlantic City and the United States district attorney of New Jersey, in relation to proposed works for protecting the beach near the light-house, and to a form of a grant by the property owners and by the corporation of Atlantic City to protect the Government from any claims for damage for land to be occupied by the United States for the sea defenses. Most of the owners have consented to sign the grant, and it only requires the consent of two or three persons to sign, when the deed can be executed. Tracings showing the changes in the high and low water-lines, as they have occurred, have been forwarded to the board during the year.

A small frame structure will be erected during next season, for use as a storehouse to take care of materials, tools, empty oil barrels, &c., to take the place of the present structure, which is in a dilapidated condition, and will not admit of repairs. These structures are appendages to the stations, and are of considerable value. The cost of the building will be about \$450.

197. *Maurice River, New Jersey, Haystack Island, Delaware Bay.*—The work of placing the new parapet and fourth-order regulation lantern on the light-house at this station is now in progress, and, it is expected, will be completed in a few days.

198. *Egg Island, New Jersey, Delaware Bay.*—No repairs have been made during the year; a new boat-house is required at a cost of about \$250.

200. *Mahon's River, Delaware, Delaware Bay.*—The abrasion of the marsh along the front of the building has been considerable. The building is on the back end of the light-house lot, and the location will have to be changed in a short time. This will require a new lot to be purchased for the building, which can probably be moved without much difficulty or expense.

201. *Cohansey, New Jersey, Delaware Bay.*—The following repairs have

been made at this station: The bank inclosing the building has been thoroughly repaired and raised 18 inches above the original level for a distance of 250 feet, where it was damaged by the storms and high tides of last spring, the outer slope and new top of the bank protected with stone, the old gas-house taken down, and the débris (bricks and mortar) deposited along the bank to protect it from the wash of the sea. The removal of the old gas-house adds very much to the good appearance of the station.

204. *Christiana, Delaware, mouth of Christiana River, Delaware Bay.*—A survey has been made at this station for locating the position of the light-house on Major Bache's map of Christiana River, (1835,) with a view of occupying the station as a light-vessel and buoy depot, wharves, and storehouse for light-house and buoy tenders, light-vessels, &c. A special appropriation was made July 15, 1870, "for building wharves, sheds, and otherwise fitting the Christiana light station as a buoy depot and winter harbor for light-vessels, at the mouth of Christiana River, near Wilmington, Delaware." The plan proposed is to build the upper wharf, and storehouse for rigging, sails, &c., and to do part of the grading, and, if the amount already appropriated is sufficient, to erect the upper buoy shed also. Plans and estimates are now being prepared. The approximate estimate for continuing the works, (that is, to finish the upper wharf, storehouse, and buoy shed, and that part of the grading,) and to construct the second wharf, buoy shed, and grading, is \$14,000.

205. *Fort Mifflin, off Fort Mifflin, Delaware River.*—An appropriation was made at the last session of Congress (July 15, 1870) for rebuilding this light-house and the pier upon which it is placed. The pier upon which the buildings stand having become decayed, operations have been commenced to take down as much of it as may be found to be necessary and rebuild upon the old foundation, taking in the space embraced in the irregular form on the northeastern front of the pier, and to remove the building back from the southeastern front of the pier, where it has frequently been injured by the jib-booms of vessels running into it during foggy weather. This light station is on a shoal in Delaware River, and lies close to the main channel, through which all the heavy vessels pass.

At each of the following-named light stations there have been repairs and renovations more or less extensive during the last year:

- 188. *Barnegat*, New Jersey, Barnegat Inlet.
- 189. *Tucker's Beach*, New Jersey, near Little Egg Harbor.
- 192. *Cape May*, New Jersey, entrance to Delaware Bay.
- 195. *Delaware Breakwater*, Delaware, entrance to Delaware Bay.
- 197. *Maurice River*, New Jersey, Delaware Bay.
- 201. *Cohansey*, New Jersey, Delaware Bay.
- 202. *Bombay Hook*, Delaware, Delaware Bay.
- 203. *Reedy Island*, Delaware Bay.
- 205. *Fort Mifflin*, Delaware Bay, off Fort Mifflin.
- 206. *Fenwick's Island*, sea-coast of Delaware.
- 207. *Assateague*, sea-coast of Virginia.

The following-named light stations require repairs to be made during the ensuing year:

- 192. *Cape May*, New Jersey, entrance to Delaware Bay.
- 193. *Cape Henlopen*, Delaware, entrance to Delaware Bay.
- 196. *Brandywine Shoal*, screw-pile light-house, Delaware Bay.
- 198. *Egg Island*, New Jersey, Delaware Bay.
- 203. *Reedy Island*, Delaware Bay.

LIGHT VESSELS.

191. *Five-fathom Bank light-vessel*, (No 37.)—Stationed off Cape May, New Jersey. This vessel was built by contract at Philadelphia last summer, and placed in December following on the station in place of the old vessel, which required very extensive repairs.

Relief light-vessel, No. 18, is now undergoing very extensive repairs under contract at Philadelphia. When completed she will be kept at Wilmington, Delaware, to take the place of either of the light-vessels in the district in case they break adrift or require to be brought in for repairs.

BUOY DEPOTS.

The spare buoys for relief and casualties in this district are at Barnegat Inlet, Little Egg Harbor, and Tucker's Cove, Absecom Inlet and Somer's Point, New Jersey. Those for Delaware Bay and River are kept at Wilmington, Delaware, and those for Chincoteague Inlet, Virginia, are kept there.

TENDERS.

The small sailing schooner *Spray* attends upon the buoys and lights in this district.

LIGHT-HOUSE AND BUOY DEPOT, AT CHRISTIANA LIGHT-HOUSE, NEAR WILMINGTON, DELAWARE.

This depot will be commenced this season, and when sufficiently far advanced the spare light-vessel and the spare buoys of the district, except those for the inlets on the coast, will be laid up at that place. The district supplies to meet immediate wants occasioned by casualties will be stored there also for distribution by the tenders.

FIFTH DISTRICT.

The fifth district extends from Metompkin Inlet, Virginia, to include New River Inlet, North Carolina, as well as Chesapeake Bay and its tributaries, and Albemarle and Pamlico Sounds.

Inspector.—Commodore Thomas A. Dornin, United States Navy, to October 1, 1870; Commander James E. Jouett, United States Navy, present inspector.

Engineer.—Brevet Brigadier General J. H. Simpson, colonel of engineers United States Army.

In this district there are:

Light-houses and lighted beacons	66
Light-vessels	5
Day or unlighted beacons	89
Buoys actually in position	523
Spare buoys for relief and to supply losses	520
Tenders (steam) Heliotrope; Tulip	2
Tender (sail) Maggie	1

The numbers preceding the names of stations correspond with the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

Lambert's Point, Virginia, east side of Elizabeth River.—A light has been strongly urged for the shoal off this point. Vessels, especially during fogs, are liable to ground on this shoal. The proper kind of structure to mark this shoal will be a square one, supported on one pile

at each corner and one in the center, similar to those erected elsewhere for the smaller orders of lights, at a cost of about \$15,000, for which an appropriation is asked.

211. *Willoughby's Spit, Virginia, Chesapeake Bay.*—To complete the changes of light-vessels to screw-pile light-houses in this district, an appropriation of \$20,000 will be necessary to erect an iron-pile structure on Willoughby's Spit, which lies about two miles to the eastward of Fortress Monroe, in from 8 to 12 feet water, to take the place of the light-vessel, with two expensive lights, which now marks that danger. The structure required for this purpose will be similar to those already placed in Chesapeake Bay, at Smith's Point, Wolf Trap, and York Spit.

215, 216. *White Shoals and Point of Shoals iron screw-piles, Virginia, James River.*—Appropriations were made at the last session of Congress of \$10,500 for each for rebuilding these two light-houses. The existing structures at these points being in imminent danger of being swept away by freshets and ice, as the one at Deep Water Shoals in the same river had been, careful examinations were made of the locations by soundings, and to determine the nature of the bottom at each place previous to the preparation of the plans for rebuilding them. The engineer of the district submitted a report and plans. The plan of each which has been approved by the board will be in general design similar to the one for Deep Water Shoals, substituting a wooden pile covered with a cast-iron screw sleeve for the solid wrought-iron screw-pile. These structures will in all likelihood be completed during the present fiscal year.

221. *York Spit, iron screw-pile light-house, Virginia, off mouth of York River, Chesapeake Bay.*—The iron and wood work of this light-house were prepared simultaneously with Wolf Trap, before the departure of the party for the erection of Wolf Trap light-house. The whole was kept in store at Baltimore until needed. On the completion of the foundation of this latter house, which was on the 30th of June, the site of the structure for York Spit was located, and the work of placing the temporary platforms and trestles commenced July 5. A relief light-vessel, which had served to mark the works at Wolf Trap, was towed to and anchored at York Spit for the same purpose. From July 22 until August 2, the time was occupied in loading the schooner with piles, iron and wood work, and supplies necessary for the prosecution of York Spit operations. The vessel left Baltimore August 3, and arrived at its destination August 5. The pile was driven August 10, and the last, or fourteenth one, on the 30th. This shoal proved to be even harder than that of Wolf Trap. In the latter case, the wooden piles, on the supposition that it was a very soft bottom, were not shod, and the difficulty experienced in driving them called attention to the necessity of shoeing those at York Spit with iron points. Notwithstanding this aid, it required 243 blows of a 1,600-pound hammer to effect a penetration of 20 feet in the first pile. At this date the iron-work of the structure is all set up and properly coupled together and braced, the staging removed and sent to the Lazaretto depot, and the frame of the house is in position. The structure is unexceptionably built, and progressing finely, the indication being that it will probably be ready for illumination some time in the latter part of November of this year.

223. *Wolf Trap screw-pile light-house, Virginia; Wolf Trap Shoal, Chesapeake Bay.*—A contract for the metal work of this light-house was made October 22, 1869. The superstructure was prepared at the Lazaretto work-shops during the past winter and spring. Two schooners were chartered and the party organized April 24. Until May 5 the time was occupied in loading the iron-work, and superstructure, materials, sup-

plies, &c. May 9 the site, as approved by the board, was identified, and marked by buoys, and the labor of placing the temporary trestles and platforms immediately commenced. Before completing this preliminary work a gale carried away such of the trestles as were in position. They were recovered in the vicinity of New Point Comfort, but the accident caused a week's delay. Since then the work has steadily progressed and a "Notice to Mariners" advertises the light to be exhibited on the evening of October 1, 1870. The light is a *fixed white* of the fourth order, *varied by a white flash every thirty seconds*, illuminating the entire horizon with a focal plane 38 feet above ordinary sea-level, and visible for a distance of $11\frac{1}{2}$ nautical miles. A fog bell of 500 pounds weight, struck by Stevens's apparatus at intervals of fifteen seconds, is placed on the eastern side of the light-house. The superstructure is painted a lead color to conform to the color of the light-vessel which the light-house replaces. The shoal, instead of being a hard crust of 6 feet of sand, overlying a soft substratum of mud, as was supposed, and on which predication was prepared the plan for a foundation of wooden piles covered with cast-iron screw sleeves, penetrating 4 feet, proved to be extremely hard as far as the piles penetrated. There is no doubt that the structure as it is built will have all the stability requisite to resist the severest storms and the heaviest ice.

Love Point Shoal, iron screw-pile light-house, Maryland, north end of Kent Island, Chesapeake Bay.—An appropriation having been made (this being the second time an appropriation has been made for this purpose) for the erection of an iron screw-pile light-house on the shoal waters off from the northern end of Kent Island, an examination has been made of the shoal and the plan for the structure approved by the board, which, as in the cases of the structures for White Shoals and Point of Shoals, is to be similar in general design to light-house at Deep Water Shoals, James River, but modified as to details. The structure is to stand in 10-foot water, and a little over a mile from the north end of Kent Island. It will differ from those ordered for James River in that there are to be four ice-breakers instead of two. The drawings and specifications are now being prepared, and the work will be finished within the present fiscal year.

Craighill Channel, leading from Chesapeake Bay into the Patapsco River, Maryland.—An estimate has been submitted in the annual estimates for the next fiscal year, based upon plans prepared by the engineer of the district for two screw-pile lights to serve as a range by day and by night for the new Craighill Channel leading from the Chesapeake Bay into the Brewerton Channel of the Patapsco River, about 15 miles from the harbor of Baltimore. This channel has been laid out and deepened with appropriations made by Congress under the direction and superintendence of officers of engineers. The channel is now 200 feet wide, with a depth at mean low tide of 21 feet. It will be completed during the current fiscal year at a probable width varying from 300 to 500 feet, and it is urged that it is of the utmost importance, in order that it may be safely used day and night, that these two light-houses be authorized and built at the earliest practicable moment. It is understood that the depth in this channel, although good, is still increasing, and continued use, especially by propeller steamers, will do more than anything else to keep it open and possibly improve it, thereby relieving the Government from an annual expense for dredging. It is believed that the establishment of these two lights would render the two expensive lights built on jetties at North Point unnecessary for all practical purposes, and might be dispensed with.

244. *Lazaretto Point light-house, Maryland, Baltimore Harbor.*—The excavation made by the contractor at Lazaretto Point light-house grounds, under a contract for mining iron ore, has been filled and graded by him, and the soil which had been preserved spread over the excavated place. A survey of the Lazaretto Point light-house lot was made, and a plat of it forwarded to the office of Light-house Board in March, 1870. The frame-work of the tower to support the fog-bell and striking apparatus ordered for this point was commenced at Lazaretto workshops in the month of November 1869. Agreeable to "Notice to Mariners," its readiness for use dates January 1, 1870. The bell was made to strike at regular intervals of ten seconds. The tower stands immediately adjoining the light-tower and between it and the Patapsco River. In the same "Notice to Mariners" which gave publicity to the fog-bell, the change in the Lazaretto Point light from white to red was noticed. This alteration was made on account of the proximity of the light to iron furnaces and a rolling-mill, which rendered it difficult to distinguish between the light of the cupolas of these factories and the light of the light-tower.

253. *Fort Washington beacon, Maryland, Fort Washington, Potomac River.*—In November 1869 orders were issued to prepare the framework of a beacon-light to replace the temporary post and lantern at Fort Washington. It was prepared at the Lazaretto workshops in December. February 1 the steam-tender Tulip, with a party and the necessary supplies and appliances, proceeded to the locality for the purpose of putting up the beacon. This structure, furnished with a lens of the sixth order and a lantern of the portable beacon pattern, was completed on the 18th February.

A first-class light-house between Cape Henry and Bodies Island, North Carolina.—With the completion of the rebuilding of the Bodies Island light-house on the coast of North Carolina, to the north of Cape Hatteras, for the commencement of which an appropriation was made at the last session of Congress, and the necessary sum for completing it estimated for this year, there will remain only one important break of unlighted coast on the Atlantic from the St. Croix, Maine, to about Mosquito Inlet, on the coast of Florida, and that dark space will be embraced between Cape Henry and Bodies Island, a distance of 80 miles, and an unlighted space of 40 miles, at the center of which latter there should be a first-order light, so that from Cape Henry to Cape Hatteras the broad side of that long stretch of low land and dangers could not be approached within 18 or 20 miles without seeing a warning of danger. In order to avoid the strong current of the Gulf stream, vessels bound around Cape Hatteras from the northern and eastern ports run inside of the cold wall of water of that stream, within which they have a favorable current of over, on an average, one mile an hour, and a smoother sea in bad weather; but in the absence of powerful sea-coast lights sufficiently near to each other to give warning of approach to danger, many vessels laden with valuable lives and cargoes have been lost annually between these two points. No estimate for a light to supply this want has been submitted this year, but as the subject was discussed before the committee of appropriations last year, when it seemed to be considered advisable to wait a little longer, in view of other pressing wants at that time, the facts are respectfully again submitted for such consideration and action as may be deemed best.

Bodies Island, sea-coast of North Carolina.—An appropriation was made at the last session of Congress (July 15, 1870) for commencing the erection of a light-house at or near the site of the former light which

marked this part of the coast prior to its destruction during the rebellion. Steps have been taken preparatory to an early commencement of this important work. It is designed to build it of brick, with a focal plane of about 150 feet above the mean level of the sea. The scows and other movable articles which are now and have been in use at Cape Hatteras, will at an early day be available for transfer to this light station.

256. *Cape Hatteras, North Carolina.*—The operations on this edifice progressed rapidly and satisfactorily under the direction of the engineer of the district from the date of the last annual report until the 16th of June. By this time the entire portion of the brick work of the tower beneath the iron capital which carries the lantern was completed. All the window frames were set, and four flights of the iron stairway in position, and their landings arched. The work thus far has been of the most thorough character, the iron work furnished by the contractors is excellent, and the brick laid in the most substantial manner, each brick being completely embraced in the best kind of cement mortar, and each course as it was laid brought truly to the batter and leveled. The cement and brick used were of unexceptionable quality. The structure thus far gives the assurance that it will meet in every respect the anticipations of the Light-house Board.

The tower having attained the above height of 153½ feet, a delay occurred in procuring the iron work of the capital, and as nothing more could be done without, it was ordered on the 16th of June to suspend operations and withdraw the force until such time as the castings would be ready, and to leave a few men for the necessary care of the tower and materials. The capital finally advancing toward completion at the workshops, the steamer Tulip was dispatched on the 10th September with a party in order to make preparations for the reception and setting up of the iron work. Two vessels were subsequently chartered for the purpose of carrying the iron work of the capital, supplies, &c., and on the 27th they left under tow of the steam tender Tulip, via the Albemarle and Chesapeake Canal, for the work.

The following is a brief summary of each month's operations till temporary suspension:

On the 25th of September, 1869, the ninth course of granite quoins was set up and backed with brick, as was also a portion of the tenth course.

During November extensive repairs were made to the old dwelling, and a large quantity of filling in of sand and soil was made in a slough surrounding the house.

January 30, brick work reached a height of 32 feet above the main floor.

April 30, the tower had reached a height of 103 feet above ground, making it 97 feet above the main floor. The first two flights of iron stairway were also placed in position, as were also the wrought iron oil tanks.

May 28, a height of 147 feet from the ground or 141 feet above main floor was reached.

June 16, the brick work was leveled up to a height of 153½ feet from the ground to the lower edge of the necking or belt course of the capital. Four flights of the iron stairway were in position in the cylinder. At this date the work was temporarily suspended as above related.

The iron casing of the watch-room and the lantern are now being placed, and it is expected that the entire height (180 feet to focal plane) will be completed before the ensuing winter. This will be the highest brick light-house tower in the world.

Hatteras Inlet, entrance to the sounds of North Carolina.—A light was authorized March 3, 1859, to be established at Hatteras Inlet, the entrance to the sounds of North Carolina, but it was not commenced before the breaking out of the rebellion, and afterward it could not be built. This is at present the best inlet leading to and from the sounds of North Carolina, with which there is a very large trade. This inlet is 14 miles southwest from Cape Hatteras, within the range of the influence of that cape upon the weather, and as the channel is narrow and only marked by buoys, it is dangerous to attempt to enter or pass out at night for want of a small light. An estimate has been submitted for the erection of a suitable light at this place.

At each of the following-named light stations there have been repairs and renovations more or less extensive during the last year:

- 210. *Cape Henry*, Virginia, entrance to Chesapeake Bay.
 - 215. *White Shoal screw-pile light-house*, Virginia, James River.
 - 220. *Back River*, Virginia, entrance to Back River.
 - 224. *Stingray Point*, Virginia, mouth of Rappahannock River, Chesapeake Bay.
 - 226. *Watt's Island*, Virginia, Tangier Sound, Chesapeake Bay.
 - 227. *James Island screw-pile light-house*, Virginia, Tangier Sound, Chesapeake Bay.
 - 228. *Somer's Cove screw-pile light-house*, Maryland, Tangier Sound, Chesapeake Bay.
 - 230. *Frog Point*, Maryland, Smith's Island, Chesapeake Bay.
 - 231. *Clay Island*, Maryland, Tangier Sound, Chesapeake Bay.
 - 232. *Point Lookout*, Maryland, entrance to Potomac River, Chesapeake Bay.
 - 233. *Hooper's Straits screw-pile light-house*, Maryland, off mouth of Hona River, Chesapeake Bay.
 - 239. *Seven-foot Knoll screw-pile light-house*, Maryland, mouth of Patapsco River, Chesapeake Bay.
 - 240. *North Point*, Maryland, mouth of Patapsco River, Chesapeake Bay.
 - 241. *Fort Carroll*, Maryland, Patapsco River.
 - 244. *Lazaretto Point*, Maryland, Baltimore Harbor.
 - 245. *Pool's Island*, Maryland, off mouth of Gunpowder River, Chesapeake Bay.
 - 246. *Turkey Point*, Maryland, mouth of Elk River, head of Chesapeake Bay.
 - 249. *Fishing Battery*, Maryland, mouth of Susquehanna River, Chesapeake Bay.
 - 248. *Havre de Grace*, Maryland, Concord Point, mouth of Susquehanna River, Chesapeake Bay.
 - 249. *Piney Point*, Maryland, Potomac River.
 - 250. *Blackistone's Island*, Maryland, entrance to Clement's Bay, Potomac River.
 - 251. *Lower Cedar Point screw-pile light-house*, Virginia, Yates Shoal, Potomac River.
 - 252. *Upper Cedar Point screw-pile light-house*, Maryland, off mouth of Tobacco River, Potomac River.
 - 253. *Fort Washington*, Maryland, Potomac River.
 - 254. *Jones's Point*, Virginia, Potomac River, near Alexandria.
- The following are the names of light stations in this district, not mentioned elsewhere:
- 208. *Hog Island*, sea-coast of Virginia.
 - 209. *Cape Charles*, Virginia, entrance to Chesapeake Roads.

- 212. *Old Point Comfort*, Virginia, entrance to Hampton Roads.
- 213. *Craney Island screw-pile light-house*, Virginia, mouth of Elizabeth River.
- 214. *Naval Hospital*, Virginia, Elizabeth River.
- 216. *Point of Shoals screw-pile light-house*, Virginia, James River.
- 217. *Deep Water Shoals screw-pile light-house*, Virginia, James River.
- 218. *Jordan's Point*, Virginia, James River.
- 219. *Cherrystone*, Virginia, mouth of Cherrystone Inlet, Chesapeake Bay.
- 222. *New Point Comfort*, Virginia, entrance to Mobjack Bay, Chesapeake Bay.
- 225. *Windmill Point screw-pile light-house*, Virginia, Chesapeake Bay.
- 259. *Smith's Point screw-pile light-house*, Virginia, mouth of Potomac River, Chesapeake Bay.
- 234. *Cove Point*, Maryland, mouth of Patuxent River, Chesapeake Bay.
- 235. *Sharp's Island screw-pile light-house*, Maryland, mouth of Chop-tank River, Chesapeake Bay.
- 236. *Thomas's Point*, Maryland, Chesapeake Bay.
- 237. *Greenbury Point*, Maryland, mouth of Severn River, Chesapeake Bay.
- 238. *Sandy Point*, Maryland, Chesapeake Bay.
- 242. *Hawkins's Point screw-pile light-house*, Maryland, Patapsco River.
- 243. *Leading Point screw-pile light-house*, Maryland, Patapsco River.
- 255. *Bowler's Rock screw-pile light-house*, Virginia, Rappahannock River.
- 258. *Ocracoke*, North Carolina, entrance to Ocracoke Inlet.
- 259. *Southwest Point Royal Shoal screw-pile light-house*, North Carolina, Pamlico Sound.
- 260. *Northwest Point Royal Shoal screw-pile light-house*, North Carolina, Pamlico Sound.
- 261. *Harbor Island screw-pile light-house*, North Carolina, Pamlico Sound.
- 262. *Brant Island Shoal screw-pile light-house*, North Carolina.
- 263. *Neuse River*, North Carolina, entrance to Neuse River.
- 264. *Pamlico Point*, North Carolina, entrance to Pamlico River, Pamlico Sound.
- 265. *Long Shoal screw-pile light-house*, North Carolina, Pamlico Sound.
- 267. *Croatan screw-pile light-house*, North Carolina, Pamlico Sound.
- 268. *North River screw-pile light-house*, North Carolina.
- 269. *Wade's Point screw-pile light-house*, North Carolina, Albemarle Sound.
- 270. *Roanoke River screw-pile light-house*, North Carolina, mouth of Roanoke River, Albemarle Sound.
- 271. *Cape Lookout*, North Carolina.

LIGHT-VESSELS.

Upon the completion of the York Spit screw-pile light-house, now in course of construction and near completion, there will be but two light-vessels actually at stations in the district. Those removed, retaining one in the district after being put in good repair, will be sent to the third district to serve as reliefs to the light-vessels in that district, in case of needed repairs or of breaking adrift. Should Congress grant the appropriation asked for the erection of the proposed screw-pile light-house as a substitute for the expensive double light-vessel light at Willoughby Spit, and the general appropriation will allow of the erection

of a small screw-pile light-house to take the place of the light-vessel in the Choptank River, there will thereafter be no light-vessel in this large district.

DEPOTS.

This district is very deficient in proper places for the storage of spare buoys and their fixtures. The one at the Lazaretto light station below Baltimore serves for the storage of a few buoys for use in the upper Chesapeake and tributaries. A lot has been procured at Portsmouth, Virginia, for a central depot for light-vessels and buoys, and for such small supplies as are necessarily kept in each district to meet cases of emergency.

TENDERS.

The steam tender *Heliotrope* and the small sailing schooner *Maggie* are employed almost exclusively in keeping the buoys in position and delivering supplies. During these visits, however, inspections are generally made by the inspector.

The steam tender *Tulip* is employed under the direction of the engineer of the district in transporting materials and labor to new light stations and to such old ones as require repairs. These vessels, from constant use, age, and small repairs made upon them, need extensive repairs at this time.

SIXTH DISTRICT.

The sixth district extends from New River, North Carolina, to include Cape Canaveral light-house, Florida.

Inspector.—Captain Bayse N. Wescott, United States Navy, to October 1, 1870; Captain Richard T. Renshaw, United States Navy, present inspector.

Engineer.—Brevet Major George Burroughs, captain of engineers United States Army, to the time of his death, January 22, 1870; Brevet Major William J. Twining, captain of engineers, United States Army, present engineer.

In this district there are:

Light-houses and lighted beacons	27
Light-houses and lighted beacons destroyed during the rebellion and not rebuilt	14
Light-houses and lighted beacons extinguished during the rebellion and not relighted since, structures not destroyed	9
Day or unlighted beacons	52
Light-vessels	6
Buoys actually in position	163
Spare buoys for relief and to supply losses	25
Tender (steam) <i>Venona</i>	1
Tender (sail) <i>Narragansett</i>	1

The following numbers preceding the names of stations correspond with those of the "Light-house Lists of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

231. *Sullivan's Island beacon, Charleston Harbor, South Carolina*.—The present beacon-light at this place is a temporary open frame-work, wooden structure, erected upon the roof of a private residence, and retained there against the wishes of the owner. It is in very bad condition. This light was established in its present position immediately after the surrender of Charleston in the spring of 1865, to enable the vessels of the Navy and those of commerce to navigate the channel safely at night, leading from the inside of the outer bar of the main channel to the turning point near Fort Moultrie. An appropriation was made

by Congress March 3, 1859 for two beacon range-lights on Sullivan's Island, which were destroyed during the rebellion, and on July 20, 1868, an appropriation of \$15,000 was made for rebuilding these lights; but failing to obtain valid title to the necessary land upon which to place them, and the required cession of jurisdiction by the State, the appropriation reverted to the treasury under the operation of the fifth and sixth sections of the act approved July 12, 1870. No further steps can be taken toward the rebuilding of these structures until a reappropriation, which has been asked, is made. It is understood that there will be neither difficulty nor unnecessary delay hereafter in obtaining from the State authorities during the next session of the legislature both a valid title to and cession of jurisdiction over the sites. These lights are essential to the easy and safe navigation of the main channel inside of the bar, and, when established and the lights exhibited, will render the Weehauken light-vessel now placed in the channel, which these lights were designed to mark, unnecessary, and cause an annual saving of about \$5,000, the cost and maintenance of that vessel, independently of natural wear and tear of the vessel and her equipments.

282. *Fort Sumter, Charleston Harbor, South Carolina.*—In case the work on the fort is resumed by the military authorities, the light-house structures will have to be lowered about 15 feet, and possibly it may become necessary to remove them entirely from their present positions.

Morris Island range-lights, Charleston Harbor, South Carolina.—The two beacon-lights authorized to be placed on Morris Island, to serve as a range for the present deepest channel, known as the Pumpkin Hill Channel, have been completed, their lights exhibited, and the Rattlesnake Shoals light-vessel restored to her proper position off Rattlesnake Shoals.

Daufuskie Island range lights, Calibogue Sound, South Carolina.—To mark the entrance into Calibogue Sound, and facilitate the passage from Port Royal Harbor to Savannah River, an appropriation for a light-house at Braddock's Point, Georgia, to mark this channel, reverted to the treasury by act of 12th July, 1870. This inside channel is used by the passenger steamers plying between Charleston, South Carolina, and Savannah, Georgia, and by some sailing vessels. The entrance of Calibogue Sound passes between the Grenadier breakers on the west and a long series of shoals and breakers on the east; the deepest water being found along a tortuous channel, for which a single light station, however situated, would be a very indifferent guide. It may be assumed that the vessels making use of this channel do not draw more than 6½ feet, this being the extreme draught for those steamers carrying passengers which are compelled to make their passage by night. Without wind or tide to affect their direction, vessels would have no difficulty in steering a true course, provided a single light were shown either on the extremity of Braddock's Point or on some one of the adjacent shoals. This, however, is not the case. There is an east and west current crossing the channel at right angles, and varying in direction and intensity with the state of the wind and tide. From the force of this varying current vessels are carried out of their true direction, and are liable to go ashore, either on the west breakers or the eastern shoals. It is to be remarked also that this bay is open and exposed to the full force of the Atlantic Ocean. If a single light is to be shown, its proper position is at a point on the shoal south of Braddock's Point, and west of the mouth of New River, and not at Braddock's Point; but a careful examination of the soundings near by shows great irregularity in the bottom, which indicate constant change, and the board is not disposed to recommend

the erection of a light on this shoal on account of the expense, and because a pair of range lights situated on Daufuskie Island would fulfill more perfectly the conditions required than can be done by a single light. An appropriation of \$15,000 is recommended in lieu of the reverted Braddock's Point appropriation.

286. *Tybee entrance to Savannah River, Georgia.*—The tower of the main light (which has been rebuilt since the close of the rebellion) is founded on the base of the old tower. This light station is very unhealthy, which is mainly attributable, it is believed, to a small swamp which lies immediately in the rear of the keeper's dwelling. Before the rebellion, this swamp was drained by carrying the water to a lower level; but the drain having become obstructed, it will be necessary to reopen it, which will be done during the dry season this fall and winter.

288. *Tybee Knoll, Savannah River, Georgia.*—The appropriation for erecting a suitable light-house, to take the place of the light-vessel stationed to mark this danger, reverted to the treasury under act of July 12, 1870. As it was supposed a screw-pile structure could be readily built, a personal examination was made by the engineer, and he selected the proper site, marking the spot with a watch buoy. Although the bottom appeared to be hard, and the lead brought up a clear sharp sand, he was convinced, from the general appearance of the shore below Fort Pulaski, and from finding doubtful bottom within 400 feet of the knoll, that the apparent hard surface rested over a layer of soft mud. He therefore caused borings to be made both at the buoy mentioned and a shoal spot distant 600 feet; both these borings showed a stratum of soft mud underlying the hard surface. The first boring was driven 13 feet, and the second 19. It is to be regretted that the defective character of the apparatus employed and the state of the weather prevented the auger from being driven deep enough to determine the thickness of the soft bed and the character of the substratum; but from what was done the engineer is of the opinion that it is impracticable to construct a light-house on the plan originally contemplated, or on any plan, except at an unwarrantable expense. It has been suggested that a light placed on the opposite side of the channel, and near the first buoy above the light-ship, would answer the purpose as far as the knoll is concerned. But in this case an important incidental advantage would be lost in such a position, that, with the beacon on Oyster Bed, it would give a range passing clear of a small lump which lies in mid-channel about a mile below. Further examination will be made at this locality before a reappropriation, as recommended, will be used.

St. Simon's entrance to St. Simon's Sound, Georgia.—After due public notice a contract was entered into with the lowest bidders for rebuilding a light-house tower 100 feet high and the other necessary buildings at this place. The contractors agreed to complete these works in conformity to the specifications and terms of the contracts within a prescribed period of time, but finding that the work could not, from delays in procuring and landing the materials at the site, and, in commencing the operations, that it would be impossible to properly construct the tower and buildings within the remainder of the prescribed time, it was extended to November 1, 1870, by which time it is hoped the buildings will be satisfactorily completed, so that the light may be exhibited at an early day thereafter. During the last summer there has been a great deal of sickness in that vicinity, and one of the contractors, who was on the spot, died.

Little Cumberland entrance to St. Andrew's Sound, Georgia.—The sea appears to be encroaching upon the land to the northwest of the light-

house tower at this place, but, at what rate of approach, sufficient time has not elapsed since special observations have been made to determine with any degree of certainty. As the encroachment is at present confined to the inner side, it may be arrested, whenever it becomes so serious as to threaten the foundation of the tower, at a comparatively small cost. No steps are considered necessary to be taken at this time, and it may be several years before sufficient inroad is made to require any great expenditure of money in protecting this site.

Amelia Island inner range beacons, to enter St. Mary's, Georgia, and Fernandina, Florida.—These beacons, established near Fort Clinch and destroyed during the rebellion, are now required to meet the wants of a growing navigation interest, and an estimate has been submitted to supply the deficiency caused by the appropriation for "restoring lights on the southern coast" having reverted to the treasury under the act of July 12, 1870.

Dames' Point, St. John's River, Florida.—A light-vessel was provided by authority of law prior to 1861, and placed to mark the channel of the St. John's River, Florida, around Dames' Point. That vessel was removed during the rebellion. The navigation of that river to Jacksonville, Pilatka, and the intermediate settlements having been renewed within the last two or three years, the construction of that or other similar aid to mark that point has been strongly urged. An estimate for a screw-pile light-house similar to those erected in the waters of the Chesapeake and North Carolina has been submitted, to be placed on the shoal opposite to Dames' Point, as being more economical and better suited for the purpose than a light-vessel.

301. *St. Augustine, north end of Anastasia Island, Florida.*—This station, erected in 1823, is in a fair condition and requires no special repair. In any case it would not be worth while to make any repairs to the dwelling, as the sea is encroaching on the shore at so rapid a rate that the dwelling will be untenable in the course of one year. Reports on this encroachment have been made to the board from time to time.

A letter has just been received, reporting a further cutting of 13 feet, due to the northeast gales of the past month. Two methods of repair have been considered, one protecting a long stretch of shore line (2,400 feet) with brush, the other protecting the immediate locality by crib-work. The opinion was had that the latter method (if any) should be adopted for two reasons. First, that the sea line was so near the station that no further encroachments could be allowed, and that protection should therefore be perfect and permanent; second, that throwing an angular crib-work in front of the threatened point would, as the shore cut away on either flank, deflect the tidal currents, and, after a certain time, cause a deposit on one or both sides. Either method would involve a large amount of money to insure success; that by crib-work, not less than \$15,000. It is now considered that the time has passed for protecting the site, and it only remains to consider the kind of light-house to be built when the present one is destroyed. The height of the old tower above the mean level of the sea is 73 feet, giving it a visible horizon of only 14 miles. The distance from this light to that at Cape Canaveral is about 100 miles, with no intermediate light, so that there is now an unlighted length of coast of about 60 miles. The board is therefore of the opinion that the new light should not be less than 150 feet high, and this, with a similar one at or near Mosquito Inlet and the light at Cape Canaveral, would effectually light the coast from St. Augustine to the latter. If this is accepted, a new tower must be constructed, and in such a position as will insure it from future changes of the shore line.

In selecting such a site we may throw out of account the consideration of range or direction of the channel, as this is constantly changing. By going 600 yards to the west of the present station, and toward the inner side of Anastasia Island, the condition of safety will be fulfilled as the currents from the upper and lower rivers meet and deposit their sediment opposite this point. The only thing lost would be that amount in the distance at which the light would be visible at sea. The erection of a tower not less than 150 feet from base to focal plane, and at or near the point mentioned, is recommended, and an appropriation therefor of \$125,000.

Mosquito Inlet, east coast of Florida.—In obedience to instructions of the board, the engineer of the district has visited Mosquito Inlet, for the purpose of reporting on the necessity and practicability of a light at that point. In common with all the inlets and harbors on the east coast of Florida, this bar shifts constantly, so that no soundings can be relied on. The general effect of westerly winds is to reduce the depth of water, and that of northeasterly gales to increase it; thus the inlet may be opened or closed one or more times each year. The wrecks lying on or near the bar give a practical illustration of the uncertainty of the channel. For all practical purposes of construction of a light-house, it may, however, be safely assumed that the material can be delivered without any very serious difficulty or delay, although additional expense would be incurred by reason of the remoteness of the station and the small size vessels that would be required for transportation. As regards the necessity of a light at this point, it is manifest that the commerce passing through the inlet would not justify an expenditure by the United States for a light for merely local purposes, or at least that there are other points that may justly take precedence of it. But a light-house between St. Augustine and Cape Canaveral lights is necessary as one of a system of coast lights, and Mosquito Inlet is undoubtedly the proper site, as, in the first place, the light there would answer the double purpose of a harbor and coast guide, and in the second for a landing-place, both for the original construction and subsequent supply and inspection, which could be made with more safety and certainty there than at any other point along the open sea beach. A tower 150 feet high lighted by a first order Fresnel lens is recommended for this position, and for the commencement of its construction an appropriation of \$60,000.

At each of the following-named light stations, there have been repairs and renovations, more or less extensive, during the last year, viz.:

- 276. *Georgetown*, South Carolina, entrance to Winyaw Bay.
- 277. *Cape Romain*, South Carolina.
- 289. *Cockspur*, Georgia, Savannah River.
- 292. *Sapelo*, Georgia, entrance to Dobey Sound.
- 297. *Little Cumberland*, Georgia, entrance to St. Andrew's Sound.
- 298, 299. *Amelia Island Range-lights*, Florida, St. Mary's Bar, Fernandina.
- 302. *Cape Canaveral*, east coast of Florida.

The following-named light stations require repairs to be made during the ensuing year, viz.:

- 272. *Federal Point*, North Carolina, New Inlet, Cape Fear River.
- 274, 275. *Oak Island Range-lights*, North Carolina, mouth of Cape Fear River.
- 276. *Georgetown*, South Carolina, entrance to Winyaw Bay.
- 277. *Cape Romain*, South Carolina.

Morris Island Range-lights, South Carolina, entrance to Charleston Harbor.

The following are the names of light stations in this district not mentioned elsewhere:

- 278. *Bull's Bay*, South Carolina.
- 283. *Castle Pinckney*, South Carolina, Charleston Harbor.
- 284. *Combahee Bank*, South Carolina, entrance to St. Helena Sound.
- 287. *Tybee Beacon*, Georgia, Tybee Island.
- 290. *Oyster Bed*, Georgia, Savannah River.
- 293. *Sapelo Beacon*, Georgia, entrance to Doboy Sound.
- 296. *St. Simons*, Georgia, entrance to St. Simon's Sound.
- 286. *Tybee*, Georgia, entrance to Savannah River.
- 291. *Fig Island*, Georgia, Savannah River.
- 292. *Sapelo*, Georgia, entrance to Doboy Sound.
- 294, 295. *Wolf Island*.—Georgia, entrance to Doboy Sound.
- 298, 299. *Amelia Island Range-lights*, Florida, St. Mary's Bar, Fernandina.
- 300. *St. John's River*, Florida.
- 302. *Cape Canaveral*, Florida.

LIGHT-VESSELS.

The five light-vessels occupying stations are in good order and condition.

RELIEF LIGHT-VESSEL.

The relief light-vessel has been put in good repair, and is kept at the depot in Charleston for immediate use.

DEPOT.

The only depot for supplies and buoys in the district is at Fort Johnson, Charleston Harbor, South Carolina.

TENDERS.

The steam tender *Alanthus* was built last year and sent to the district. The sailing tender *Du Pont*, being inefficient for the service required of her, was sold, and the amount of sale turned into the treasury.

The sailing schooner *Maggie* was sent to the fifth district to assist in placing and keeping the buoys in position in that district.

The sailing schooner *Narragansett* has been employed in transporting materials and labor for repairs of light-houses, under the direction of the engineer of the district.

SEVENTH DISTRICT.

This district extends from Cape Canaveral, Florida, to include Cedar Keys, Florida.

Inspector.—Captain F. S. Haggerty, United States Navy, to October 1, 1870; Commander Charles A. Babcock, United States Navy, present inspector.

Engineer.—Brevet Colonel C. E. Blunt, lieutenant colonel of engineers United States Army, to March 21, 1870; James B. Quinn, first lieutenant of engineers, from March 21, 1870, to September 1, 1870; Brevet Colonel Blunt present engineer.

In this district there are—

Light-houses and lighted beacons	10
Day and unlighted beacons	16
Buoys actually in position	81
Spare buoys for relief and to supply losses	44
Tender (steam-tug) Commodore	1
Tender (sail) Florida	1
Day or unlighted beacons on the seaward side of Florida Reefs	16

The numbers preceding the names of stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

In 1862 there were sixteen iron screw-pile beacons standing on the outer points of the reefs of Florida, extending from the "Fowey Rocks" beacon, near Cape Florida light-house, to Key West, Florida. These beacons were of a sufficient height to be seen by day at safe distances from the reefs by vessels navigating closely to their line, and each one so marked and distinguished by letters of the alphabet as to be known to passing vessels, and afforded them the means of determining with accuracy their positions.

From inability to keep these aids in proper repair, during the rebellion, many of them were damaged, and some thrown down by the action of winds and sea. An appropriation of \$50,000 was made March 3, 1869, for restoring the missing beacons, repairing those damaged, and completing the system.

Ten of those iron day-beacons were delivered at Key West, Florida, by the contractor in December 1869. As soon as the necessary arrangements could be made, and the season of quiet, calm weather came round, work was commenced at the beacon sites, and such progress made as weather and the peculiar character of the work would permit. After replacing two of these beacons, and recovering two which had been thrown down by the storms, instructions had to be given to discontinue further operations for want of funds, the appropriation having reverted to the treasury under the operation of the fifth and sixth sections of the act of July 12, 1870. These day-marks have been, while up, of incalculable benefit to vessels navigating that dangerous pass; and, both during and since the rebellion, repeated applications have been made for their entire restoration, so that there may be no break in the system from the eastern to the western end of these dangerous reefs.

Alligator Reef, Florida Reefs.—An appropriation was made at the last session of Congress (July 15, 1870) for commencing the construction of a first-class sea-coast light on this remaining important unlighted point on this dangerous coast. The structure is designed to be on iron piles, with a focal plane of 150 feet above the mean level of the sea. The great importance of marking this salient point of these dangerous reefs, and completing the system as originally planned, can hardly be estimated. The work at such a point, depending upon both wind and sea, to say nothing of the health of the mechanics and laborers in such a climate, must necessarily make comparatively slow progress after the material, which must be prepared at the workshops at the North, shall all have been delivered at the extemporized depot, on the main land opposite the site.

At each of the following-named light stations there have been repairs and renovations more or less extensive during the last year:

303. *Jupiter Inlet*, east coast of Florida.

304. *Cape Florida*, Florida.

310. *Dry Tortugas*.

311. *Dry Tortugas Harbor*, Fort Jefferson.

Repairs (chiefly repainting of iron-work) will be required at the following light stations during the ensuing year:

303. *Jupiter Inlet*, Florida.

304. *Cape Florida*, *Florida Reefs*, off southern coast of Florida.

305. *Carysfort Reef*, *iron-pile light-house*, Florida Reefs, off coast of Florida.

306. *Dry Bank*, *iron-pile light-house*, Florida Reefs, off coast of Florida.

307. *Sand Key*, *iron-pile light-house*, Florida Reefs, off coast of Florida.

308. *Key West*, Key West Island, Florida.

309. *Northwest Passage*, *iron-pile light-house*, Key West, Florida.

310. *Dry Tortugas*, Loggerhead Key, Florida.

311. *Dry Tortugas Harbor*, Fort Jefferson, Florida.

312. *Egmont*, entrance to Tampa Bay, Florida.

LIGHT-VESSELS.

There are no light-vessels in this district.

BUOY DEPOTS, ETC.

Key West.—At this place spare supplies and most of the spare buoys of the district are kept. Buoys are placed at several of the light stations in readiness for use, as reliefs to replace those lost.

TENDERS.

The little steamer-tug *Commodore* was purchased and sent to the district last spring to enable the engineer to carry on the work of rebuilding the beacons on the Florida Reefs.

The sailing schooner *Florida* has been in that district for many years, employed in looking after the buoys, delivering supplies other than are annual, and for visiting the light stations periodically. These lights are all at remote and isolated points, and can only be reached by a vessel. A small steamer would be more effective and equally economical. The present sailing tender is too old for economical repair, and her place must be filled before very long.

EIGHTH DISTRICT.

This district extends from Cedar Keys, Florida, to the Rio Grande, Texas.

Inspector.—Captain William A. Parker, United States Navy, October 1, 1870; Commander William P. McCann, United States Navy, present inspector.

Engineer.—Brevet Brigadier General C. B. Reese, major of engineers, United States Army, until the time of his death, September 22, 1870; Brevet Major A. N. Damrell, captain of engineers, United States Army, present engineer, (east of Pearl River;) M. F. Bonzanó, esquire, acting, (west of Pearl River.)

In this district there are—

Light-houses and lighted beacons	44
Day or unlighted beacons	15
Buoys actually in position	91
Spare buoys for relief and to supply losses	92
Light-vessels	1
Tender, steamer <i>Geranium</i>	1
Tender, steam-tug <i>General Poe</i>	1
Old light stations not relighted since the close of the war	10

The following numbers, preceding the names of the stations, correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

317. *Cape San Blas, Florida*.—Ten thousand dollars was appropriated by act of Congress July 15, 1870, for a new dwelling for the keeper at this station, and plans are now preparing for its erection during the coming season. The wearing of the beach near the light-house indicates that steps will have to be taken toward its protection within a few years. The new dwelling will be placed in a safe position, 300 or 400 yards from the light tower.

318. *Pensacola, Florida*.—The beacon range-light for the outer main channel will have to be removed at an early day, as the sand-bank upon which it is placed is greatly worn away, and is wearing daily by the action of the winds and waves, so that it will soon be in danger of falling. The Cay-cas range-lights, serving as a guide for the middle parts of the main channel, were destroyed during the rebellion, and ought to be reestablished soon, as the lumber business of the tributaries of Pensacola Bay is being rapidly reestablished. No estimate has been submitted. If the balance of the appropriation remaining in the treasury at the date of the passage of the act of July 12, 1870, causing all balances to revert to the surplus fund on account of the appropriation for "restoring aids to navigation on the southern coast destroyed during the rebellion," had remained available, these and other works of small cost would have been reestablished with the least avoidable delay.

319. *Sand Island, off Mobile Bay, Alabama*.—At this station the first-class light-house tower and other buildings belonging to it having been destroyed by the rebels, at the close of hostilities a temporary tower and keeper's dwelling were constructed, and the station remains in that condition at present. An appropriation was made in 1856 for a sea-coast light at this point; the light-house tower was built and the light exhibited. In 1861 the rebels destroyed it. Congress having made an appropriation for rebuilding this light-house tower, plans were being prepared and the necessary steps being taken for arranging for landing the material, when the money reverted to the treasury under the operation of the fifth and sixth sections of the act of July 12, 1870, and arrested further progress of the work. The light is a very important one to commerce, and a reappropriation has been submitted in the annual estimates. The sea has made such inroads upon the eastern side of this island, on which the temporary light-house and keeper's dwelling are placed, as to endanger their safety during a heavy gale from the eastward. These buildings being on a small sand-hill only 47 feet from the water-line, it is designed to place the temporary light upon the top of a building standing a short distance from the present buildings, and fit it for the greater comfort of the keeper during the ensuing winter, and until an appropriation is available for constructing a permanent tower and keeper's quarters.

320. *Mobile Point, entrance to Mobile Bay, Alabama*.—The light placed on the southern point of Mobile Point, and within a short distance of Fort Morgan, was destroyed by Admiral Farragut's fleet on the 5th August, 1864, in passing into Mobile Bay. After the surrender of the rebel armies a temporary light and keeper's dwelling were constructed, and the light exhibited. An appropriation was made for reestablishing this light, by the erection of suitable buildings, &c., but before the work could be economically commenced, (the effort and desire being to carry on the several works authorized in that vicinity together,) the appropriation reverted to the treasury under the operations of the

fifth and sixth sections of the act of July 12, 1870, and no further steps can be taken until a reappropriation is made. The dwelling of the keeper, like that on Sand Island, is in very bad condition, and scarcely habitable, but not fit under the circumstances to spend money upon in repairs.

Battery Gladden, upper part of Mobile Bay, Alabama.—Under the appropriation for "reestablishing lights on the southern coast," an iron screw-pile light-house was purchased and sent to Mobile to be erected on this site, and to be substituted for the old Choctaw Point light, rendered useless by changes in the channel, growing doubtless out of the defensive works erected during the rebellion; but, before the building could be erected, and while the operations were going on, they were arrested by the passage of the act of July 12, 1870; carrying this fund into the treasury. A small sum has been submitted in the annual estimates for completing this work.

Dog River Bar range-lights, Mobile Bay, Alabama.—At the breaking out of the rebellion, and for many years prior to that time, there were two small lights, which had been authorized by Congress, to serve as a range for that part of the channel in the upper part of Mobile Bay known as "Dog River Bar." Without the restoration of these range-lights upon proper sites, the upper part of that bay cannot be navigated at night by vessels of the draught usually entering the harbor, therefore an estimate has been submitted for that object.

325. *Cat Island, Mississippi Sound, Mississippi.*—This very useful and important light in navigating Mississippi Sound between Mobile Bay and Lake Pontchartrain was destroyed during the rebellion. Congress made an appropriation for rebuilding it. Bids had been called for, and tenders were being received upon plans and specifications previously prepared to suit the site upon which it had been determined to erect the new iron screw-pile light-house, when the work was arrested by the passage of the act of July 12, 1870, causing the appropriation to revert to the treasury.

329. *East Rigolet, Pleasonton's Island, Louisiana.*—The keeper's dwelling at this station is old and not worth the cost of the extensive repairs it would require to put it in good order. A new building would cost very little more. It is however habitable for that climate, and no estimate has been submitted for a new structure at this time.

330. *Proctorsville Beacon, Lake Borgne, Louisiana.*—An elevated structure, on the plan of the light-house at the head of the passes, Mississippi River, was recommended in the last annual report. The locality being subject to inundations in heavy easterly gales, it will be necessary to raise the structure about 8 feet above the ground. As wooden piles are considered good enough for the purpose, and as the work can be economically done, owing to its proximity to New Orleans, an appropriation of only \$5,000 has been asked for for the purpose. This is one of the works which could have been included in the appropriation for "restoring lights on the southern coast" if the balance had not been carried, in last July, to the surplus fund.

331. *West Rigolets, eastern entrance to Lake Pontchartrain, Louisiana.*—The wharf and breakwater at this station were destroyed by the gales of September 1869, and general repairs to the keeper's dwelling were asked for, including a new slate roof, plank wharf over the marsh, and a new breakwater; but these works have been deferred for the present.

Pointe aux Herbes, Louisiana.—The appropriation for a light-house at this place having reverted to the treasury under the operation of the act of July 12, 1870, steps towards purchasing the site and perfecting

the title were arrested. The owner of the land had agreed to sell the necessary quantity of land at \$10 per acre, but until a reappropriation is available no engagement can be entered into with the owner for it.

332. *Port Pontchartrain, Louisiana.*—The light-house tower, built of brick, stands in a depth of about two feet water in ordinary stages of the tides. About two years since the base of the tower was surrounded by a square inclosure of piles and planking filled in with concrete, to protect it from the damaging effects of the wash of the sea. This concrete work has fully answered the purpose for which it was designed, and is now in excellent condition. The keeper's dwelling is an old frame house, in too dilapidated a state to justify its being repaired. The September gales of 1869 did some damage to this dwelling, and the walk leading to the wharf was destroyed. An estimate is submitted of \$7,500 for the erection on piles, above the highest waves of the sea, of a suitable dwelling for the keeper at this place.

333. *Bayou St. John, iron screw-pile light-house, Louisiana.*—A new illuminating apparatus was put up, and the light exhibited from it on January 1, 1870.

336. *Pass Manchac, Louisiana.*—A breakwater in its simplest form, that of a row of sheet piling, is necessary to protect this station from the erosion caused by waves, the estimated cost of which is \$1,700, and included in the annual estimates.

337. *Chandeleur, Louisiana.*—It is designed to strengthen the screw piles supporting the keeper's dwelling at this station by connecting them by diagonal braces, at an estimated cost of \$1,000. A new cistern is needed, which should be placed on a brick foundation, rising 5 feet above the ground, as the water rises several feet above the surface in heavy gales from the southeast.

Erol Island, Louisiana.—The proximity of this outlying island to the dangerous shoals off Grande Gosier, to the northward of Pass à Loutre light-house, distant 23 miles, and midway between the Pass à Loutre and Chandeleur lights, marks it as the proper location for a light to fill up the dark space in the approaches to the northern mouth of the Mississippi River. The only structure offering a reasonable prospect of stability in a locality so exposed to wind and sea is an iron screw-pile tower, for the erection of which an estimate of \$30,000 has been submitted in the annual estimate for the next fiscal year.

338. *Pass à Loutre, northern mouth of the Mississippi, Louisiana.*—A steam fog-signal is required for this light station. Its importance and usefulness can hardly be calculated in pointing out this entrance during the dense and frequently long-continued fogs which envelop the Delta of the Mississippi during the winter months. The day or unlighted beacon authorized to be erected in place of the present dilapidated wooden one is in readiness, and will be put up as soon as it can be done without incurring the extra expense which a party specially sent so far would necessarily cause. This may be done while the works at the head of the passes are in progress, unless in the mean time the wooden beacon should be destroyed, in which event the iron one will be sent and put up at once.

339. *South Pass, mouth of the Mississippi, Louisiana.*—The light-house at this, the most seaward point of the delta of the Mississippi, and therefore of the importance of a first-class sea-coast light, was built in 1831, and is only a low wooden tower on the top of the keeper's dwelling. The grave objections to a wooden structure at so distant a point from succor in case of fire, and one occupying so important a position, (being only of the third class,) have been mentioned in the several annual reports from

this board since 1867. The remarks previously made have acquired additional force from the fact that the natural decay of so perishable a material, and the age of the structure, render a new tower at no distant day indispensable, even in an economical point of view alone. An estimate of \$75,000 for commencing the work is submitted.

340. *Head of the passes, Mississippi River, Louisiana.*—The work authorized, consisting of the construction of a wharf, protecting levee, and for a light-house and buoy depot, will be commenced as soon as the prevailing epidemic will allow it to be done. It is expected that work may be resumed in that vicinity by the 1st of October. The breakwater built in 1868 has had a very beneficial effect upon this station. The land within the inclosure has been raised from 18 to 24 inches by the deposition of sediment. Where large row-boats could navigate without difficulty there is now solid dry ground. The danger apprehended from the threatened undermining of the foundation of the light-house by washings of the current of the river seems no longer to exist, and it may be considered as permanently arrested.

341. *Southwest Pass, mouth of the Mississippi, Louisiana.*—The preliminary work of survey, experimental borings, and plank walk over the marsh, preparatory to the authorized rebuilding of the light-house at this point, were commenced in July 1869, and completed in the following summer and fall months. During the last winter a strong wharf was built on "Nine-foot Bayou," with a railroad on piles connecting it with the coffer dam inclosing the space selected for the site of the new light-house. The work upon the pile foundation has made fair progress up to July 30 last, when operations had to be temporarily suspended on account of sickness among the workmen. Work will be resumed in a very short time, as the prevailing epidemic on that coast is disappearing. An efficient steam fog-signal is necessary for this light station, for which an estimate has been submitted.

Stake Island, Southwest Pass, Louisiana.—A wooden beacon was erected during the last winter on Stake Island, which lies close to the bar, and has been found very useful in the navigation of the pass during foggy weather. A beacon of iron, and of greater height than the present wooden one, will be put up during the operations at the Southwest Pass light station.

Timballier Bay, coast of Louisiana.—The light-house at this point on the sea-coast of Louisiana was destroyed by a tornado, and Congress at its next session made an appropriation for rebuilding it, which however reverted to the treasury under the operations of the fifth and sixth sections of the act of July 12, 1870. This light is considered of so much importance to the commerce of the Gulf, and especially to that from and to Mobile, New Orleans, and the ports of Texas and Mexico, that application was made for the temporary employment of a small light-vessel until the new tower could be built, which had to be declined on account of the absence of authority to comply with the request. Although this light station is at the mouth of Timballier Bay, its importance to navigation consists in the fact that it is a sea-coast light, marking an important dark space on that low coast off which there are dangerous shoals. A reappropriation of the money which reverted to the treasury has been asked and included in the annual estimates.

343. *Ship Shoal, iron screw-pile light-house, Louisiana.*—The filling up with concrete around the iron piles of this structure, which is in 15 feet water, has been attended with the happiest results. The water, which was increasing in depth, is now gradually shoaling all around the structure, and there is every prospect that it will continue to diminish in

depth. The light was for a time greatly impaired in power and usefulness by the criminal neglect of a late keeper, who suffered the mechanical lamp machinery to run down, and this melted the burners. The lamps and burners were promptly repaired by the lampist of the district soon after this neglect was discovered. This second-order lens apparatus with its appendages is one of the finest on the coast, and the light has been one of the best to be found anywhere.

Shell Keys, or Trinity Shoal, Louisiana.—The appropriation for rebuilding the light-house at this place, which was destroyed in a tornado, reverted to the treasury under the operation of the fifth and sixth sections of the act of July 12, 1870. A dangerous shoal, lying well out from the low coast of that region, and more in the track of passing vessels than the old site of the Shell Keys light-house, having been recently discovered, it is deemed advisable to recommend that a reappropriation be made for erecting the light-house on that shoal known to navigators as "Trinity Shoal." This shoal is southward of the Shell Keys shoal, and lies nearly in a straight line drawn from the entrance to Galveston Bay to the Ship Shoal light-house, without anything to mark it except a first-class buoy, which has recently been placed near it. The land from this shoal can seldom be seen on account of its little elevation above the level of the sea, and is therefore a very dangerous obstruction to navigation. Since the close of the rebellion several lines of steamers are in active operation between New Orleans and Texas ports, in addition to a large number of sailing vessels, which necessarily pass near this danger day and night.

Calcasieu, Louisiana.—Petitions have from time to time been received for a light to mark the entrance to this place, and in 1860 an appropriation was made, which, however, reverted to the treasury. This place, in addition to its significance as the key to the vast lumber region divided by the Calcasieu River, has within the last two years become of still further importance from the fact of the discovery of sulphur and coal oil in its vicinity, and not very remote from the salt mines which were somewhat developed and used by the insurgents during the rebellion. Although the site for this light will be on *fast land*, yet the great and sudden rise of the tide during equinoctial and other heavy storms on this part of the Gulf coast, which in many instances have been known to destroy nearly every building within many miles, and caused great loss of life, it is considered that nothing but a screw-pile structure can insure a proper degree of safety to life and property. An estimate has been submitted in the annual estimates for the next fiscal year for the structure.

347. *Bolivar Point entrance to Galveston Bay, Texas.*—At the commencement of the rebellion there was a third class cast-iron light-house at this important point, leading to the best harbor on the coast of Texas. During hostilities the tower was taken down, the material removed, and possibly used for war purposes. Immediately after the close of the rebellion a temporary light was established near the site of the old one, which is at present kept up, and during last year a light-vessel was placed inside the bar to render its passage at night comparatively safe. At the last session of Congress an appropriation of \$40,000 (July 15, 1870) was made for rebuilding the light-house at this point, which will be sufficient for one of the third class. Instructions have been given to proceed with the execution of this work, but, owing to the rigid quarantine which exists between New Orleans and Galveston during the existence of the prevailing epidemic, nothing can be done toward commencing work until after frost.

351. *Matagorda, Texas.*—This light-house tower was built of cast-iron and thrown down during the rebellion. At the close of the war a temporary light was exhibited from a site near the old one, and negotiations entered upon for the purchase of a new site, the old one having become untenable by the action of the sea and winds. After considerable delay, valid title and cession of the State jurisdiction have been obtained. The work, for which an estimate is submitted in the annual estimate for the next fiscal year, can be commenced immediately upon funds becoming available. The difficulty of reconstructing this tower is found to be much greater than was at first anticipated. Having sent a party of men to remove the cast-iron sections from the site of the old foundation which has been washed away, it was found that several sections were broken, and would have to be renewed. The transportation of the material for building the foundation will have to be made with ox teams for a distance of three miles from the landing to the site. An estimate of \$20,000 has been submitted for rebuilding this important light-house tower, in addition to such materials of the old structure as may be fit for use, rendered necessary in consequence of the reverting to the treasury of the funds for "restoring lights on the southern coast."

Decro's Point entrance to Matagorda Bay, Texas.—An appropriation of \$15,000 was made July 15, 1870, for two range lights to mark the channel at this place. The necessary preliminary steps for selecting the sites, procuring the land, valid title, and cession of State jurisdiction have been taken, and the work will be commenced as soon as possible.

353. *Swash, Matagorda Bay, Texas.*—This is one of the light-houses which was destroyed during the rebellion, and for which an appropriation was made for rebuilding it, but before the work could be done the passing of the act of July 12, 1870, carried the money back to the treasury. An estimate of \$15,000 has been submitted for its reconstruction upon the old site.

At each of the following-named light-stations there have been repairs and renovations more or less extensive during the past year, viz:

314. *Pensacola, Florida.*

315. *Sand Island, off Mobile Bay, Alabama.*

356. *Point Isabel, mouth of the Rio Grande, Texas.*

The following-named light stations require repairs to be made, during the ensuing year:

314. *St. Mark's, Florida.*

315. *Dog Island, entrance to St. George's Sound, Florida.*

316. *Cape St. George, Florida.*

321. *Round Island, Mississippi.*

322. *East Pascagoula, Mississippi.*

323. *Ship Island, Mississippi.*

324. *Biloxi, Mississippi.*

326. *Pass Christian, Mississippi.*

327. *Merrill's Shell Banks, iron screw-pile light-house, Mississippi.*

334. *New Canal, Lake Pontchartrain, Louisiana.*

336. *Pass Manchac, Louisiana.*

337. *Chandeleur, Louisiana.*

352. *Half Moon Reef, iron pile light-house, Matagorda, Texas.*

354. *Aransas Pass, Texas.*

The following are the names of light-stations in this district not mentioned elsewhere:

313. *Cedar Keys, Florida.*

328. *St. Joseph, entrance to Lake Borgne, Louisiana.*

335. *Tchefuncte River, Louisiana.*

342. *Barrataria Bay*, Louisiana.
 344. *South West Reef*, iron screw-pile light-house, entrance to Atchafalaya Bay, Louisiana.
 345. *Sabine Pass*, Texas.
 348. *Half Moon Shoal*, iron screw-pile light-house, Galveston Bay, Texas.
 349. *Red Fish Bar*, iron screw-pile light-house, Galveston Bay, Texas.
 350. *Clopper's Bar*, iron screw-pile light-house, Galveston Bay, Texas.
 355. *Brazos Island Beacon*, Texas.

LIGHT-VESSEL.

346. *Light-vessel inside the bar at Galveston, Texas*.—This is the only light-vessel on the Gulf coast. It was placed in its present position after arriving from Norfolk, Virginia, last year. It is proposed to restore the range beacon formerly existing, in connection with the Bolivar Point main light, when the new tower is completed, and dispense with the now expensive light-vessel.

DEPOTS FOR BUOYS.

The principal depot in this district for the safe-keeping and protecting of spare buoys and for coal for the tender is at the Head of the Passes light station, Mississippi River.

There is also a depot at Fort Pickens' wharf, Pensacola Bay, and at Fort Morgan, Mobile Bay, for the storage of spare buoys, and at the former for the storage of coal.

TENDERS.

The small steamer *Geranium* is the only tender in this district.

TENTH DISTRICT.

This district extends from the mouth of St. Regis River, New York, to include Grassy Island light-house, Detroit River, Michigan.

Inspector.—Commodore Gustavus H. Scott, United States Navy.

Engineer.—Brevet Lieutenant Colonel George L. Gillespie, captain of engineers, United States Army.

In this district there are—

Light-houses and lighted beacons	52
Day or unlighted beacons	0
Buoys actually in position	72
Spare buoys for relief and to supply losses	98
Tender (steam) <i>Haze</i> , common to tenth and eleventh districts	1

The numbers preceding the names of stations correspond with those of the "Light-house List of the Northern and Northwestern Lakes of the United States," issued January 1, 1870.

396. *Ogdensburg, New York, St. Lawrence River*.—By act of Congress approved July 15, 1870, an appropriation of \$13,000 was made for the renovation and repair of this station, and on August 23, 1870, under this act, work was commenced. The design is the same as that for Stony Point, except that the tower is 6 feet 8 inches higher, (height 39 feet 8 inches.) The material used in the construction is dark gray limestone, obtained from the Kingston quarries, and the same that has been used on Sister Island. The renovations are well under way; the latest report received places the top course of the stone built in at 7½ feet above the water-table. It is expected that the whole house will be covered in

and the lantern adjusted at the close of the season. It was not found necessary, as was expected from the low site, to use piles in the foundation. The order of the light will not be changed.

Sisters Islands, New York, St. Lawrence River.—A new light-house has been built on the lower island according to the original intention of the Light-house Board, altered only in respect to material, stone being substituted for brick because of the exposed site and of the difficulty of obtaining the best quality of brick at a price to which the appropriation was adequate. The light was exhibited on 15th September, 1870. It is a fixed white light of the sixth order, illuminating an arc of 360°.

402. *Horse Island, New York, Sackett's Harbor, Lake Ontario.*—An appropriation of \$12,000 was made at the last session of Congress (July 15, 1870) for rebuilding the tower and keeper's dwelling at this place. The work was commenced in August, and has been pushed rapidly ahead, the construction having already advanced a few feet above the water-table. The material used is brick, and the design the same as that of Ogdensburg; the order of the light will not be changed. The site has been changed to a point about 300 yards to the south and east of the old tower. The old dwelling and tower were too close to the shore, and the lake was beginning to make encroachments upon it, which might have endangered in a short time a new dwelling near the old site. It is expected to complete the dwelling during the season, excepting the interior finish and outside painting.

403. *Stony Point, New York, Lake Ontario.*—A new dwelling for the keeper, with attached tower, was built at this station during the last season, for operations in this region. During the present season the outside pointing, and some of the plastering which could not be done last year, were finished.

405. *Big Sodus range-beacons, New York, Lake Ontario.*—A new permanent beacon will be built on the pier of entrance, and both beacons will be fitted with improved lens apparatus this season.

406. *Big Sodus Bay, New York, Lake Ontario.*—An appropriation was made at the last session of Congress (July 15, 1870) for rebuilding the tower and keeper's dwelling at this light station. Work was commenced in August, which has been pushed rapidly. The construction has already advanced to a height of 4 feet above the water-table. The material used is limestone, from the Kingston quarries. The dwelling will be two stories, with the light-house tower attached; the height, from the base to the focal plane, will be 45 feet. It is built upon the same general plan as the one at Stony Point, New York.

Oak Orchard, New York, Lake Ontario.—An appropriation was made at the last session of Congress for a light-house "at or near Oak Orchard Creek, Lake Ontario, New York," primarily designed for a lake coast light, to guide navigators on that part of the unlighted coast between the Genesee and Fort Niagara lights, and secondarily, if it be found to be practicable, to mark the approaches to Oak Orchard Creek. The necessary preliminaries are in progress for purchasing the site, perfecting the title, &c., preparatory to commencing the erection of the buildings.

408. *Fort Niagara, New York, entrance to Niagara River.*—This light is exhibited from a low frame tower, projecting above the roof of the mess-house, which is at present occupied as quarters by the officers of the garrison, through which the keeper has to pass to attend upon the light at night, as well as to clean and put it in order during the day. The position is not a proper one for a light, and as the tower is in a most dilapidated condition, without oil-room or other necessary means for

keeping the oil and other supplies, it is recommended that an appropriation, for which an estimate has been submitted, be made for the construction of a proper tower on a suitable site, to serve the double purpose of a lake-coast and a local light at the same time.

409. *Black Rock beacon, New York, head of Niagara River, Lake Erie.*—This beacon-light having been established to serve a temporary purpose, until the completion and exhibition of the light on Horseshoe Reef, and being of no use, will be extinguished at the close of navigation this season, and will not be relighted next spring.

411. *Buffalo, New York, Lake Erie.*—The pier on the creek side of the light-house lot is very old and should be entirely removed. It was originally made with an open bottom, the foundation to a certain height being filled in with brush, upon which rested the stone filling. There is a strong underground pressure from the land side by which the brush has been gradually forced out of place and into the creek; the stone sinking, in consequence, have likewise been forced from under the pier in some parts. The sand washed into the creek from behind the pier has formed a shoal along the entire front, with scarcely 18 inches of water in some places, which renders the pier unserviceable for the supply vessel. Taking out the old pier, dredging to a depth of 4 feet and sinking a new pier on the same line, with grillage bottom, are recommended; the front to be protected at a distance of 2 feet by a row of piles 4 feet from center and driven 6 or 8 feet, with a "sill and binder" capping. The present pier is 264 feet long by 12 feet wide. It is thought it may be necessary to drive sheet piling behind the pier to prevent the undertow of sand that fills the channel. The estimate cost of the work is \$10,000.

Buffalo breakwater beacons, New York, Lake Erie.—An appropriation was made July 15, 1870, for a beacon-light on each end of the breakwater in this harbor. The one authorized to be placed on the north end may be commenced at this time, but the other must await the completion of that end of the breakwater; it will therefore be necessary to continue the balance of the appropriation which may remain June 30, 1871, for the next fiscal year.

414. *Presque Isle, Erie, Pennsylvania, Lake Erie.*—The keeper's dwelling at this light station was not rebuilt at the time a new tower was erected in 1867; the walls of this house are perfectly good, but floors, window casings, plastering, &c., &c., require renewing.

415. *Presque Isle beacon, Erie Harbor, Pennsylvania, Lake Erie.*—A breakwater has been built along the shore on the east side, to protect the keeper's dwelling. It is sunk in 3 feet water, is 245 feet long by 16 wide, and 6 feet high on the lake side, and 4½ feet on the land side. It is filled with heavy blocks of stone, covers the entire front of the dwelling, and affords ample protection to it. A boat shed has been provided for the keeper. A buoy shed, for the storage and protection of spare buoys, is in process of completion, on the north side of the pier of entrance to the harbor, and between the beacon and range-beacon No. 1.

416, 417. *Presque Isle Bay range-lights, Erie, Pennsylvania, Lake Erie.*—These two small lights placed on the spit making out to the southward and eastward from Presque Isle, and designed to serve as a guide to vessels after passing between the piers into the bay, will be renovated, and a more powerful illuminating apparatus fitted during the present season of operations.

418. *Conneaut, Ohio, mouth of Conneaut River, Lake Erie.*—This light station is without a keeper's dwelling, and as one is essential to the proper attendance upon the light, an estimate of \$4,000 has been sub-

mitted for the purchase of a site and the erection of a convenient frame dwelling.

419. *Ashtabula, Ohio, Lake Erie.*—There is no dwelling for the light-keeper at this light station, and an estimate has been submitted for an appropriation to erect one similar to the one proposed for Conneaut.

420. *Grand River, Fairport, Ohio, Lake Erie.*—An appropriation was made March 3, 1869, for rebuilding the tower and keeper's dwelling at this light station. Near the close of the season of operations of 1869, a temporary tower from which to exhibit a light was erected, and the light exhibited December 10, 1869. The old tower was taken down and an examination, by borings, showed the necessity for a pile foundation for the new one. This work was commenced early in the spring of 1870. The piles were driven flush with the bottom of an excavation 11 feet 4 inches deep, and their heads inclosed in one foot of concrete. Upon the heads of the piles a grillage of two courses of 12-inch timber was laid, from which the foundation of limestone rises to the surface of the ground, where the tower proper, built of Berea sandstone, commences. At the time the work was suspended by the operation of the act of 12th July, 1870, carrying the balance of the appropriation then available to the treasury, twenty-nine courses of the tower proper had been set, and thirty-two iron steps built into the brick livings. Upon the suspension of the work, the tower was protected by placing a board roof covering over it, and all materials and tools belonging to it safely stored to await a reappropriation, which has been submitted in the annual estimates. The dwelling for the keeper at this station is in a very dilapidated condition, so much so as to make the construction of a new one absolutely necessary.

422. *Cleveland, Ohio, Lake Erie.*—An appropriation was made March 3, 1869, of \$45,000, for rebuilding the light-house tower and keeper's dwelling at this place. A temporary structure was erected and the light exhibited from it August 9, 1870, preparatory to the removal of the old and the commencement of the construction of the new tower. Directions were given August 16 to suspend further operations, in consequence of the available funds, which had been appropriated little over a year, having reverted to the treasury, under the operation of the fifth and sixth sections of the act of July 12, 1870, at which time the old lantern and a part of the masonry of the tower had been taken down. The engineer of the district, under authority from the board, had previously entered into a contract for the delivery of stone for a wall of inclosure on the east and north sides of the light-house site, and for all the necessary excavation. The delivery of the stone had not commenced, and the execution of the contract was suspended. By suspending the work, the station has been left in very bad condition. The widening of the street in front of the old tower by the city authorities, with the sanction of the Government, was at the same time suspended, although it had already made considerable progress. The old tower has been covered over and all tools and materials remaining on hand safely stored to await a reappropriation to recommence the work.

424. *Black River, Ohio, Lake Erie.*—This light station is without a keeper's dwelling. An estimate of \$4,000 is submitted for the erection of a dwelling and for making the necessary repairs upon the light-house and the pier of protection to the light.

425. *Vermillion, Ohio, Lake Erie.*—This light station has not been provided with a dwelling for the light keeper. An appropriation is asked, of \$4,000, for the purchase of a site, to erect a suitable frame dwelling and for repairs of the pier of protection to the light.

426. *Huron, Ohio, Lake Erie*.—An appropriation of \$4,000 has been asked in the annual estimates for the purpose of erecting a suitable dwelling for the keeper of this light station.

427. *Cedar Point Beacon, Ohio, entrance to Sandusky Bay*.—A buoy shed has been constructed at this light station for the protection and storage of spare buoys and their fixtures.

434. *Maumee Outer Range, Ohio, Maumee River*.—These two lights are placed in small framed towers, without conveniences for the keeper or supplies. The appropriation which was made at the time they were authorized to be built was inadequate and no dwelling for the keeper could be built. An estimate of \$3,000 has been submitted for that purpose.

At each of the following-named light stations there have been repairs and renovations more or less during the last year, viz.:

399. *Rock Island, New York, St. Lawrence River*.

404. *Oswego, New York, Lake Ontario*.

407. *Genesee, New York, Lake Ontario*.

409. *Black Rock Beacon, New York, head of Niagara River, Lake Erie*.

410. *Horseshoe Reef, Buffalo Harbor, New York, Lake Erie*.

411. *Buffalo, New York, Lake Erie*.

416, 417. *Presque Isle Bay range-lights, Erie, Pennsylvania, Lake Erie*.

418. *Conneaut, mouth of Conneaut River, Ohio, Lake Erie*.

421. *Grand River Beacon, Fairport, Ohio, Lake Erie*.

424. *Black River, Ohio, Lake Erie*.

426. *Huron, Ohio, Lake Erie*.

435. *Maumee Middle Range, Maumee River, Ohio*.

436. *Maumee Inner Range, Maumee River, Ohio*.

The following-named light stations require repairs to be made during the ensuing year, viz.:

398. *Sunken Rock, New York, St. Lawrence River*.

401. *Galloo Island, New York, Lake Ontario*.

407. *Genesee Beacon, New York, Lake Ontario*.

410. *Horseshoe Reef, Buffalo Harbor, New York, Lake Erie*.

426. *Huron, Ohio, Lake Erie*.

429. *Sandusky, Sandusky Bay, Ohio, Lake Erie*.

The following are the names of the light stations in this district not mentioned elsewhere:

397. *Cross-over Island, New York, St. Lawrence River*.

400. *Tibbitt's Point, New York, head of St. Lawrence River, Lake Ontario*.

412. *Dunkirk, New York, Lake Erie*.

413. *Dunkirk Beacon, New York, Lake Erie*.

423. *Cleveland Beacon, Ohio, entrance to Cleveland Harbor, Lake Erie*.

427. *Cedar Point Beacon, Ohio, entrance to Sandusky Bay, Lake Erie*.

428. *Cedar Point Range, Ohio, entrance to Sandusky Bay, Lake Erie*.

431. *Green Island, Ohio, Lake Erie*.

432. *Western Sister Island, Ohio, Lake Erie*.

433. *Turtle Island, Ohio, entrance to Maumee Bay, Lake Erie*.

437. *Monroe, Michigan, mouth of River Raisin, Lake Erie*.

439. *Mamajuda, Michigan, Detroit River*.

440. *Grassy Island, Michigan, Detroit River*.

There are neither light-vessels nor tenders in this district. The buoys were kept by contract, although far from satisfactorily or economically;

but in the absence of a tender, which cannot be purchased for want of funds, this is the only course that can be taken.

The tender *Haze* delivers all the supplies once a year, at which time the inspector goes around with the lampist and inspects all the lights and other aids to navigation.

The strong current in the Niagara and St. Lawrence Rivers prevents the use of any other than a steam tender in looking properly after the buoys.

DEPOTS.

Buffalo, New York.—The principal depot for the storage of supplies, buoys, &c., is at Buffalo, New York.

Cedar Point.—A buoy shed and depot has been erected at Cedar Point, on the light-house lot.

Erie, Pennsylvania.—A buoy shed and depot will be provided at this place this season.

Toledo, Ohio.—There is a buoy depot and shed at this place.

Maumee River.—A buoy depot is necessary for this vicinity and will be provided as soon as a proper place on Government premises can be found for establishing it.

ELEVENTH DISTRICT.

The eleventh district embraces all aids to navigation above Grassy Island light-house, Detroit River.

Inspector.—Commodore James P. McKinstry, United States Navy, to October 1, 1870; Captain Alexander Murray, United States Navy, present inspector.

Engineer.—Brevet Brigadier General William F. Reynolds, lieutenant colonel of engineers United States Army, (Lakes Huron and Superior and Waugoshance Reef in Lake Michigan,) to April 14, 1870; Brevet Colonel J. B. Wheeler, major of engineers United States Army, (Lake Michigan, excepting Waugoshance Reef,) to March 24, 1870; Brevet Brigadier General O. M. Poe, major of engineers United States Army, present engineer.

There are in this district—

Light-houses and lighted beacons	82
Day or unlighted beacons	2
Buoys actually in position	144
Spare buoys for relief and to supply losses	30
Tenders (steam) Warrington and Haze	2
Tender (sail) Belle	1

The numbers preceding the names of stations correspond with the "Light-house List of the Northern and Northwestern Lakes of the United States," issued January 1, 1870.

St. Clair Flats, Michigan, new channel.—These two light-houses were in course of construction when work had to be stopped owing to the law of July 12, 1870, carrying to the surplus fund all unexpended balances. The building at the north end of the channel had then reached the height of the first floor. The building at the south end had reached nearly the same height. The new channel is expected to be completed before the close of navigation, and it is to be regretted that the lights cannot be shown at the same time the channel opens for navigation. The unexpended balance of \$33,000, which under the law reverted to the treasury, would have been ample to have completed both light-houses. It is recommended that the above amount be reappropriated.

444. *Fort Gratiot, Michigan, Lake Huron.*—This is one of the points

named in the appropriation for new and efficient fog signals, approved March 2, 1867. The balance of this appropriation having reverted to the treasury under the law of July 12, 1870, it is respectfully recommended that a reappropriation be made for this purpose.

The navigable channel at this place (Port Huron on the American side, and Sarnia on the Canadian) is quite narrow, needing during fogs something to guide passing vessels. The terminus of the Grand Trunk (Canadian) Railroad is at Sarnia, which connects with the road on the Port Huron side by ferry-boat.

Lake coast light between Fort Gratiot and Pointe aux Barques, Michigan, Lake Huron.—A lake coast light to be placed between the present lights at Fort Gratiot and Pointe aux Barques was asked for last year, and again recommended by the light-house officers of the eleventh district. The distance on the Lake Huron shore between these two lights is 75 miles, and vessels navigating the lake keep the shore close aboard, rendering a mark at night very desirable. In consideration of many other pressing wants of this kind, no estimate has been submitted this year.

Range lights to guide into Taras Harbor, Michigan, Lake Huron.—An appropriation of \$8,000 has been asked for establishing two small lights to serve as a range for entering this excellent harbor of refuge, but it has been deemed advisable to defer including the amount in the appropriations at present. The point on which the present main light, marking the approach, is only a short distance from the harbor, and it is believed will answer the present wants of navigation. The place, however, is growing in importance, and range-lights will be necessary at no distant day to render the harbor easy of access, especially at night and in bad weather.

Range lights at the mouth of Saginaw River, Michigan, Lake Huron.—An appropriation of \$12,000, approved July 15, 1870, is available for this object. The county surveyor of Bay County, in which the proposed new station lies, has been requested to make a survey of the site required. When received, the Governor of Michigan will be applied to for the condemnation of the necessary land, it appearing from correspondence held with the county authorities that the title to the land required is rather intricate, and could not be cleared up without much time and labor. The construction will commence as soon as a valid title shall have been obtained and approved by the Attorney General of the United States, in conformity to law.

449. *Sturgeon Point, Michigan, Lake Huron.*—This light-house, in course of construction at the date of the last annual report, was completed early in November of last year, but the new keeper not arriving in time, it was deemed best to postpone the exhibition of the light until the opening of navigation this spring, which was done, due "notice to mariners" having been given previously.

450. *Thunder Bay Island, Lake Huron.*—A steam fog signal is greatly needed to mark, during fogs, this dangerous point, in place of a bell now there, which is not efficient for a position of its danger and importance.

Presque Isle ranges, Michigan, Lake Huron.—Two small lights have been established at this harbor of refuge to serve as a range guide to a safe anchorage. The work was finished early in the month of August, and the lights will be exhibited as soon as a keeper takes charge of them.

New light at Presque Isle, Michigan, Lake Huron.—Appropriations having been made for a lake coast light at this place, (the last one July 15, 1870,) to take the place of the old tower on the point at the entrance to the harbor, the work on the new tower is in progress on the north point of the peninsula, and adjoining Presque Isle Harbor. The new

buildings will consist of a brick tower, having a focal plane of 100 feet above the ground, and connected with a keeper's dwelling, constructed of brick, by a covered passage way. The illuminating apparatus will be a third-order lens for a fixed light. The steam tender Warrington has delivered all the material for these buildings. Owing to the very short season for operations on the lakes and the necessity for great care in putting materials together at such exposed points as those occupied by light-houses, it is probable that the work cannot be entirely completed this season. A fog signal is very much needed at this place, to serve passing vessels and those seeking the harbor in bad weather. An estimate has been submitted for one.

453 *Sheboygan, Michigan, Straits of Mackinac.*—This is one of the most important stations on the lakes, making, as it does, the turning point between Lake Huron and the south channel of the straits, the one almost exclusively used by sailing vessels and steamers plying between Lake Michigan and the lower lakes. The present light being a fifth-order, (fixed, varied by flashes,) shown at an elevation of only 37 feet, should be replaced by one of the third-order, with an elevation of at least 80 feet above lake level. To accomplish this would require an appropriation of \$33,000, but it has not been included in this year's estimates.

Spectacle Reef, Lake Huron.—Preparations for this work were commenced early this spring. A steam barge was purchased and fitted up last winter for this work. A depot has been established at Scammon's Harbor, 17½ miles north of the reef—an excellent harbor, which is safe in all winds.

The necessary timber for the pier of protection was contracted for last winter and transported early in the spring to the harbor, where temporary quarters, a storehouse, and a wharf have been erected. Here the timber for the pier of protection is being framed. The necessary ballast stone is found here in large quantities, and is being collected and deposited on temporary wharves, built in 5 feet of water, from which it will be transported to the reef as required. From this harbor the crib, with the necessary ballast stone, will be towed to the reef during next season. It is proposed to transport the necessary stone for the tower to this place, where it is to be cut and fitted upon temporary foundations prepared for this purpose. The total estimated cost for this light-house is \$316,093 20. Two appropriations of \$100,000 each are already available, which amount, it is presumed, will be expended during this and the next working season of 1871. It is therefore recommended that an additional appropriation be made to continue the light-house works at Spectacle Reef of \$116,000. In order to conform the bottom of the crib to the reef, a careful survey of the site selected last year was again made, which revealed the fact that the hull of the schooner Nightingale, wrecked on this reef last fall, covers, with her cargo of iron ore, a good portion of the bed of rock upon which the tower is to stand. As there is no other place on the reef where bare bed-rock is to be found, except in 18 feet of water, the place selected having only 11 feet of water on it, it will be necessary, and most economical, to remove at least that portion of the wreck covering the area required for the coffer dam. This work is now in progress.

Straits of Mackinac, Michigan.—Attention is respectfully invited to the following remarks in the annual report for 1869 concerning the necessity for a light to mark the passage between Round Island and the Island Mackinac, known as the north channel:

STRAITS OF MACKINAC.—The necessity for a light to mark the passage between the Island of Mackinac and Round Island, known as the north channel, is again presented

for consideration, and attention is respectfully invited to the remarks upon this head in the annual report of 1867. The estimated cost of a light at this place is \$12,000, for which an appropriation is now asked.

The appropriation therein named is again recommended, amounting to \$12,000

454. *McGulpin's Point, Michigan, Straits of Mackinac.*—This is one of the light stations for which appropriations have been made for efficient fog signals and which reverted to the treasury under the act of July 12, 1870. An estimate for a reappropriation has been submitted.

455. *Detour, Michigan, Lake Huron.*—In view of the importance of this station a third-order lens will be substituted for the present one of the fourth order, the light-house having been originally designed for a third-order light, and the lantern being of ample capacity to receive a lens of that order.

The old dwelling and remnants of the old tower remain standing at this station, and will be removed. This is also one of the points named in the appropriation for new and efficient fog signals, and for the same reasons as stated under McGulpin's Point, an appropriation is recommended.

St. Helena Island, Lake Michigan.—The establishment of a suitable light to mark the anchorage, as a harbor of refuge, at this island in Lake Michigan, and not far from the Straits of Mackinac, has been again urged by those interested in the navigation of the lakes. An estimate has been submitted.

456. *Waugoshance, Lake Michigan.*—Work was resumed at this station on the 20th of May last. The hope that the stone work of the pier of protection would be completed by October 15, 1869, was not realized, owing to the stormy weather, which prevented the landing of stone upon the pier until October 15. Seven stones of the top course were in position on the 20th of the same month, when ice began to make, and it was deemed necessary to suspend the work of setting stone. The whole force was at once employed filling in, with rubble masonry, the space between the tower and the face wall. This was accomplished, after much interruption by rough weather, and on the 29th of October the working party was removed from the pier and discharged. As soon as the stone work was completed the erection of the keeper's dwelling was commenced, which is now so far advanced that there is reasonable hope that the whole station may be completed before the close of navigation. This is also one of the points named in the appropriation for new and efficient fog signals, the balance of which reverted to the treasury. It is recommended that for the establishment of a proper fog signal at this station an appropriation be made this year, and for which an estimate has been submitted in the annual estimates.

457. *Skullagalee, (Isle aux Galets,) Michigan, Lake Michigan.*—The keeper of this light station has stated that the island has been abraded, since the 1st of June last, on the northwest side 20 feet, and about 12 feet on the southeast side. It is presumed that this apparent abrasion is due to the rise of the lake, which is 15 inches higher than last year. A fog signal is very much needed here, and for this purpose an appropriation is recommended, and an estimate submitted in the annual estimates.

458. *Beaver Island Harbor, Lake Michigan.*—The light-house tower at this place has been rebuilt and provided with an iron stairway and new lantern. A fourth-order illuminating apparatus will take the place of the present sixth-order lens, to increase the power and range of the light, to make it visible from Hog Island Reef, distant 8 miles, and lying

nearly in the track of vessels bound to this harbor from the Straits of Mackinac.

461. *Grand Traverse, Michigan, Lake Michigan.*—An illuminating apparatus of the fourth order has been substituted for the fifth order, heretofore at this light station, a very necessary and decided improvement.

Mission Point, Michigan, Grand Traverse Bay, Lake Michigan.—This newly established light station has been completed this season, and the light exhibited on the 10th ultimo, (September 1870.) The timber on a part of the light-house grounds obstructs the light through a small arc and will be removed.

462. *South Manitou, Lake Michigan.*—An appropriation of \$10,000 was made at the last session of Congress (July 15, 1870) for improving the light at this place. There was, at the time this estimate was submitted, an available balance of the appropriation of March 3, 1869, for repairs and renovations at Point Betsey and South Manitou light stations. With these amounts it was proposed to erect a brick tower 65 feet high, to be connected with the present dwelling by a covered passage way, and to substitute for the present fourth-order lens one of the order of 3½. For this project plans and estimates were prepared, but the balance reverted to the treasury, under the law of July 12, 1870, and the project was, therefore, necessarily abandoned for the present. The importance of this station demands even a better light than originally proposed, and but for the limited amount appropriated there would have been recommended the erection of a tower of greater height, with a lens of the third order. Such a structure is now recommended, and, for its erection, an appropriation, in addition to the amount of \$10,000, already available, of \$20,000. This amount will be ample to repair, also, the fog signal (a bell) at this station, the wood-work of which is in a very dilapidated condition. Through the channel between South Manitou Island and the main land the principal commerce of the lakes passes, guided by this light, which should have a lens of a higher order, with greater elevation, and a characteristic distinction not readily mistaken. It is also a guide to a harbor of refuge which is probably more used than any other on the entire chain of lakes, and it is frequently impossible to distinguish the present light from those on board of vessels at anchor. If desirable, Point Betsey, now a fixed light, varied by flashes, might be changed to an alternating red and white flash simply by the introduction of a plate of red glass.

464. *Manistee, Michigan, Lake Michigan.*—This station was lighted on the opening of navigation of the present year, although the building was not entirely completed. On discovering that the rear addition of the building did not stand upon light-house ground, the work was temporarily suspended, and an additional piece of land, at the cost of \$30, was purchased. This being accomplished, and the title approved by the Attorney General of the United States, the work was resumed and completed in July of this year.

Petite Pointe au Sable, Michigan, Lake Michigan.—A lake-coast light seems to be demanded by the largely increasing commerce of that region, and at that salient point on the coast, to fill an important blank in the existing coast line. Such a light is estimated to cost \$35,000, but it has not been included in this year's estimates.

✱ *Père Marquette, Michigan, Lake Michigan.*—An appropriation of \$6,000 was made July 15, 1870, for a light at this place. The engineer officer who is in charge of the harbor works has been requested to furnish a copy of the survey of the harbor, and as soon as it is received, plans will be prepared for the erection of the necessary buildings.

White River, Michigan, Lake Michigan.—The appropriation of \$10,000 made by Congress for the establishment of a light at this place, reverted to the treasury under the act of July 12, 1870. An appropriation is recommended, and the amount has been included in the annual estimates of this year.

466. *Muskegon, Michigan, Lake Michigan.*—The board having decided to rebuild this light-house upon the old site upon the south side of the river, negotiations which had been going on for some time for a new site on the north side of the river have been discontinued, and a working party is now engaged in building the light-house upon the place originally approved by the board.

Beacon at the entrance to Grand Haven, Michigan, Lake Michigan.—The large commerce entering and leaving this harbor demands that an efficient light should be placed at the end of the harbor pier. Such a light was, before the extension of the harbor pier, erected and maintained by the Detroit and Milwaukee Railroad Company, and after the United States authorities extended the pier, a temporary structure was erected near the extreme end of the pier and maintained by private enterprise. It has since been discontinued for the reason that when most needed (during heavy gales) it could not be reached, as the sea breaks over the pier. An elevated walk will, therefore, have to be constructed to enable the keeper to reach the beacon at all times. The length of this walk will have to be 1,200 feet. Its height above the harbor pier should be at least seven feet.

The present fog signal is a bell, rung by means of a caloric engine. Its distance from the pier head, which it is presumed to make during foggy weather, is over 1,200 feet. It will be placed as near to the end of the pier as possible, and outside of the tower, so that no obstacle may interfere with the transmission of the sound. For such an exposed position the present fog signal is not suited, and therefore a bell, with Stevens's striking apparatus, will be placed in the proposed new tower. For the construction of a wooden tower, an elevated walk 1,200 feet long, and a fog signal, an appropriation is recommended of \$8,000, and is embraced in the estimates for the next fiscal year.

Black Lake Harbor, Michigan, Lake Michigan.—An appropriation was made July 15, 1870, of \$6,000 for the establishment of a beacon light at this place. As soon as the necessary plats and drawings of the harbor works at this place are received, the work will be commenced.

South Haven, Michigan, Lake Michigan.—Plans had been prepared and approved for the construction of a beacon at this place, for which there was an appropriation of \$6,000, but before the work could be commenced the money reverted to the treasury under the act of July 12, 1870. A reappropriation is asked, and the amount included in the estimates for the next fiscal year.

470. *St. Joseph's Beacon, Michigan, Lake Michigan.*—An appropriation of \$3,000 was made July 15, 1870, for rebuilding the beacon on the end of the pier at this place. The work is in progress.

Calumet, Illinois, Lake Michigan.—The improvements to be made at this harbor under a recent appropriation of Congress will open it to commerce and will necessitate the usual aids to navigation. These will have to consist in—

1st. A light-house tower at the end of one of the harbor piers with a keeper's dwelling on shore, and an elevated walk connecting both structures, to enable the keeper to reach the tower at all times.

2d. A buoy, which may be a third-class can, to mark the rocky reef or shoal lying north of the new entrance to the harbor, and distant from

it about $1\frac{1}{2}$ mile, and from the shore about 2,800 feet. It is proposed that the keeper's dwelling be erected upon the old light-house site, which is close to the new entrance and is still owned by the United States. For these improvements an estimate is submitted and an appropriation is recommended of \$10,000.

472. *Chicago, Illinois, Lake Michigan.*—When this light-house was built, it marked the extreme end of the North Harbor pier. This pier has been extended lakeward at different times so that now its extreme end is 1,200 feet from the light-house, which was last year marked by a beacon. The smoke of the many factories and steamers frequently obscures this light. The time has come when this light should be removed to a more eligible site, and it is recommended that it be transferred to Grosse Point, 13 miles north of Chicago. It would there serve what it was intended for, to mark the approach to Chicago, and a prominent point of the coast, the present wooden dwelling to remain in its position, to serve as a dwelling for the keeper of the beacon. From its gable end a light to be shown which, with the beacon, will form a range indicating the direction of the North Harbor pier.

A proper light should also be placed upon the crib at the outer end of the tunnel of the Chicago water-works, to replace the present inefficient one, not under the control of the Light-house Establishment.

There are recommended for the present only the removal of the main light to Grosse Point, and to provide the dwelling with a proper light, and for these objects an appropriation of \$25,000 is recommended and included in the annual estimates.

473. *Chicago (Illinois) beacon, Lake Michigan.*—This beacon was erected on the end of the north pier, and the light exhibited during the last season.

477. *Racine, Wisconsin, Lake Michigan.*—A fourth-order lens of 270° arc has been placed in this light-house as a substitute of the fifth order of 180° arc of illumination, making a great improvement in it.

A light-house on Racine Point, Wisconsin, Lake Michigan.—A lake-coast light has been asked for to be placed on Racine Point, which lies $3\frac{1}{2}$ miles to the north of Racine and 18 miles south of the light on the pier at Milwaukee. This point shuts out to the northward the light at Racine, which is in an indentation of the lake coast line, and is therefore not seen by vessels coming from the north while keeping the shore well aboard, as they must do ordinarily until well abreast of it. Frequent shipwrecks have occurred at this point for want of a proper mark upon it. A light is needed on this point also, to direct navigators clear of Racine Reef, which lies well out, and only marked by a buoy. A fog signal should be established at the same time. The estimated cost of this establishment is \$40,000.

479. *Milwaukee (Wisconsin) North Out beacon, Lake Michigan.*—The same difficulty exists here as at Chicago and other places where the piers have been extended, which will require at no distant day a small beacon light on the extreme end of the pier, which will however serve as a range for entering between the two piers. The outer approach to the harbor is however marked by a light on the north point of the bay.

A coast light at Twin River Point, Wisconsin, Lake Michigan.—This point is 7 miles north of Manitowoc, and occupies a position on the west coast of Lake Michigan similar to Grand "Point au Sable" on the east coast. It is the prominent landmark for vessels navigating Lake Michigan, and should be marked by a tower 100 feet high, with an apparatus of the third order. There is an old discontinued station at the village of "Twin Rivers," but the site is too far south of the point

to answer the purpose of a coast light. It will require an appropriation of \$40,000 for this lake-coast light; and as its importance has been urged, attention is called to it, but it has not been included in the annual estimates for the next fiscal year.

483-484. *Bayley's Harbor (Wisconsin) range light, Lake Michigan.*—These lights were completed at the close of the working season last year. With a range beyond the outer shoals off the harbor and bar, and the "Cana Island" light to guide to the approach, these lights will enable vessels seeking a harbor of refuge to safely enter to a safe anchorage.

485. *Cana Island, Lake Michigan.*—This light was completed at the close of the working season last fall, and exhibited for the first time at the opening of navigation this spring. This light is a substitute for the old Bayley's Harbor light, to serve the double purpose of a lake-coast light, and at the same time mark the near approach to Bayley's Harbor, which can only be safely entered at night by bringing the two lights inside in range line while outside of the bar.

North Bay, Wisconsin, Lake Michigan.—Negotiations are now pending for a proper site for range lights to guide into this harbor; an appropriation of \$7,500, approved July 15, 1870, being available for this purpose.

Poverty Island, Lake Michigan.—Attention is respectfully invited to remarks in the last annual report from this office regarding the necessity of a light at this point, and the appropriation therein named is again asked, amounting to \$18,000:

POVERTY ISLAND.—The importance of a light at this place will be better recognized by quoting the remarks relating to it in the annual report of 1867, viz.: "The already large and rapidly increasing commerce to and from the northern end of Green Bay and lower lake parts now takes in daylight the northern passage from Lake Michigan into Green Bay, because of its being much shorter and more direct. To enable vessels to use the same passage in the night, a light-house on Poverty Island is necessary."

Fox River, Wisconsin, Green Bay, Lake Michigan.—The appropriations, amounting in the aggregate to \$11,000, for beacon lights at the entrance to Fox River, having reverted to the treasury under the law of July 12, 1870, it is recommended that the above amount be reappropriated. The board is informed that the harbor improvements there will be completed during the present season for work.

494. *Round Island, Lake Superior.*—This station is being thoroughly renovated under an appropriation of \$8,000, approved July 15, 1870, upon plans approved by the board. The tower is to be raised and provided with a new deck plate and lantern; a kitchen addition is to be built; the cellar to have a concrete floor; and a drain to be put in a thorough state of repair. These improvements will be completed before the close of the present working season; all the materials have been delivered.

495. *Point Iroquois, Michigan, Lake Superior.*—A working party is now engaged in rebuilding this station under a recent appropriation. It is hoped that the work may be completed before the close of navigation. All the materials have been delivered.

496. *White Fish Point, Michigan, Lake Superior.*—This is one of the most important lights on the lakes, owing to the point upon which it is placed being projected well into the lake, with deep water close to it. Vessels bound either up or down the lake run for this light, and in foggy weather without an efficient fog signal both delay and risk are encountered. The balance of the appropriation for efficient fog signals at this and other important points in the district having been carried into the treasury under the operation of the act of July 12, 1870, a reappropriation has been asked for in the annual estimates.

A coast light between White Fish Point and Grand Island Harbor, Michigan, Lake Superior.—In the three last annual reports an appropriation of \$40,000 was recommended for the purpose of establishing a light on this portion of the lake coast. As it is deemed of great importance, the recommendation is renewed, although not included in the annual estimates.

501. *Marquette, Michigan, Lake Superior.*—The arc illuminated by this light having been found too small, an apparatus of 270° arc has been ordered to be placed in lieu of the one of 180° now there.

502. *Granite Island, Lake Superior.*—This light serves the double purpose of marking a dangerous outlying rock, lying 12 miles to the northwest of the harbor of Marquette, and as a key to the approach to that harbor when coming from up the lake, and as it is outside of the general line of the trend of the coast, it is in foggy weather, in the absence of an efficient fog signal, a serious obstruction to navigation, and hence an estimate has been submitted for a fog signal for this light station.

503. *Huron Island, Lake Superior.*—Huron Island consists of a series of granite peaks separated by deep chasms. Upon the highest of these peaks the light-house was placed at an elevation of 163 feet above the lake. A road was constructed at the time of building the light-house. The chasms were then spanned by temporary wooden structures, the timber used being the small birch trees found on the island. These wooden structures are already showing signs of decay and should be superseded by structures more permanent. To build a proper road from the lower landing to the light-house will require an outlay of about \$3,000.

A fog signal is very much needed at this station, and provision for one had been made in the appropriation for new and efficient fog signals, which, under the law of July 12, 1870, has reverted to the treasury. An appropriation for the road and a reappropriation for the fog signal have been submitted in the annual estimates.

505-506. *Portage (Michigan) Ranges, Lake Superior.*—The buildings stand in a marsh, and the unusually high water during the past summer has shown that they should be raised as well as the walk connecting front and rear light. There should also be a sufficient place around the dwelling filled in with gravel so as to afford the keeper a dry place around his house. The buildings are of wood, and can therefore easily be raised. The cost of all these improvements will probably be about \$900, which has been submitted in the estimates.

507. *Mendota, Michigan, Lake Superior.*—This light, designed to guide vessels through an artificial cut to Lac La Belle, having been found to be of no use to navigators as a coast light, and as there is no commerce or at present attraction for commercial enterprise, and insufficient depth of water for any freight or passenger vessel navigating Lake Superior, its discontinuance has been ordered from and after the close of the present navigating season.

508. *Manitou, Michigan, Lake Superior.*—This light is off the most easterly part of Keweenaw Point, in Lake Superior, close around which vessels bound up or down the lake or to Marquette have to pass without any guide for turning during fogs, which prevail during parts of the navigating season. This light-station is one of great importance, and a first-class fog-signal is almost indispensable, and therefore a reappropriation of the funds carried into the treasury by the act of July 12, 1870, for this object has been included in the annual estimates.

513. *Eagle Harbor, Michigan, Lake Superior.*—An appropriation was made July 15, 1870, for rebuilding the light-house structures at this

place. The plans have been prepared and the work will be done without avoidable delay. The materials are now being delivered at the site.

514. *Eagle River, Michigan, Lake Superior.*—It was the intention to rebuild this station during the present season, under an appropriation approved March 3, 1869, amounting to \$14,000. This it will be impossible to do now, the appropriation having reverted to the treasury under the law of July 12, 1870. It is recommended that the above amount be reappropriated, as estimated for in the annual estimates. The condition of the present structure is very bad, the effect of age and exposed location.

516. *Michigan Island, Lake Superior.*—This station was reestablished last season, after undergoing thorough renovation and repair.

Duluth, Minnesota, Lake Superior.—This is the terminus of the railroad from St. Paul, Minnesota, to the head of Lake Superior. The place is becoming rapidly built up; wharves, elevators for grain, and piers are being built; and although there is a light-house at Minnesota Point, at the mouth of St. Louis River, Superior City, yet it only serves as a general guide for that side of the head of the lake. A light having been asked for to guide to that side of the lake, an estimate of \$10,000 has been submitted in the annual estimates of this year. The numerous petitioners for this light, upon six different petitions, represent "that while the harbor of Duluth is easy of access and safe during the day, or when land-marks are visible, it being without beacons, is difficult and dangerous at night when the weather is thick; that vessels are now arriving and departing daily, and with the prospect of greatly increased trade to follow the completion of the Lake Superior and Mississippi Railroad, which will be ready for through traffic in a few weeks; that the Northern Pacific Railroad Company is about forwarding the iron and other materials for building its line to Red River (over 200 miles) to this port, which will make the trade this season exceedingly large. An immense future commerce is also assured by the building of the above-named two roads to this port, the most westerly point to which the great lakes can be navigated; that the nearest harbor of refuge on the south shore of the lake is at Bayfield, 75 miles distant, while the nearest safe harbor on the north shore is still more distant. Sudden storms at this end of the lake, therefore, render the harbor at Duluth one of peculiar and exceeding importance to the commerce of the lakes. We therefore pray your honorable board to take such measures as will lead to the early establishment of such lights and guards as may be necessary for the protection of the large shipping interests from all the lake ports now centering there."

DAY OR UNLIGHTED BEACONS.

Peshtigo Shoal, Green Bay.—A day-beacon has been erected at the extreme easterly end of the spit of sand extending from Peshtigo River into Green Bay. It consists of a wooden crib 30 feet square, surmounted by a pyramidal skeleton frame, upon which is placed an iron cage. The beacon is completed, except some rip-rapping required to secure its foundation.

Stanard's Rock, Lake Superior.—The beacon erected upon this isolated rock, lying in the lake, $23\frac{1}{2}$ miles from Manitou light-house, (the nearest land,) was found in August last to be intact and in good condition. It was repainted, to preserve the material and render it a better day-mark.

At each of the following-named light stations there have been repairs and renovations, more or less extensive, during the last year:

451. *Presque Isle, Michigan, Lake Huron.*

- 453. *Cheboygan*, Michigan, Straits of Mackinac.
- 455. *Detour*, Michigan, Lake Huron.
- 458. *Beaver Island Harbor*, Lake Michigan.
- 460. *South Fox Island*, Lake Michigan.
- 490. *Eagle Bluff*, Wisconsin, Green Bay, Lake Michigan.
- 491. *Chambers Island*, Green Bay, Lake Michigan.
- 498. *Grand Island Harbor Beacon*, Lake Superior.
- 499, 500. *Grand Island Harbor ranges*, Lake Superior.
- 501. *Marquette*, Michigan, Lake Superior.
- 502. *Granite Island*, Lake Superior.
- 503. *Huron Island*, Lake Superior.
- 504. *Portage River*, Michigan, Lake Superior.
- 516. *Michigan Island*, Lake Superior.
- 518. *Raspberry Island*, Lake Superior.

The following named light-stations require repairs to be made during the ensuing year:

- 441. *Windmill Point*, Michigan, Lake St. Clair.
- 442, 443. *St. Clair Flats light-house and beacons*, Michigan, Lake St. Clair.
- 444. *Fort Gratiot*, Michigan, Lake Huron.
- 446. *Ottawa (Tawas) Point*, Michigan, Lake Huron.
- 447. *Charity Island*, Michigan, Saginaw Bay, Lake Huron.
- 448. *Saginaw Bay*, Michigan, Lake Huron.
- 450. *Thunder Bay Island*, Lake Huron.
- 452. *Bois Blanc*, Bois Blanc Island, Lake Huron.
- 455. *Detour*, Michigan, Lake Huron.
- 459. *Beaver Island*, Michigan, Lake Michigan.
- 461. *Grand Traverse*, Michigan, Lake Michigan.
- 465. *Grande Pointe au Sable*, Michigan, Lake Michigan.
- 468. *Kalamazoo*, Michigan, Lake Michigan.
- 471. *Michigan City*, Indiana, Lake Michigan.
- 474. *Waukegan*, Illinois, Lake Michigan.
- 477. *Racine*, Wisconsin, Lake Michigan.
- 478. *Milwaukee*, Wisconsin, Lake Michigan.
- 480. *Port Washington*, Wisconsin, Lake Michigan.
- 481. *Sheboygan*, Wisconsin, Lake Michigan.
- 482. *Manitowoc*, Wisconsin, Lake Michigan.
- 486. *Port du Mort*, Michigan, entrance to Green Bay, Lake Michigan.
- 488. *Point Peninsula*, Michigan, Green Bay, Lake Michigan.
- 493. *Tail Point*, Wisconsin, Green Bay, Lake Michigan.
- 496. *White Fish Point*, Michigan, Lake Superior.
- 497. *Grand Island*, Lake Superior.
- 499, 500. *Grand Island Harbor ranges*, Lake Superior.
- 508. *Manitou*, Michigan, Lake Superior.
- 509. *Gull Rock*, Michigan, Lake Superior.
- 519. *Minnesota Point*, Michigan, Lake Superior.

Light-house depot, Detroit, Michigan.—The grounds at this depot are being filled in and graded, and necessary small repairs to wharf, &c., made. All the oil and other supplies for the light-houses on the lakes are received at, and distributed from, this depot. The small temporary storehouse of wood is not only inadequate in size and unadapted to the service, but is unsafe for the storage of such valuable combustible property as is necessarily deposited for annual and incidental distribution.

Plans are in preparation for the erection of a suitable fire-proof vault and storehouse for oil and other supplies, and for a lamp shop for the repair of lamps, revolving machinery, &c., for the numerous lights on

the lakes. The wharf and dock serve for laying up the tender during the winter, where it will be safe from the effects of running ice, and a place for storing and repairing during the winter all buoys and their equipments. An estimate has been included and submitted in annual estimates for the sum of \$25,000 for the next fiscal year.

TENDERS.

The little steam-tender Haze is employed every year, from the opening of navigation in the spring to the close in the fall, in placing the buoys as far as possible, and in delivering oil and other annual supplies to all the lights in the St. Lawrence and Niagara Rivers, and in Lakes Ontario, Erie, St. Clair, Huron, Michigan, and Superior, and their tributaries, during which time the inspectors and lampists of the two districts make visits of inspection, and put the lamps and machinery in repair. This vessel also carries such freight and parties for repairing, rebuilding, &c., of light-houses, before and after delivering supplies, as time and other duties will allow.

The steam-tender Warrington and the sailing schooner Belle are employed exclusively by the engineer in transporting material and workmen to the different light stations for construction or repair, as the case may be. The Warrington is an indispensable adjunct to the other means employed for constructing the difficult works on Spectacle Reef. As the operations for this work are at present mainly on shore, she has been used during the present season in transporting materials for numerous new works in the district. She has delivered so far all the materials for Spectacle Reef, in addition to those of ten other light-stations, which have been, or are at present, in progress.

The sailing schooner Belle has been in attendance upon the Spectacle Reef working party at Scammon's Harbor; in transporting tools, rigging, &c., from completed works to those needing them. When not required for other service, she is employed as at present, collecting ballast stone for the pier of protection at Spectacle Reef. This vessel also serves occasionally for quarters for working parties, when required at places where other economical means are not available for that purpose.

TWELFTH DISTRICT.

This embraces all aids to navigation on the Pacific coast of the United States, from the Mexican frontier to the 41st parallel of latitude.

Inspector.—Commodore Alfred Taylor, United States Navy.

Engineer.—Brevet Lieutenant Colonel R. S. Williamson, major of engineers, United States Army.

There are in this district—

Light-houses	12
Buoys actually in position	55
Spare buoys, for relief and to supply losses	33
Tender (steam) Shubrick	1

The numbers preceding the names of light stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

Point Fermin, California, entrance to San Pedro Harbor.

360. *Point Pinos*, California, entrance to Monterey Harbor.—At the close of the Mexican war, and the acquisition of California, the President gave orders through the General Land Office to the surveyor general of the Pacific coast to reserve, of the public domain on that coast, cer-

tain sites for light-houses and other public purposes, among which was the site for a light-house at Point Pinos. An appropriation was made and the light exhibited in 1854. Certain parties claimed to be the owners of the land, and resorted to vexatious proceedings to coerce the Government into the payment of \$8,000 for the site, and finally obtained a decision from the courts in their favor, whereupon the only alternative left to the United States was that of having the land condemned for public use under the laws of the State as prescribed for such cases. This has resulted in an award of \$1,000 by the court to the claimants for the land embraced in the site.

361. *Santa Cruz, California, entrance to Santa Cruz Harbor.*—This light-station was established during the last year.

Point Año Nuevo, and Pigeon Point, sea-coast of California.—An appropriation was made for a light on Point Año Nuevo or vicinity, and during the two last years every effort was made to obtain a site and valid title. Finally these efforts were crowned with success, and preparations made for at once commencing the work, but before much progress could be made the balance supposed to be ample to complete the work reverted to the treasury under the act of July 12, 1870. An estimate has been submitted for a re-appropriation.

Straits of San Pablo, California, between the Bay of San Francisco and the Bay of San Pablo.—A light-house and fog-signal at San Pablo Point or vicinity is much needed, as it would serve as a guide for all vessels navigating the Sacramento and San Joaquin Rivers, and for ocean steamers and sailing vessels bound to and from Vallejo and Mare Island navy yard.

Straits of Carquinez, California, between the Bay of San Pablo and Suisun Bay.—An appropriation was made for the erection of a light-house on Mare Island, but as that location was not suited to the wants of navigation, the money was turned into the treasury, and a re-appropriation is submitted on the estimates for this point as the proper one.

Point Reyes, sea coast of California.—The purchase of the site for this light station was reported last year. The work of construction will, it is expected, be completed about the middle of November, and the light ready for exhibition about the first of December of this year.

366. *Point Arena, sea-coast of California.*—The works at this station were commenced September 30, 1869, and completed the following April. The light was exhibited for the first time, May 1, 1870. The apparatus is of the first order, fixed in a tower 100 feet high from base, and the height of the light above the mean level of the sea 150 feet.

367. *Cape Mendocino, sea-coast of California.*—A person claiming to be the rightful owner of the land upon which this light-house is built brought suit to eject the keeper, and to obtain possession of the station. The case was tried at the June term of the district court of the eighth judicial district, at Eureka, California, and resulted in a nonsuit.

The following-named light stations require repairs to be made during the current and ensuing year:

360. *Point Pinos, California, entrance to Monterey Harbor.*

363. *Point Bonita, California, entrance to San Francisco Harbor.*

365. *Alcatraz, California, Alcatraz Island, San Francisco Harbor.*

368. *Humboldt, California, entrance to Humboldt Bay.*

At the following-named light stations there have been repairs and renovations more or less extensive during the last year:

357. *Point Loma, sea-coast of California, entrance to San Diego Harbor.*

358. *Santa Barbara, California, Santa Barbara Channel.*

359. *Point Conception*, sea-coast of California, entrance to Santa Barbara Channel.

360. *Point Pinos*, California, entrance to Monterey Harbor.

362. *Farallones*, California, South Farallone Islet, off San Francisco Harbor.

363. *Point Bonita*, California, entrance to San Francisco Harbor.

364. *Fort Point*, California, at the "Golden Gate" entrance to San Francisco Harbor.

365. *Alcatraz*, California, Alcatraz Island, San Francisco Harbor.

There are no light-vessels in this district.

TENDERS.

The small steam-tender Shubrick is employed in this and the thirteenth district, embracing the entire Pacific coast, and delivering supplies of oil, and other necessities for the different light stations; in placing and replacing the buoys; in making inspections; and when not otherwise employed, in carrying freight of material and labor for constructing new, and repairing old light-houses. Congress, at its last session, made an appropriation for another tender for the Pacific coast, which, when built and sent there, will add much to the economy of the service, especially in transferring labor and materials for repairs of old, and the construction of new works.

THIRTEENTH DISTRICT.

This district embraces all aids to navigation on the Pacific coast of the United States north of the forty-first parallel of latitude.

Inspector.—Commodore Alfred Taylor, United States Navy.

Engineer.—Brevet Lieutenant Colonel R. S. Williamson, major of engineers United States Army.

There are in this district—

Light-houses	9
Buoys actually in position	10
Spare buoys for relief and to supply losses	10
Tender (steam) Shubrick, common to twelfth and thirteenth districts	1

The numbers preceding the names of light stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1870.

Fauntleroy Rock, California, entrance to Crescent City Harbor.—This is a very dangerous rock, which needs to be marked; and an estimate of \$5,000 has been submitted in the annual estimates for that purpose.

Cape Blanco, sea-coast of Oregon.—The light-house structures at this point are in progress, and will be completed by December 15 of this year. This point can only be reached with materials and labor by sea, and, after reaching the offing, they can only be landed under the most favorable circumstances of sea and weather through the surf. Freights for this section were held at fabulous prices by owners of vessels, rendering it necessary to burn the brick on the ground, which was successfully done; but all other materials and provisions for the mechanics had to be sent by sea, and landed at great risk of loss of life and property.

Yaquina, Oregon, entrance to Yaquina Bay.—An appropriation was made at the last session of Congress for lighting the entrance to this bay. An examination of the locality has been made, and the work will be commenced as soon as a proper site and valid title can be obtained.

Cape Foulweather, sea-coast of Oregon.—An estimate was submitted

last year for a sea-coast light at this point. A reservation of the necessary land has been made. This being one of the outlying points on the Pacific coast upon which a first-class light must be placed, sooner or later, and in consideration of the commerce of that coast, the estimate is renewed this year.

At the following-named light stations there have been repairs and renovations more or less extensive during the last year:

369. *Crescent City*, California, entrance to Crescent City Harbor.

373. *Cape Flattery*, sea-coast of Washington Territory, entrance to the Straits of Juan de Fuca.

The following-named light-houses require repairs, to be made during the current and ensuing year:

370. *Cape Arago*, (*Gregory*,) sea-coast of Oregon.

371. *Cape Disappointment*, (*Hancock*,) sea-coast of Washington Territory, entrance to the Columbia River.

372. *Shoalwater Bay*, Washington Territory.

374. *New Dungeness*, Washington Territory, Straits of Juan de Fuca.

375. *Smith's (or Blunt's) Island*, Washington Territory, inner end of Straits of Juan de Fuca.

376. *Admiralty Head*, Washington Territory, Whidby's Island, Admiralty Inlet to Puget Sound.

377. *Ediz Hook*, Washington Territory, entrance to Port Angeles, Straits of Juan de Fuca.

There are no light-vessels in this district.

TENDERS.

The small steam-tender Shubrick is used in common to look after the lights and buoys in this and the twelfth district.

BUOY DEPOTS.

The principal station for keeping spare buoys is at Mare Island. The spare buoys for the Columbia are kept in the vicinity for use at the bar of that river.

All of which is very respectfully submitted.

W. B. SHUBRICK,

Rear-Admiral United States Navy,

Chairman of Light-house Board.

THORNTON A. JENKINS,

Rear-Admiral United States Navy, Naval Secretary.

GEORGE H. ELLIOT,

Major of Engineers United States Army, Engineer Secretary.

REPORT OF THE LIGHT-HOUSE BOARD.

31 F

OFFICERS OF THE LIGHT-HOUSE BOARD.

[Light-House Board of the United States, organized in conformity to the act of Congress approved August 31, 1852.]

LIGHT-HOUSE BOARD.

HON. GEORGE S. BOUTWELL, Secretary of the Treasury, *ex-officio* President.

REAR-ADMIRAL W. B. SHUBRICK, United States Navy.	REAR-ADMIRAL C. K. STRIBLING, United States Navy.
PROF. JOSEPH HENRY, LL. D., Secretary Smithsonian Institution.	PROF. BENJ. PEIRCE, LL. D., Superintendent Coast Survey.
BREVET MAJOR GENERAL A. A. HUMPHREYS, Chief of Engineers, United States Army.	REAR-ADMIRAL THORNTON A. JENKINS, United States Navy.
BREVET MAJOR GENERAL J. G. BARNARD, Colonel of Engineers, United States Army.	MAJOR GEORGE H. ELLIOT, Corps of Engineers, United States Army.

CHAIRMEN OF COMMITTEES.

Finance.—GENERAL HUMPHREYS.
Engineering.—GENERAL BARNARD.
Experiments.—PROF. HENRY.

Lighting.—PROF. PEIRCE.
Floating Aids.—REAR-ADMIRAL STRIBLING.

The Chairman and Secretaries are *ex-officio* members of all committees.

MEMBERS OF THE BOARD EMPLOYED IN THE OFFICE

REAR-ADMIRAL W. B. SHUBRICK, United States Navy, Chairman.
 REAR-ADMIRAL THORNTON A. JENKINS, United States Navy, Naval Secretary.
 MAJOR GEORGE H. ELLIOT, Corps of Engineers, United States Army, Engineer Secretary.

CLERKS.

ARNOLD B. JOHNSON, chief clerk.
 WILLIAM D. O'CONNOR, corresponding clerk.
 FRANK BAKER, accountant.
 BRUCE SMALL, examining clerk.

A. H. SAWYER, records clerk.
 SAMUEL STONE, recording clerk.
 MRS. E. J. BEARE, register clerk.
 JOSEPH McMAKIN, draughtsman.

REPORT

OF

THE UNITED STATES LIGHT-HOUSE BOARD.

TREASURY DEPARTMENT,
Office Light-House Board, September 25, 1871.

SIR: By your direction the following report of the operations of this Board, during the last year, is respectfully submitted:

The detailed statements under the heads of the respective districts, based mainly upon the annual reports of the Engineers and Inspectors, embrace the work which has been done; that which has been laid out for the current year; and the present condition of all the aids to navigation, with such remarks and recommendations in regard to improvement of existing and the establishment of such new aids as seem to require the attention of Congress at this time.

The Light-houses and Light-vessels (so far as the exhibition of efficient Lights is concerned) are, it is believed, equal to any in the world, and those beacons and buoys actually in position are efficient day-marks to guide clear of the obstructions for which they were established. For those Light-stations at which extensive repairs and renovations are needed, special appropriations are recommended.

The aggregate estimates for the fiscal year ending June 30, 1873, are \$45,000 in excess of the appropriations for the fiscal year ending June 30, 1872, and \$358 less than the estimates of last year.

The special items in excess, in the estimates of general expenses, over the actual appropriation for the current fiscal year, are for buoyage and for expenses of Fog-signals. The sum estimated for the buoy service is the same that has been submitted for several years past, owing to the great increase in the numbers of those aids to navigation, especially on the Southern, Gulf, and Pacific coasts, and the failure to make the increased appropriation (\$25,000) asked for two years since, made it necessary to apply for a deficiency appropriation, part of which was made.

The other item of increase (\$20,000) "for expenses of Fog-signals," arises from the large number of those aids to navigation authorized within the last two years.

Of the large number of Lights and other aids to navigation for which appropriations have been made, such as are established on sites belonging to the Government, and those where valid titles, according to law, in cases in which land had to be purchased, have been obtained, the works have been commenced or completed. Great difficulty is experienced in perfecting titles to sites for Light-houses, and building them within the limited time appropriations are available. It not unfrequently happens that the title-papers of a site for a Light-house, costing only a few hundred dollars, remain in the hands of the law officers for many months before the validity of the title is reported upon, and then, very often,

in consequence of some legal omission or informality, the papers have to be returned to the United States attorney for further investigation.

The two small sailing-vessels which have been employed for many years in delivering oil and other Light-house supplies on the Atlantic and Gulf coasts are too much decayed to be economically repaired after the present year, and an estimate for building two new vessels for that service has been submitted in the estimates for next year.

FIRST DISTRICT.

The First District extends from the northeastern boundary of the United States, (Maine,) to and including Hampton Harbor, New Hampshire.

Inspector.—Commander A. E. K. Benham, United States Navy.

Engineer.—Brevet Brigadier General J. C. Duane, Lieutenant Colonel of Engineers, United States Army.

In this district there are:

Light-houses and lighted beacons	48
Day, or unlighted beacons	50
Buoys actually in position	339
Spare buoys for relief, and to supply losses	177
Tender, steamer <i>Iris</i>	1
Tender, steam launch, <i>Mary</i>	1
Tender, (sail,) schooner <i>Wave</i>	1

The following numbers, which precede the names of stations, correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1871.

LIGHT-HOUSES AND LIGHTED BEACONS.

Burnt-Coat Harbor, Swan's Island, coast of Maine.—In consequence of difficulty in obtaining title to the land, it will probably be impossible to complete the Light-house before the 1st of July next, and it is therefore recommended that the money may be re-appropriated.

21. *White Head*.—Repairs are being made to the main part of the keeper's dwelling; a road has been graded from the landing to the Fog-signal house; a coal-shed erected, and a wharf is being built.

Halfway Rock, Casco Bay, Maine.—On the 30th of June, 1870, the balance on hand for the construction of this work having reverted to the Treasury, the construction of the work was discontinued, and the machinery and material removed and stored. As soon as the new appropriation became available the work was resumed. The tower has been completed, and all that now remains to be done is the roofing of the lantern and the introduction of the apparatus. The station will be lighted on the 15th of August. It is proposed, during the present season, to build a substantial masonry boat-house and establish a Fog-signal.

40. *Cape Elizabeth*, coast of Maine.—The westerly tower of the two, at this Light-station, was built in 1828 of *rubble stone*, and is now in such a state as to render it necessary to rebuild it in a better manner, for which an estimate has been submitted in the annual estimates. The station is one of the most important on the eastern coast, serving the double purpose of a sea-coast Light-station, and as a mark for the entrance into Casco Bay and to Portland Harbor.

43. *Whale's Back*.—The masonry of the new tower has reached the height of twenty feet above low-water mark. The position is one of the most difficult to work upon on the coast, as the rock is covered by the

waves, except at low water, and is exposed to the full force of the Atlantic. The new structure will be a masonry tower, solid to the height of twenty feet above low-water mark, and the blocks of granite which will form a facing for the interior mass of concrete will be tied together by dove-tail joints, as is usual in similar sea structures. The diameter of the tower at the base will be twenty-seven feet, and height of focal plane above the sea will be sixty-eight feet.

4. *Portsmouth Harbor*.—A new keeper's dwelling is being erected.

At each of the following-named Light-stations there have been repairs and renovations, more or less extensive, during the year, viz:

1. *St. Croix*, on Dochet's Island, St. Croix River, Maine.
2. *West Quoddy Head*, west entrance to Passamaquoddy Bay.
3. *Little River*, west side of entrance to harbor.
4. *Libby Island*, entrance to Machias Bay.
5. *Moose Peak*, on Moosepeak Head.
6. *Nash's Island*, west end of Moosepeak Reach.
7. *Narraguagus*, entrance to Narraguagus Bay.
8. *Petit Menan*, on Petit Menan Island.
9. *Prospect Harbor*, east side of entrance to Prospect Harbor.
10. *Winter Harbor*, west side of entrance to Winter Harbor.
11. *Mount Desert*, on Mount Desert Rock.
12. *Baker's Island*, southwest side entrance to Frenchman's Bay.
13. *Bear Island*, east side entrance to northeast harbor.
14. *Bass Harbor Head*, east side entrance to Bass Harbor.
15. *Edgemoggin*, near east end of Edgemoggin Reach.
16. *Saddleback*, in Isle au Haute Bay.
17. *Heron Neck*, west entrance to Carver's Harbor.
18. *Deer Isle*, west entrance to Thoroughfare.
19. *Eagle Isle*, west side of Isle au Haute Bay.
20. *Pumpkin Isle*, west entrance to Edgemoggin Reach.
21. *Matinicus*, off Penobscot Bay.
22. *Owl's Head*, west side of Muscle Ridge Channel, Penobscot Bay.
23. *Brown's Head*, south side of west entrance to Fox Islands Thoroughfare.
24. *Negro Island*, south side of entrance to Camden Harbor.
25. *Grindle's Point*, north side of entrance to Gilkey's Harbor.
26. *Dice's Head*, north side of entrance to Castine Harbor.
27. *Fort Point*, west side of entrance to Penobscot River.
28. *Tenant's Harbor*, south side of entrance to Tenant's Harbor.
29. *Marshall's Point*, east entrance to Herring Gut.
30. *Manheigan*, off George's Islands.
31. *Franklin Island*, on east side of west entrance to George's River.
32. *Pemaquid*, on Pemaquid Point.
33. *Burnt Island*, west side of entrance to Townsend Harbor.
34. *Hendrick's Head*, east side of entrance to Sheepscoot River.
35. *Pond Island*, west side of entrance to Kennebec River.
36. *Seguin*, off Kennebec River.
37. *Cape Elizabeth*, on southwest side of Casco Bay.
38. *Portland Head*, on southwest side of entrance to Portland Harbor.
39. *Portland Breakwater*, on outer end of Breakwater, Portland Harbor.
40. *Wood's Island*, west side of entrance to Saco River.
41. *Goat Island*, east side of entrance to Cape Porpoise Harbor.
42. *Boone Island*, off York Harbor.
43. *Isle of Shoals*, on White Island, off Portsmouth.

The following-named Light-stations require repairs to be made during the current and ensuing year :

1. *St. Croix.*
2. *West Quoddy Head.*
4. *Libby Island.*
6. *Nash's Island.*
7. *Narraguagus.*
8. *Petit Menan.*
Prospect Harbor.
9. *Winter Harbor.*
10. *Mount Desert.*
11. *Baker's Island.*
12. *Bear Island.*
13. *Bass Harbor Head.*
14. *Edgemoggin.*
15. *Saddleback.*
16. *Heron Neck.*
18. *Eagle Island.*
19. *Pumpkin Isle.*
20. *Matinicus.*
21. *White Head.*
22. *Owl's Head.*
23. *Brown's Head.*
24. *Negro Island.*
25. *Grindle's Point.*
26. *Dice's Head.*
27. *Fort Point.*
28. *Tenant's Harbor.*
29. *Marshall's Point.*
30. *Manheigan.*
31. *Franklin Island.*
32. *Pemaquid.*
33. *Burnt Island.*
34. *Hendrick's Head.*
35. *Pond Island.*
36. *Seguin.*
37. *Cape Elizabeth.*
38. *Portland Head.*
40. *Wood Island.*
41. *Goat Island.*
42. *Boone Island.*
44. *Portsmouth Harbor.*
45. *Isle of Shoals.*

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the first district :

No. 1. *Jerry's Point*, Portsmouth Harbor.—Iron beacon. In good condition.

No. 2. *South Beacon*, Portsmouth Harbor.—Stone beacon. In good condition.

No. 3. *North Beacon*, Portsmouth Harbor.—Wooden mast. In good condition.

No. 4. *Willey's Ledge*, Portsmouth Harbor.—Iron spindle. In good condition.

No. 5. *York Ledge*, off York River.—Iron spindle. In good condition.
No. 6. *Fishing Rocks*, Kennebunkport.—Iron spindle. Broken off. Spar-buoy substituted.

No. 7. *Stage Island Monument*, entrance to Saco River.—Stone tower forty feet high. In good condition.

No. 8. *Sharp's Rocks*, entrance to Saco River.—Iron socket and wooden shaft. Socket broken off. Spar-buoy placed to mark the danger.

No. 9. *Back Cove Beacon*, Portland Harbor.—Pile beacon. In good condition.

No. 10. *White Head Ledge*, in White Head passage to Portland Harbor.—Iron spindle slightly bent under the cage, in good condition otherwise.

No. 11. *Trott's Rock* in the above passage.—Iron spindle broken off within a few feet of the ledge.

No. 12. *Mark Island Monument*, Casco Bay.—Stone tower fifty feet high. In good condition.

No. 13. *Black Jack Rock*, Kennebec River.—Iron socket, wooden shaft; broken off.

No. 14. *Seal Rock*, Kennebec River.—Iron spindle with copper cylinder, painted black. In good condition.

No. 15. *Lee's Rock*, Kennebec River.—Iron and wood broken; a spar-buoy is placed to mark the danger.

No. 16. *Ram Island Ledge*, Kennebec River.—Iron socket and wooden shaft. In good condition.

No. 17. *Winslow's Rocks*, Kennebec River.—Iron socket, wooden shaft; broken off. Spar-buoy substituted.

No. 18. *Ame's Ledge*, Kennebec River.—Iron socket, wooden shaft. In good condition.

No. 19. *Beef Rock*, Kennebec River.—Iron socket, wooden shaft. In good condition.

No. 20. *Lime Rock*, Back River.—Iron socket, wooden shaft. In good condition.

No. 21. *Carleton's Ledge*, Back River.—Iron socket, wooden shaft. In good condition.

No. 22. *Clough's Rock*, Sheepscot River.—Iron socket, wooden shaft. In good condition.

No. 23. *Merrill's Ledge*, Sheepscot River.—Iron socket, wooden shaft. In good condition.

No. 24. *Yellow Ledges*, Penobscot Bay.—Iron shaft, copper cylinder. In good condition.

No. 25. *Garden Island Ledge*, Penobscot Bay.—Iron shaft, copper cylinder and one ball. Shaft good, cylinder partially broken away and ball gone.

No. 26. *Otter Island Ledge*, Penobscot Bay.—Iron shaft, copper cylinder and two balls. Shaft bent, cylinder partially broken away, and one ball gone.

No. 27. *Ash Island Point*, Penobscot Bay.—Iron socket, wooden shaft. In good condition.

No. 28. *Dodge's Point Ledge*, Penobscot Bay.—Wooden mast twelve feet long. In good condition.

No. 29. *Potters-field Ledge*, Penobscot Bay.—Stone beacon. In good condition.

No. 30. *Lowell's Rock*, Penobscot Bay.—Iron spindle and cage. In good condition.

No. 31. *Seal's Ledge*, Penobscot Bay.—Iron spindle and cage. In good condition.

No. 32. *Harbor Ledge*, Penobscot Bay.—Stone beacon. In good condition.

No. 33. *Shipyard Ledge*, Penobscot Bay.—Iron spindle; broken off. Not necessary.

No. 34. *Fiddler's Ledge*, Penobscot Bay, near west entrance to Fox Island Thoroughfare.—Stone beacon. Two or three stones of the upper course are out of place; otherwise, in good condition.

No. 35. *North Point of Northeast Ledge*, Camden Harbor.—Iron spindle. In good condition.

No. 36. *Morse's Point Ledge*, Camden Harbor.—Iron spindle. In good condition.

No. 37. *Hosmer's Ledge*, Castine Harbor.—Stone monument. In good condition.

No. 38. *Steel's Ledge*, Belfast Harbor.—Stone beacon. In good condition.

No. 39. *Fort Point Ledge*, Penobscot River.—Stone beacon. In good condition.

No. 40. *Odom's Ledge*, Penobscot River.—Stone beacon. In good condition.

No. 41. *Buck's Ledge*, Penobscot River.—Iron beacon. In good condition.

Centre Harbor Ledge, in Centre Harbor, near east end of Edgemoggin Reach, three feet out at low water.—Iron socket with wooden shaft, twenty-five feet high, and cask at top painted black, (new.) In good condition.

No. 42. *Ship and Barges*, Blue Hill Bay.—Iron socket, wooden shaft thirty feet, and cask. In good condition.

No. 43. *Bunker's Ledge*, Mount Desert.—Stone beacon. In good condition.

No. 44. *Half-tide Ledge*, Narraguagas Harbor.—Iron socket, wooden shaft and cask. In good condition.

No. 45. *Norton's Reef*, Pleasant River.—Iron tripod and shaft, ball at top. In good condition.

No. 46. *Snow's Rock*, Moosepeak Reach.—Iron socket, wooden shaft. In good condition.

No. 47. *Gilchrist Rock*, Moosepeak Reach.—Iron shaft. In good condition.

No. 48. *Moose Rock*, Moosepeak Reach.—Iron tripod. In good condition.

No. 49. *Western Bar*, Lubec Narrows.—Wooden crib filled with stone. Being rebuilt.

No. 50. *The Ledge*, St. Croix River.—Wooden crib filled with stone. In good condition.

The beacons on *Fishing Rocks*, Kennebunkport; *Sharp's Rocks*, Saco River; *Lee's Rock* and *Winslow's Rocks*, Kennebec River, were broken off by ice and other casualties, and their places supplied with spar-buoys.

The steam-whistles in this district are in good working order, and are highly spoken of by persons navigating this coast.

SECOND DISTRICT.

The Second District extends from Hampton Harbor, New Hampshire, to include Gooseberry Point, Massachusetts.

Inspector.—Commander John J. Walker, United States Navy.

Engineer.—Brevet Brigadier General J. C. Duane, Lieutenant Colonel of Engineers, United States Army.

In this district there are—

Light-houses and lighted beacons	58
Day or unlighted beacons	49
Light-vessels, (including one for relief)	9
Buoys actually in position	500
Spare buoys for relief and to supply losses	273
Tender (steam) <i>Verbena</i>	1

The numbers preceding the names of stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1871.

LIGHT-HOUSES AND LIGHTED BEACONS.

46. *Newburyport Harbor*, Massachusetts.—The fifth-order lens has been removed and a fourth-order substituted. A new keeper's dwelling is being erected. This Light-station was first established in 1790, and the beacon-light, designed to serve as a range for entering the harbor, (or for reaching a safe anchorage at night,) was erected in 1816. The tower of the main Light is a low, octagonal wooden structure, and the beacon must necessarily be so constructed as to allow it to be moved from one side to another in front of the main Light, as changes take place on the bar and in the outer channel.

Newburyport is a place of sufficient importance to justify the establishment of a more powerful light than the present one, and the erection of buildings of better materials than wood.

It is recommended that the temporary wooden structure on which the main Light is situated be replaced by a permanent cast-iron tower, supported on a concrete base, extending below the low-water line.

Should any future change in the formation of the site require the removal of the tower, this may be effected with little more expense than that of making a new concrete base.

The citizens of Newburyport have for several years maintained by subscription two range lights to guide vessels in the inner harbor, and they have lately petitioned the Government to take charge of them. Should this petition be granted it will be necessary to erect two small structures near the sites of the present lights. As a further aid to navigation entering this difficult harbor, it is recommended that a day beacon be erected on Black Rock, near the entrance. This point is at present marked by a spindle, which will probably sooner or later be carried off by the ice; moreover it does not sufficiently mark the rock in the night.

Estimated cost of main Light-house	\$50, 000
Estimated cost of two range-lights	10, 000
Estimated cost of day-beacon	6, 000
Total	<u>66, 000</u>

52 *Cape Ann*, Massachusetts.—A steam Fog-signal has been placed at this station. The towers are being repointed and buildings repaired.

Hospital Point, Salem Harbor, Massachusetts.—This new Light was exhibited from a temporary building on May 1, 1871. Permanent buildings are now being erected.

Fort Pickering, Salem Harbor, Massachusetts.—This new Light was exhibited on January 17, 1871.

Derby Wharf, Salem Harbor, Massachusetts.—This new Light was exhibited on January 17, 1871.

59. *Boston, Massachusetts*.—Two frame buildings for Fog-signals have been erected. The floor of the room for the storage of oil has been relaid.

60. *Narrows, entrance to Boston Harbor, Massachusetts*.—The tower-platform, railing and posts, and window-shutters and doors have been thoroughly repaired and all the iron-work has been scraped and painted. The ice-breaker has also been thoroughly repaired. A fifth-order lens will be substituted for the present sixth-order.

62. *Plymouth, "The Gurnet," entrance to Plymouth Harbor, Massachusetts*.—These Lights are of the sixth order and are entirely too small; they may readily be mistaken for the lights in a dwelling-house, when they can be seen at all, and the distance apart, thirty-one feet, is altogether too short to afford an efficient range. It is recommended to replace them by two fourth-order Lights, separated by a proper distance for an effective range. The estimated cost is \$25,000.

Duxbury Pier, entrance to Plymouth, Duxbury, and Kingston Harbors, Massachusetts.—Four sections of the tower have been erected, bringing it to a height of thirty-six feet, and the base filled with concrete to a height of twenty feet. The structure will be a tower twenty-five feet in diameter at the base, with a height of fifty feet focal plane. It is founded in two feet of water at low tide, and is of concrete, faced with iron. The run of ice is very severe from Plymouth Harbor, and to resist it, and the heavy seas by which it will be assailed, the tower will be built in one solid mass to a height of fifteen feet above the water. It is expected that the entire work will be completed by the end of the current fiscal year.

72. *Monomoy Point*.—The Light at this station, which is of the fourth order, on a tower about forty feet high, was originally intended as a guide to *Old Stage Harbor*. The harbor has been filled with sand, and cannot now be entered, and the Light is therefore of no further use for that purpose. But inasmuch as nearly all vessels (both steamers and sailing) plying between New York and the eastern ports pass this point, and have now no other guide than the Light-ships, which cannot be seen a sufficient distance, it is considered a matter of the greatest importance that this Light should be replaced by one of sufficient power to guide vessels safely through this intricate passage. For this purpose there is recommended a second-order Fixed Light, varied by red flashes, for which an estimate is submitted.

80. *Nantucket Beacon*.—Land has been purchased for a site for a keeper's dwelling, and the dwelling is now being erected. The beacon will also be removed to this lot.

At each of the following-named stations there have been repairs more or less extensive during the last year:

47. *Newburyport Beacon, Merrimack River.*
48. *Ipswich, entrance to Ipswich Harbor.*
49. *Ipswich, beacon, Ipswich Harbor.*
50. *Annisquam, Annisquam Harbor.*
51. *Straitsmouth, Straitsmouth Island.*
53. *Eastern Point, Gloucester Harbor.*
54. *Ten Pound Island, Gloucester Harbor.*
55. *Baker's Island, Salem Harbor.*
56. *Marblehead, Marblehead Harbor.*
57. *Egg Rock, off Nahant.*
58. *Minot's Ledge, in Boston Bay.*
61. *Long Island Head, Boston Harbor.*

62. *Plymouth*, entrance to Plymouth Harbor.
63. *Race Point*, Cape Cod.
64. *Long Point*, Cape Cod.
65. *Mayo's Beach*, Wellfleet Bay.
66. *Billingsgate*, entrance Wellfleet Harbor.
67. *Sandy Neck*, Barnstable Bay.
68. *Cape Cod*.
69. *Nanset Beach Beacon*, Cape Cod.
70. *Chatham*, Chatham Harbor, Cape Cod.
71. *Pollock Rip Light-vessel*.
72. *Monomoy Point*, Cape Cod.
73. *Shovelful Light-vessel*.
74. *Handkerchief Light-vessel*.
75. *Nantucket*, (Great Point.)
76. *Sankaty Head*, Nantucket.
77. *South Shoal Light-vessel*.
78. *Gay Head*, Martha's Vineyard.
79. *Brant Point*, Nantucket.
81. *Nantucket Cliff Beacons*.
82. *Bass River*, Vineyard Sound.
83. *Bishop & Clerk's*, Vineyard Sound.
84. *Hyannis*, Vineyard Sound.
85. *Cross Rip Light-vessel*.
86. *Cape Poge*, Martha's Vineyard.
87. *Succonnessett Light-vessel*.
88. *Edgartown*, Martha's Vineyard.
89. *Holmes' Hole*, Martha's Vineyard.
91. *Nobsque*, Wood's Hole.
92. *Tarpaulin Cove*, Naushon Island.
93. *Vineyard Sound Light-vessel*.
94. *Hen and Chickens Light-vessel*.
95. *Cuttyhunk*, Buzzard's Bay.
97. *Clark's Point*, New Bedford Harbor.
98. *Palmer's Island*, New Bedford Harbor.
99. *Ned's Point*, Mattapoissett Harbor.
100. *Bird Island*, Sippican Harbor.
101. *Wing's Neck*, Buzzard's Bay.

The following named Light-stations require repairs to be made during the ensuing year :

48. *Ipswich*.
52. *Cape Ann*.
61. *Long Island Head*.
72. *Monomoy Point*.
83. *Bishop & Clerk's*.
98. *Palmer's Island*.
51. *Straitsmouth*.
57. *Egg Rock*.
63. *Race Point*.
81. *Cliff Beacons*.
96. *Dumpling Rock*.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the Second District :

No. 1. *Old Cock*, Buzzard's Bay, iron spindle, thirty-six feet high, with eagle at top.

No. 2. *Egg Island*, Buzzard's Bay.—Granite cone with iron spindle, vane at top.

No. 3. *Range Beacon*, Fairhaven Fort Point.—Boiler-iron triangular pyramid, forty feet high.

No. 4. *Cormorant Rocks*, south side of entrance to Mattapoissett Harbor, Buzzard's Bay.—Iron spindle, twenty-six feet high, with cage at top.

No. 5. *Lone Rocks*, northeast entrance to Wood's Hole.—Iron spindle, cage at top.

No. 6. *Collier's Ledge*, entrance Centreville Harbor, Vineyard Sound.—Granite base, iron spindle, ball and vane.

No. 7. *Great Rock*, west of Point Gammon, Vineyard Sound.—Iron spindle, twenty-six feet high, cage at top.

No. 8. *Hyannis Breakwater*, east end.—Wooden spindle, four arms and cask at top.

No. 9. *Sunken Pier*.—Wooden spindle, cask at top, on northeast part of Bass River Bar.

No. 10. *Spindle Rock*, entrance to Edgartown Harbor.—Iron spindle, cask at top.

No. 11. *Billingsgate Shoal*, old site.—Timber beacon, fifteen feet high, with fifteen feet masts and slats across.

No. 12. *Egg Island Rock*, entrance to Wellfleet Harbor.—Wooden spindle, cask at top.

No. 13. *Duxbury Beacon*, square, granite, with four-foot granite post on top.

No. 14. *Breakwater Beacon*.—Square open-work granite, with wooden spindle.

No. 15. *Hogshead Beacon*.—Iron spindle with arm, cask and cage at top.

No. 16. *North Beacon*, entrance Scituate Harbor.—Iron spindle with two rounds.

No. 17. *South Beacon*, entrance Scituate Harbor.—Iron spindle with two lozenges.

No. 18. *Londoner*, off Thatcher's Island, Cape Ann.—Iron spindle forty-five feet high, with cage at top.

No. 19. *Point Alderton*.—Square granite pyramid with cone at top.

No. 20. *False Spit*.—Granite base with iron spindle and cage.

No. 21. *Spit Beacon*.—Square granite pyramid.

No. 22. *Nix's Mate*.—Square granite base with octagonal pyramid.

No. 23. *Great Farm Bar*.—Square granite base and granite cone with iron spindle and cage at top.

No. 24. *Deer Island Point*.—Square granite pyramid.

No. 25. *Bird Island Beacon*, southeast point of Bird Island.—Iron spindle with cage at top.

No. 26. *Sunken Island*.—Open-work granite base, with wooden spindle and cage at top.

No. 27. *Pig Rocks*.—Granite pyramid, ten feet square at base, twenty feet high, with wooden mast and square cage at top. (Rebuilt this season.)

No. 28. *Halftide Rock*.—Wooden shaft forty feet high, with cask at top.

No. 29. *Cat Island Beacon*.—Wooden spindle.

No. 30. *Marblehead Rock*.—Conical, granite, with wooden spindle.

No. 31. *Little Aquavitæ*, entrance Salem Harbor.—Granite, with wooden spindle and cage at top.

No. 32. *Great Aquavitæ*, entrance to Salem Harbor.—Granite, with wooden spindle and cage at top.

- No. 33. *Hardy's Rock*.—Wooden spindle, with two triangles at top.
- No. 34. *Bowditch Beacon*.—Triangular pyramid of granite, with wooden spindle and cage at top.
- No. 35. *Halfway Rock*.—Granite beacon in ruins.
- No. 36. *Little Haste*.—Wooden mast thirty-five feet high, with cask at top.
- No. 37. *Abbott's Monument*.—Square, granite, with wooden mast and cage at top.
- No. 38. *Monument Bar*.—Square wooden crib filled with stone, mast and cage at top.
- No. 39. *Ram's Horn*.—Square wooden crib filled with stone, wooden shaft at top.
- No. 40. *Lobster Rocks*, Beverly Harbor.—Stone, with wooden spindle.
- No. 41. *Black Rock*, Gloucester Harbor.—Iron spindle with oblong cage at top.
- No. 42. *Harbor Rock*, Gloucester Harbor.—Iron spindle, with ball cage at top.
- No. 43. *Five-Pound Island*, Gloucester Harbor.—Granite base, with iron spindle and ball at top.
- No. 44. *Lobster Rock*, Annisquam.—Square open-work granite beacon.
- No. 45. *Lane's Point*.—Square wooden beacon.
- No. 46. *Point Neck Rock*.—Iron spindle, with ball at top.
- Black Rocks* on starboard hand entering Merrimack River, Newburyport Harbor, rocks out at half tide.—Iron spindle twenty-three feet high, with cask at top. Erected this season.
- No. 47. *North Pier*.—Newburyport harbor.—Wooden crib filled with stone.
- No. 48. *South Pier*, Newburyport harbor.—Wooden crib filled with stone.

LIGHT-VESSELS.

- No. 87. *Shovelful Light-vessel* No. 3.—Good order. This vessel has been taken into Hyannis, her metal repaired, &c.
- No. 88. *Handkerchief Light-vessel* No. 4.—Good order. This vessel has been taken into Hyannis to have her metal and stern repaired, &c.
- No. 100. *Cross Rip Light-vessel* No. 5.—This vessel has been taken into New Bedford placed on the marine railway, her metal repaired, partially recalced, her boats repaired, &c.
- No. 102. *Succonnessett Light-vessel* No. 6.—This vessel is in very bad condition, and another vessel (No. 24) has been sent to the district to supply her place, but she will require some repairs before being put on the station.
- No. 107. *Vineyard Sound Light-vessel* No. 7.—This vessel was taken to New Bedford last November, her upper works newly calked, decks sheathed, supplied with new foresail, new windlass, new running rigging, fifteen fathoms new chain cable, and put in thorough order.
- No. 108. *Hen and Chickens Light-vessel* No. 8.—This vessel has been taken to New Bedford, placed upon the marine railway, her bottom partially refastened, recalced, remetaled, a new set of plain sails supplied, and the vessel put in thorough order generally.

RELIEF LIGHT-VESSELS.

- Relief Light-vessel* No. 9.—This vessel has been entirely retopped the past year, supplied with a new suit of plain sails, her water-tanks rebottomed, furnished with new day-marks, and such new rigging as she

required, and is now a most excellent vessel, suitable for occupying any station in the district.

Relief Light-vessel No. 38.—The upper works of this vessel have been recalcked and painted, and the vessel is now in excellent condition, and in readiness to go to any station in the district at a moment's notice. Has been recently sent for temporary service to the Sixth District.

BUOYS.

Buoys actually in position.—All the buoys in the district (five hundred in number) have been shifted since the opening of the spring, and are now in excellent order.

TENDERS.

° The steam tender *Verbena* is an efficient vessel, and in good condition, but one tender is insufficient for a district having so many buoys, Light-vessels and Light-houses to visit and look after.

LIGHT-VESSEL AND BUOY-DEPOTS.

The *Buoy Depot at Gulf Island*, the place of residence of the Minot's Ledge Light-keepers, is difficult of access, as it can only be reached at high water, and it is proposed to have the buoys kept higher up in Boston Bay if a proper place can be obtained.

At the *Light-vessel and Buoy-depot* at Wood's Hole some repairs of the wharf required will soon be made under the direction of the Engineer of the district.

TENDER.

The tender authorized by the last session of Congress, designed for the use of the Engineer of the First and Second Districts, is being built under contract.

THIRD DISTRICT.

The Third District embraces all aids to navigation from Gooseberry Point, Massachusetts, to include Squam Inlet, New Jersey, as well as the Hudson River, Whitehall Narrows, and Lake Champlain.

Inspector.—Commodore James H. Strong, United States Navy.

Engineer.—Brevet Brigadier General I. C. Woodruff, Lieutenant Colonel of Engineers, United States Army.

In this district there are—

Light-house and lighted beacons.....	107
Day or unlighted beacons.....	48
Light-vessels.....	9
Buoys actually in position.....	432
Spare buoys for relief and to supply losses.....	458
Tenders (steam) <i>Cactus</i> and <i>Putnam</i>	2

The numbers preceding the names of stations correspond with the "Light-house Lists of the Atlantic, Gulf, and Pacific Coasts, and the Northern and Northwestern Lakes of the United States," issued January 1, 1871.

LIGHT-HOUSES AND LIGHTED BEACONS.

Castle Hill, east side of entrance to Newport Harbor, Narragansett Bay, Rhode Island.—The application of former years for a Fog-signal on *Castle Hill* is not renewed, in view of the proposed erection of a

steam syren signal at *Beaver Tail* Light-station, distant only about two miles.

118. *Beaver Tail*, Rhode Island.—A steam syren will be erected at this station during this season, and it is believed that there will be no necessity for the Fog-signal at *Castle Hill* on the opposite side of entrance to Newport Harbor, which has frequently been petitioned for.

119. *Lime Rock*, Rhode Island.—The rock on which this Light-house stands is full of crevices, through which the water, during heavy rains, enters the cellar. It is proposed either to cover the rock with concrete made of Portland cement, gravel, and sand, or to endeavor to remedy it by drains. The latter has been directed to be done, (experimentally,) being less expensive.

120. *Newport Harbor*, (Goat Island,) Rhode Island.—It is recommended that a Fog-bell, operated by Stevens's striking apparatus, may be placed at this station, as an essential aid in entering the harbor. Estimated cost, \$300.

123. *Poplar Point*, Narragansett Bay, Rhode Island.—The repairs and renovations which were authorized for this station have been completed, and a new lantern substituted for one of the oldest construction.

Muscle Bed Beacon, Narragansett Bay, Rhode Island.—The construction of a Light-house on *Hog Island Reef* has been petitioned for for several years, but hitherto Congress has not granted an appropriation therefor. The erection of a portable Light and a Fog-bell on the existing stone tower on the *Muscle Bed*, one-half mile distant, on the opposite side of the channel, at a cost of \$3,000, will, it is believed, obviate the necessity for this Light-house, which would be a very expensive construction.

127. *Conimicut Point*, Rhode Island, entrance to Providence River, Narragansett Bay.—When the Light on the shoal off *Conimicut Point* was lighted as a substitute for the Light on the main land, at *Nayat Point*, (distant about one mile,) the only available means of attending upon it were to allow the keepers to retain the dwelling at the old Light-station, and for them to visit the new Light by boat. The land constituting the site of the old Light-station at *Nayat Point* is valuable, and would bring at public sale a good price. The old tower is not worth the cost of tearing it down, and the dwelling not having been repaired, in expectation of an appropriation for completing the buildings at *Conimicut Point*, to include a proper dwelling for the keeper, it now becomes necessary either to make considerable expenditure upon the *Nayat Point* dwelling, or ask for a special appropriation for the necessary protection pier against running ice, and for a dwelling at that Light-house. The estimated cost of the work is \$30,000.

Sabine's Point, Providence River, Rhode Island.—By an act of Congress, approved March 3, 1871, an appropriation was made for the erection of a Light-house on this point. Plans and specifications have been prepared, and proposals for the construction of the work are invited by public advertisements, to be received until July 31, 1871.

128. *Pumham Rock*.

129. *Fuller's Rock*.

Sassafras Point.

The construction of these three permanent Lights in Providence River, above *Sabine's Point*, Rhode Island, authorized by an appropriation made July 15, 1870, is progressing under contracts, and will be completed this season.

130. *Point Judith*, Rhode Island.—The present Fog-signal, operated by a caloric engine, has been found insufficient for this important sta-

tion on the water-route from New York to New England. Frequently the sound of the signal is lost in the noise of the surf, so that steamers and vessels are left without a reliable guide off this dangerous point. It is recommended to replace the present signal by a first-class steam Fog-signal *whistle*, and a duplicate at a cost of \$5,000, including the housing. To distinguish it from the *Beaver Tail Syren*, a whistle should be placed at *Point Judith*.

131. *Block Island*.—To arrest the drifting sands which created some apprehension for the safety of the buildings, a wattling of small stakes, driven into the sand and interlaced with brush, was recommended in a special report to the Light-House Board, and by it approved. It is believed that willow-slips, in addition to the above wattling, will be efficient in arresting the drifts. For this object an estimate of \$1,800 is presented.

132. *Watch Hill*, Connecticut.—The repairs and renovations provided for in the appropriation of July 15, 1870, were completed during this season, with the exception of placing the lantern-deck and parapet, which is now ready for shipping to the station.

133. *Montauk Point*, Long Island, New York.—The keeper's dwelling requires a new roof, and ceilings in the attic require replastering. This, with other incidental repairs of the tower, &c., will cost \$1,500. It is recommended that a Fog-signal be placed at this important station, for which, with a duplicate, \$8,000 is estimated.

137. *North Dumpling*, Fisher's Island Sound.—The repairs and renovations provided for in the appropriation of July 15, 1870, are completed. The roof on the keeper's dwelling was replaced by a Mansard roof, and a new tower, with lantern, erected upon the dwelling. The bell-tower was thoroughly repaired, the roof over the striking apparatus tinned, and the whole repainted. A barn was built, and the banks of the sluice leading into the pond, which is used as a basin for the keeper's boat, have been protected by rough granite blocks.

140. *Race Rock*, Fisher's Island Sound, New York.—The construction of the foundation for a new Light-house on *Race Rock*, commenced in April last, is progressing satisfactorily, about 3,000 tons of granite having been placed in riprap foundation, in addition to which 7,000 tons will be delivered under a contract now in operation. The entire foundation, together with a portion of the supporting pier and landing wharf, will be put under contract and completed by the close of this fiscal year. The original estimate of the cost for this structure is \$200,000. The amounts provided by special acts of Congress are as follows, viz:

By act approved July 15, 1870.....	\$10,000
By act approved March 3, 1871.....	150,000
Total.....	<u>160,000</u>

The amount of \$40,000 is embraced in the estimates for continuing this work.

141. *Little Gull Island*, Long Island Sound.—A horizontal steam-boiler to operate a syren Fog-signal has been placed at this important point, and is found to be very efficient in guiding vessels through "the Race" in foggy weather. A duplicate signal, for which an appropriation was made March 3, 1871, is in process of construction, and will be put up as soon as completed. The bell, which had been retained for cases of emergency, will then be removed. A suitable building for the reception

of the duplicate signal is just being completed. Cisterns have been built, and the entire pier, on which the tower and dwelling stand, was covered with concrete flagging for the purpose of collecting all the rainfall which is required for the steam Fog-signals. To complete the landing the sum of \$5,000 is estimated.

142. *Gardiner's Island*, Long Island Sound.—The necessary alterations in the lantern, and the painting of the tower and keeper's dwelling, inside and out, are completed.

143. *Plum Island*, Long Island Sound.—The rebuilding of this station is completed, and a Fog-bell, operated by a Stevens's striking apparatus, placed at this station.

Oyster Pond Point, Plum Gut, Long Island Sound.—An estimate is again submitted for the erection of a stone beacon on *Oyster Pond Point Reef*, to guide vessels to and from Long Island Sound to Gardiner's Bay, New York.

144. *Long Beach Bar*, Long Island Sound.—The erection of a lighted beacon at this station was provided for by special appropriation of July 15, 1870, the plan adopted being a light on the keeper's dwelling, which is founded on screw-piles. These are protected by an ice-breaker of granite blocks placed in riprap. The entire iron and wood-work for this structure is completed, and contracts are now in operation for the erection of the Light-house, and building the ice-breaker. It is expected that the Light can be exhibited at this station by the close of this season.

148. *Brockway's Reach*, Connecticut River.—A portion of the stones which protect the foundation of this beacon having been washed away by the spring freshets, has been replaced.

149. *Devil's Wharf*, Connecticut River.—The stones, which were washed away by freshets, have been replaced.

151. *Horton's Point*, Long Island.—The repairs and renovations provided for by the appropriation of July 15, 1870, are completed. The rooms for the accommodation of the assistant keeper were added to the keeper's dwelling, and a room provided for the Light-house supplies; the keeper's dwelling was thoroughly repaired and repainted. A cast-iron lantern-deck was substituted for the stone one, which leaked. The third-order lens, which originally formed a part of a revolving apparatus, has been replaced by a third-order fixed lens; the focal plane was raised and the illuminating apparatus rendered more efficient. The entire outside brick-work of the tower and dwelling, which was found in a state of rapid decay, caused by the action of the atmosphere and frost, was covered with a coating of Portland cement-mortar. The barn has been thoroughly repaired, and the fences to a great extent renewed and repaired.

152. *Falkner's Island*, Long Island Sound.—The repairs and renovations—including rebuilding of keeper's dwelling, and substituting an iron stairway for a wooden one—authorized by the appropriation of July 15, 1870, are progressing, and will be completed during this season. A powerful steam Fog-signal is recommended for this station to prevent the frequent losses of vessels which occur in its vicinity during fogs and snow-storms. For this object an appropriation of \$8,000 is asked. The bank to the eastward is slowly wearing away, the loss having been about twelve feet in the course of twenty years. It may be necessary at a day not far distant to protect the foot of the slope, near the Light-house, by riprap along a distance of about two hundred feet or more.

153. *New Haven Harbor*.—The repairs and renovations provided for by the appropriation of July 15, 1870, are completed. The caloric

engine which operated the Fog-bell being worn out, was replaced by a Stevens's striking apparatus.

155. *Stratford Point*, Long Island.—The condition of this station is very bad. The rebuilding of the tower and keeper's dwelling has been recommended for the last three years. It is now recommended that a frame building be erected, on which the lantern-tower will be placed. For this and the necessary out-buildings, an estimate of \$15,000 is respectfully submitted.

157. *Bridgeport Harbor*, Connecticut.—The rebuilding of this beacon was authorized by the appropriation of July 15, 1870. The plan adopted is similar to that for *Long Beach Bar*, viz, a Light on keeper's dwelling, which is founded on screw-piles: these being protected by an ice-breaker of granite blocks placed in riprap. The entire iron and wood-work for this structure is completed, and contracts are now in operation for the erection of the Light-house, and building the ice-breaker. The Light will probably be exhibited by October next.

158. *Black Rock*, Connecticut.—The buoy-wharf and shed for storage of buoys at this station, authorized by the appropriation of \$8,000, on March 3, 1871, will be built during this season, the plans being in readiness to invite proposals for its construction.

160. *Penfield Reef*, Long Island Sound.—The construction of a Light-house on *Penfield Reef*, near Bridgeport, Connecticut, authorized by appropriations made July 15, 1870, and March 3, 1871, has been commenced under contracts now in operation, and will be prosecuted with a view to its completion during the next working season.

161. *Eaton's Neck*, Long Island.—A powerful steam Fog-signal, authorized under appropriation made July 20, 1868, has been put up at this station. It is a syren, and a building for a duplicate now in process of construction, and a building for the caloric engine for pumping water for the use of the Fog-signal, have been erected.

162. *Lloyd's Harbor*, Long Island.—The damage caused to the Light-house at this station by the gale of November 22, 1870, has been repaired and a granite wall built to protect the station, at a cost of about \$3,000.

Stamford Harbor, Connecticut.—An examination of the "Ledge" in this harbor was made under instructions from the Light-House Board, by the Inspector and Engineer of the district, in accordance with petition of a large number of persons interested in the trade of this port for a Light to mark the "Ledge." The report of the Inspector and Engineer recommends a day-beacon on the "Ledge" and a lighted beacon on the opposite side of the channel. The cost of the two structures will be \$8,000, which amount is included in the estimates.

165. *Execution Rocks*, Long Island Sound.—The work of protecting this station against the ice and sea, authorized by the appropriation made July 15, 1870, has been completed. The damage caused by the ice during the winter has also been repaired, and the keeper's dwelling is now being repainted. The tower needs extensive repairs, pointing on the exterior, and alterations in the interior.

166. *Sand's Point*, Long Island.—The damage caused by gales during the winter to the jetties and sea-wall which protect this station, been repaired at a cost of about \$3,000. The buildings require repairs, and for this purpose an estimate is submitted of \$3,000.

Hart Island, Long Island Sound.—An appropriation was made in 1866 for the erection of a Light at this point. The owner of the island being unwilling to sell the requisite quantity of land for this Light-tation for such a sum as the Board would have been authorized to

give, proceedings were instituted, in conformity to law, for condemning the land. The award of the appraisers for five acres of land was \$25,000, a sum far exceeding the entire appropriation, and, in the opinion of the board, far beyond its intrinsic money value. Having made further examinations, it is found that the south end of the island, upon which the Light would necessarily be placed, if placed on the island at all, is continually washing away, and unless it is protected by an expensive sea-wall, a Light-house could not remain there very long. The end of the reef, (in six feet water,) which runs out from the southern end of the island, would afford a good foundation and proper site for the erection of a stone structure similar to those already erected at points on the Hudson River. The estimated cost of the proposed structure and apparatus, complete in all respects, is \$50,000, and is included in the annual estimates this year.

169. *Great West Bay*, Long Island.—The tower requires repointing and coating with Portland cement; the dwelling also requires repairing and painting; speaking-tubes and an alarm-bell are needed to communicate from the watch-room in the tower with the keeper's dwelling. An estimate of \$500 is submitted herewith.

170. *Fire Island*, Long Island.—The outside painting on the tower is very defective, and does not appear in the color represented in the Light-house list. Many bricks are crumbled, and require to be replaced by sound ones, and the tower covered with Portland cement-wash. Speaking-tubes and an alarm-bell are also needed to communicate from the watch-room with the keeper's dwelling. An estimate of \$500 is submitted herewith.

175. *East Beacon*, Sandy Hook.—A new first class steam (syren) Fog-signal, with horizontal boiler, has been substituted for the old one with vertical boiler, the tubes of which were destroyed by corrosion. A duplicate steam Fog-signal, authorized by the appropriation of March 3, 1871, is in course of construction, and will be put up as soon as completed.

A new frame building has been erected for the new Fog-signal. The old building has been moved to the vicinity of the new one, and has been renovated to receive the duplicate signal.

A well has been dug and walled, which furnishes fresh water for the boilers of the signal. The keeper's dwelling requires repainting inside and outside, which will be done at an early period.

In the previous annual report reference was made to the abrasion of the beach, which rendered it necessary to remove the beacon building five hundred feet to the southward. The abrasion does not seem to be of a threatening character at this time, but no doubt is entertained that upon the completion of the jetties, recently commenced by the Engineer Department for the protection of the beach in front of the fort from abrasion, the accumulation of sand will be arrested, and abrasion will most likely result in the vicinity of the beacon and the new Fog-signal structures. It is hence deemed imperative to guard against such a contingency by the construction of two jetties similar to those adopted by the Engineer Department. The cost of such protection is estimated at \$20,000.

It may be well to state that a further removal of the beacon and the Fog-signal to the southward is impossible, as they would, if so removed, be masked by the works of defense seaward or in the direction the sound from the signal is especially needed.

Flynn's Knoll, Lower Bay of New York.—The erection of a Light-house on *Flynn's Knoll*, in nine feet water, to form a range with *Princess Bay Light*, for the deepest water in Gedney's Channel, was recom-

mended in last year's report and in those of former years. The great importance of a reliable guide to navigation on this dangerous shoal seems to justify the attempt to bring the subject again to the attention of Congress. The amount of \$100,000 for commencing the work is embraced in the estimates.

177. *Conover Beacon*, Sandy Hook Bay.—Repairs at this station are much needed and will be made as soon as the more urgent necessities of the district admit.

178. *Chapel Hill Beacon*, New Jersey.—The out-buildings at this station, blown down during a gale, have been rebuilt, and the fences have been repaired.

181. *Elm Tree Beacon*, Staten Island.—The extension of the jetty, for which funds have been provided by the appropriation of March 3, 1871, will be built during this season.

183. *Princess Bay*, Staten Island.—The protecting wall authorized by the appropriation of July 15, 1870, is in course of construction under contract, and, it is expected, will be completed during the present season. The wood-work of the keeper's dwelling and the iron-work of the tower have been repainted.

184. *Fort Tompkins*, Staten Island.—The Light-house at this station must be removed shortly to the interior of the works of defense. Its present site is required for the purposes of a battery now in course of construction. Experimental firings are of frequent occurrence at this fort, during which the glass of the lantern is broken. As a temporary expedient a wooden frame has been made, and a light will be exhibited therefrom near to the present Light-house, at a point designated by the Engineer officer in charge of the fort. For a dwelling surmounted by a tower, at the new site of the Light-house, the sum of \$8,000 is asked.

192. *Esopus Meadow*, Hudson River.—The rebuilding of this station under the appropriation of July 15, 1870, is in progress under contract, and will be completed during the present fiscal year.

194. *Saugerties*, Hudson River.—The Engineer of the district was authorized to draw up a contract for signature of the persons desiring to occupy the old Light-house pier at this station for a public wharf, in such a manner as to secure the interests of the United States. He sent the contract so prepared, but up to this time the contract has not been returned to him. One of the conditions was to remove the old dwelling-house, also requested by the petitioners for use as a store-house, to such a distance as not to endanger the new structure by fire. In case the parties do not comply with the terms of the contract, the old buildings will be taken down, being of no further use to the station.

197. *Stuyvesant Light-house*, Hudson River.—The old dwelling at this station will be retained as a depot for keeping portable beacons of Hudson River during the close of navigation.

198. *New Baltimore.*

199. *Five Hook Island.*

200. *Coeysman's Bar.*

201. *Roha Hook.*

202. *Schodack Channel.*

203. *Nine-mile Tree.*

204. *Cow Island.*

205. *Parada Hook.*

206. *Van Weiss Point.*

207. *Cuyler's Dyke.*

These ten beacon-lights in the Hudson River, which were destroyed

by ice and freshets, will be restored during this season, under the appropriation of March 3, 1871, for this purpose.

White Hall Narrows, 416, 417, and 420-431 inclusive.—The portable beacons in *White Hall Narrows* are in good order. The customary removal for the winter was unnecessary, during the last winter the ice in the Narrows having melted to such a degree before it moved that no damage to the beacons was anticipated. Two stake-lights require to be replaced by portable beacons, viz:

418. *Opposite Chapman's Dock*; and

419. *South of Snoddy's Dock*.

Estimated cost \$800 each.

432. *Crown Point*, Lake Champlain.—The keeper's dwelling needs repairs and repainting. A stable is much needed at this station, and has been recommended in previous reports. The recommendation is renewed. Estimated cost for repairs and for stable, \$1,500.

433. *Barber's Point*, Lake Champlain.—A contract has been made for the construction of a Light-house on this point, as provided by the appropriation of July 15, 1870. The work will be commenced as soon as a certain judgment debt is removed and a valid title to the United States can be secured.

434. *Split Rock*, Lake Champlain.—Boatways and capstan authorized by the appropriation of March 3, 1871, will be supplied during this season.

435. *Juniper Island*, Lake Champlain.—The construction of a wharf and boat-house, under the appropriation of March 3, 1871, will be carried into effect during the present season.

436, 437. *Burlington Breakwater*, Lake Champlain.—Funds have been provided, under the appropriation of March 3, 1871, for the construction of a Light on keeper's dwelling upon the north end of the breakwater. The work will be commenced as soon as the extension of the breakwater is completed.

438. *Colchester Reef*, Lake Champlain.—By an act of Congress approved July 15, 1870, the amount of \$20,000 was provided for building a Light-house at *Colchester Point*, or in its vicinity, Lake Champlain. It was reported last year as follows: "After a careful examination and survey of the locality, it was found that the rock called 'Middle Bunch' was the proper place for the new Light-house. This rock is in the middle of the channel, with seven feet water over it at low water, and deep water on either side. With a Light thereon a vessel can pass on either side close to the rock. The work has been commenced and will be carried above water (and further, if possible) this fall, and will be completed next season."

The crib for the foundation was made in Burlington, and was towed to, placed on the reef, and filled in with concrete and rough stone. Two courses of the cut stone were also laid, and thereby the pier was brought above water. Before the work was abandoned for the season, it was ballasted with heavy blocks of stone to prevent its being moved by the ice. When the ice moved in the spring the ballast on the pier, with a part of the second course of cut stone, were shoved into the lake; the first course was found undisturbed. A few of the cut stone were found and replaced; but four hundred and eighty-one feet had to be rebuilt. After the damage had been repaired, the work on the pier was resumed and completed by the end of June.

The appropriation of \$20,000 was made for a Light-house on *Colchester Point*, or its vicinity, which amount would have been ample for a structure on land. The necessary change in the locality for the Light

from *Colchester Point* to a reef in seven feet water, required also a change in the plans of the structure. The new plans were prepared with the intention to keep the expenses within the amount of the appropriation. This, however, was frustrated by the various causes enumerated. The amount required for the completion of the Light-house on the *Middle Bunch*, (*Colchester Reef*), Lake Champlain, in addition to the former appropriation, is \$4,500. A Fog-bell will be erected at this station.

439. *Bluff Point*, Valcour Island, Lake Champlain.—The appropriation of July 15, 1870, provides for the construction of a Light-house on this point. A contract for its construction has been entered into, and work will be commenced as soon as a valid title to land is secured to the United States.

442. *Cumberland Head*, Lake Champlain:—The appropriation of March 3, 1871, provides the means for the purchase of additional land at this station for the object of removing certain trees which now obstruct the Light. The purchase will be made and the obstructions removed during this season.

444. *Isle La Motte*, Lake Champlain.—It has been recommended in previous reports to replace the present beacon-light by a Light on keeper's dwelling, and is renewed. The distance between the residence of the keeper and the beacon is too great to secure proper attendance. The estimated cost of the dwelling, surmounted by a tower, is \$8,000.

At each of the following Light-stations there have been repairs and renovations more or less extensive during the year, and not alluded to in this report:

- 126. *Warwick Neck*, Narragansett Bay.
- 136. *Morgan's Point*, (Mystic,) Fishers' Island Sound.
- 138. *New London Harbor*, Connecticut.
- 145. *Cedar Island*, Gardiner's Bay.
- 154. *New Haven Long Wharf*, Long Island Sound.
- 167. *Throgg's Neck*, Long Island Sound.
- 174. *Sandy Hook*, entrance to New York Bay.
- 189. *Elbow Beacon*, Newark Bay.
- 440, 441. *Plattsburgh Beacons*, Lake Champlain.
- 443. *Point au Roche*, Lake Champlain.
- 445. *Windmill Point*, Lake Champlain.

The following-named stations have not been mentioned elsewhere:

- 121. *Rose Island*, Narragansett Bay, Rhode Island.
- 122. *Dutch Island*, Narragansett Bay, Rhode Island.
- 124. *Prudence Island*, Narragansett Bay, Rhode Island.
- 125. *Bristol Ferry*, entrance to Mount Hope Bay, Rhode Island.
- 134. *Stonington Harbor*, Connecticut.
- 146. *Saybrook*, mouth of Connecticut River.
- 147. *Calves' Island*, Connecticut River.
- 159. *Old Field Point*, Long Island Sound.
- 163. *Norwalk Island*, Long Island Sound.
- 164. *Great Captain's Island*, Long Island Sound.
- 168. *North Brother Island*, East River, New York.
- 172, 173. *Highlands of Navesink*, New Jersey, New York Bay.
- 176. *West Beacon*, Sandy Hook, New York Bay.
- 179. *Point Comfort Beacon*, entrance to New York Bay.
- 180. *Waackaack Beacon*, entrance to New York Bay.
- 182. *New Dorp Beacon*, Staten Island, New York Bay.
- 185. *Robbin's Reef*, New York Harbor.
- 186. *Bergen Point*, Newark Bay, New Jersey.

- 187. *Corner Stake*, opposite Elizabethport, New Jersey.
- 188. *Passaic Light*, near mouth of Passaic River, New Jersey.
- 190. *Stony Point*, Hudson River.
- 191. *West Point*, Hudson River.
- 193. *Rondout*, Hudson River.
- 195. *Four-mile Point*, Hudson River.
- 196. *Coxsackie*, Hudson River.

UNLIGHTED BEACONS, INCLUDING SPINDLES.

All the beacons and spindles in the following list are in good condition, unless otherwise stated.

- 1. *East Lime Rock*, near Newport.—A granite structure, surmounted by an iron spindle and cage.
- 2. *South Point*, Rose Island, Narragansett Bay.—Granite structure, surmounted by a spindle and cage.
- 3. *Halfway Rock*, three-fourths of a mile southward of Prudence Island Point, Narragansett Bay.—Spindle, with square cage.
- 4. *Bullock's Point*, Narragansett Bay.—Stone beacon, with iron spindle and day-mark.
- 5. *Pawtuxet Beacon*, Narragansett Bay.—Of stone.
- 6. *Pumham Beacon*, Providence River.—A stone beacon, with vase and ball.
- 7. *Muscle Bed*, east side of the channel below Bristol Ferry, Rhode Island.—A stone beacon, with iron spindle and day-mark.
- 8. *Borden's Flats*, opposite to Fall River.—A stone beacon, with iron column and day-mark.
- 9. *Castle Island*, near north end of Hog Island, Bristol Harbor.—A stone beacon, surmounted by a red ball. The foundation requires repairing and protection.
- 10. *Allen's Rock*, Warren River.—Stone beacon, one-eighth mile north of Adam's Point.
- 11. *Warwick, or Spindle Rock*, west channel of Narragansett Bay, and entrance to Greenwich Harbor, between Warwick Neck and Pojack Point.—Iron spindle, with square wooden cage.
- 12. *White Rock Beacon*, at the entrance of Wickford Harbor, Narragansett Bay.—Stone beacon, with iron column and day-mark.
- 13. *Watch Hill Spindle*, entrance to Fisher's Island Sound from Lighthouse southwest by south three-fourths of a mile.—Stands on a rock, which is bare at low water, and is surmounted by a cage.
- 14. *Sugar Reef Beacon*, Fisher's Island Sound.—Iron-pile beacon with cage-work day-mark in the form of a cone.
- 15. *East or Catumb Reef Spindle*, entrance to Fisher's Island Sound by Lord's Channel, one and one-fourth miles east of east point of Fisher's Island.—An iron-pile beacon, with square cage-work.
- 16. *West or Wicopesset Spindle Rock*, entrance to Fisher's Island Sound by Lord's Channel.—Northwest of East Spindle two-thirds of a mile.
- 17. *Latimer's Reef*, Fisher's Island Sound, one mile northwest of east point of Fisher's Island, and three-fourths of a mile southeast of Eel Grass Shoal Light-vessel.—An iron spindle, bearing a square cage-work.
- 18. *Ellis's Reef*, Fisher's Island Sound, three-fourths of a mile northwest of Eel Grass Shoal Light-vessel.—An iron spindle, with a square cage-work.
- 19. *Ram Island Reef*, Fisher's Island Sound. One-half of a mile southeast of Ram Island.

20. *Spindle on the Whale*, entrance to the Mystic River.—As reported last year, this spindle was carried away by ice. It is proposed to build a beacon of stone, bearing a day-mark, at the estimated cost of \$5,000.

21. *Crook's Spindle*, Mystic River.—Is an iron spindle, with a keg on top.

22. *Groton Long Point*, Fisher's Island Sound.—An iron spindle, bearing a cage-work in the form of an inverted cone.

23. *Sea-flower, or Potter's Reef Beacon*, Fisher's Island Sound, north-west of *North Dumpling Light* one mile.—Remains as reported last year. It is a very important mark in Fisher's Island Sound, and recommended for immediate reconstruction. It is proposed to build a granite structure for the purpose of upholding the spindle and cage of the old beacon. Estimated cost, \$4,200.

24. *Black Ledge*, entrance to New London Harbor.—An iron shaft, bearing a cage-work day-mark, formed by two cones connected at the vertices.

25. *Saybrook Beacon*, Connecticut River.—Stone beacon, with globe on Saybrook Bar.

26. *Hen and Chickens*, Long Island Sound.—Iron spindle bearing a square cage, painted black.

27. *Branford Reef Beacon*, Long Island Sound.—Granite beacon, surmounted by an iron shaft, bearing a black day-mark.

28. *Quix's Ledge*, entrance to New Haven Harbor, Connecticut.—An iron spindle, with a cask on top; stands on a rock which is dry at half tide.

29. *Southwest Ledge Spindle*, entrance to New Haven Harbor, Connecticut.—Marked by a second-class buoy.

30. *Stratford River Beacon*, entrance to Stratford River.—Granite beacon, with iron column and day-mark.

31. *Inner Beacon*, Bridgeport Harbor, Connecticut.—A frustum of a square pyramid of wood, surmounted by a wooden mast, with a cask, painted black.

32. *Outer Beacon*, Bridgeport Harbor, Connecticut.—The same as the inner beacon.

33. *Black Rock Beacon*, Long Island Sound.—An iron-pile beacon, with a cage on top.

34. *Southport Beacon*.—Granite beacon, with iron column and day-mark.

35. *Southport Breakwater Beacon*.—Granite beacon, with iron column and day-mark.

36. *Norwalk Beacon*, southwest of Norwalk Island, Connecticut.—A granite structure, supporting a shaft and day-mark of iron.

37. *Great Reef*, off Norwalk Island, entrance to Norwalk Harbor.—A wooden spindle, with cage day-mark, is in course of construction.

38. *Sand Spit*, on the south point of Sand Spit, Sag Harbor.—This beacon, having been destroyed by ice, is being replaced by a stone beacon, surmounted by a wooden tower.

39. *Oyster Pond Point*, Plum Gut, entrance to Gardiner's Bay.—As reported last year. A reef runs out into Plum Gut, which is bare at low water. It is proposed to erect a stone beacon upon it to guide vessels running into Gardiner's Bay clear of this danger. Estimated cost, \$5,000.

40. *Success Rock*, Long Island Sound.—An iron shaft, with conical cage-work.

41. *Romer Beacon*, on the west side of Romer Shoal, entrance to the Bay of New York.—A granite structure in the form of a frustum of a cone, surmounted by a wooden mast and square cage day-mark. The

repairs authorized by the appropriation of March 3, 1871, will be made during this season.

42. *Mill Reef Beacon*, Kill Van Kull, opposite New Brighton.—This is a sheet-iron beacon, filled in with concrete, and secured to a granite base. It is conical in shape, and supports an iron shaft with an iron cage on top.

STATEN ISLAND LIGHT-HOUSE DEPOT.

Building for offices.—The work on this building, having been suspended more than one year for want of funds, has been resumed, and the structure will be completed and ready for occupation by November.

Shed and Wharf.—The work authorized by the appropriation of July 15, 1870, has been completed. The basin in front of the depot has been dredged to a depth of ten feet at low-water, and is now a safe harbor for the vessels connected with the Light-house service. Adjacent to the basin a coal bin of 800 tons capacity has been built. The depot being situated at the foot of a slope, which is full of springs, requires a system of drainage and grading. The estimated cost for this work, in addition to the expenses of keeping the depot and buildings in order, is \$20,000.

LEGISLATION CEDING JURISDICTION OVER LIGHT-HOUSE SITES.

A circular letter from the Light-House Board of July 11, 1870, called for the names of such States in this district as had not passed, first, a general law ceding jurisdiction over land purchased by the United States from time to time for public uses; and, second, a general law providing for the acquirement of land by the United States in cases of disagreement with the owners. Letters were addressed to the secretaries of state of New Jersey, Vermont, Connecticut, Rhode Island, and New York, inquiring if these laws had been passed, and it was subsequently learned that none of these States had passed such general laws, the custom being uniform to pass special acts for each case, where land was required. Subsequently letters were addressed to the governors of Rhode Island, Connecticut, New Jersey, and New York asking the passage of these general laws, and the Engineer of the district personally urged their passage at the capitals of the States named. Rhode Island passed the general law, and in addition a special act, ceding the State's right over certain points in the navigable waters of the State. New York adhered to its former custom, and only passed a special act to cover certain sites named in the acts, and limiting the quantity of land. It is not known if the other States in the districts have passed any acts. The passage of these acts by the States of New York and Rhode Island was delayed until late in the session of their legislatures, and the works appropriated for in the act of Congress of July 15, 1870, dependent upon the passage of these laws ceding jurisdiction, were consequently delayed until very near the close of the last fiscal year.

REPORT ON THE FINANCES.

Number of boxes, packages, and barrels received at and shipped from Light-house depot, Staten Island, from October 1, 1870, to June 30, 1871.

	Boxes.	Packages, cans, &c.	Barrels.	Total.	Same period of time last year.	Increase.
Received	1,840	3,775	2,809	8,424	4,996	3,428
Shipped	1,389	3,338	2,293	7,020	5,935	1,085
Total	3,229	7,113	5,102	15,444	10,931	4,513

Lens apparatus received at and shipped from Light-house depot, Staten Island, from October 1, 1870, to June 30, 1871.

	1st order.	2d order.	3d order.	3d order.	4th order.	5th order.	6th order.	Steamer lenses.	Pressed lenses.	Canal lenses.	Totals.
Received	1		3		6	1	1	15	4		31
Shipped			2	1	6	5		9		4	27
Total	1		5	1	12	6	1	24	4	4	58

Articles manufactured and repaired in lamp-shop at Light-house depot, Staten Island, from October 1, 1870, to June 30, 1871.

	Lenses.	Lamps.	Lamp burners.	Miscellaneous articles.	Total.
Manufactured	11	70	216	485	782
Repaired	5	61	20	38	144
Total	16	131	236	543	926

FOURTH DISTRICT.

The Fourth Light-house District extends from Squam Inlet, New Jersey, to and including Metomkin Inlet, Virginia. It also includes Delaware Bay, River, and tributaries.

Inspector.—Commodore William H. Macomb, United States Navy.

Engineer.—Brevet Brigadier General I. C. Woodruff, Lieutenant Colonel of Engineers, United States Army.

In this district there are—

Light-houses and lighted beacons	18
Light-vessels	3
Buoys actually in position	104
Spare buoys for relief and to supply losses	83
Tender (steam) <i>Violet</i>	1

The numbers preceding the names of stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coast of the United States," issued January 1, 1871.

208. *Barnegat, New Jersey*.—The semi-monthly measurements along the beach near the Light-house have been continued throughout the year. During the winter a portion of the works of protection was damaged to some extent, though not seriously, part of the riprapping having slidden into deep water, allowing the sea to pass over and wash out the sand. Three stone jetties, for the protection of the former works, have been built, requiring 993 tons of stone, which will, it is believed, prove satisfactory. The fence around the building has been rebuilt.

210. *Absecum, New Jersey*.—The semi-monthly measurements along the beach in the vicinity of the Light-house have been made throughout the year. Favorable changes have taken place, and no apprehension for the safety of the station need be entertained. A store-house is now being built, and repairs to the keeper's dwelling made, which will be completed during the next month. The authorities of Atlantic City have not yet furnished the grant from the property owners, for the occupation of the land required for sites for the works of protection heretofore appropriated for by Congress, and the money still remains in the Treasury.

Hereford Inlet, on the coast of New Jersey, ten and three-fourths nautical miles north of *Cape May Light-house*.—A small light, say a fourth order, is respectfully recommended for this place, as it would be of importance to the coal trade, and to steamers navigating Delaware Bay and River, and to mark the entrance to the inlet, where there is a good harbor of refuge for small coasting vessels. Estimated cost \$25,000.

Cross Ledge Light Station, Delaware Bay.—An estimate has been submitted for the erection of an iron screw-pile Light-house to take the place of the Light-vessel now occupying that station. An appropriation was made many years since for this Light-house, but it was found impracticable at that time to erect it, and the appropriation reverted to the surplus fund. Congress ordered subsequently (in 1867) a survey of this shoal. An estimate is submitted.

219. *Upper Middle or Cross Ledge Light-vessel*.—No repairs have been made to this vessel since the last report. This vessel was compelled to leave her station in the Delaware Bay January 10, on account of heavy ice; was returned to it again on the 25th, and remained until the 27th, when the ice again coming down the bay very heavily she was driven from her station, and was picked up by the city ice-boat and towed to New Castle, Delaware, where she remained until March 4, when she was returned to her station. Such absences of light is a great injury to commerce, but it may be remedied by building a Light-house on the shoal.

220. *Mahon's River*, Delaware, Delaware Bay.—The abrasion of the marsh at this station has been so great as to compel a change in the site of the Light-house. There is a good location about a quarter of a mile north of the present site, which will serve equally well the purposes of navigation. The estimate for a screw-pile building is \$15,000.

223. *Reedy Island*, Delaware Bay.—Extensive repairs have been made to the bank inclosing the buildings, as follows: The earth bank has been thoroughly repaired and raised fifteen inches along the eastern side for a distance of four hundred feet, the outer slope protected with quarry stone imbedded in fresh mud, the top of the bank roughly paved with stone, a new sluice for draining, and the ditches cleaned out. A new roof has been put on the dwelling, and the plank platform repaired.

224. *Christiana*, Delaware Bay.—Extensive operations have been going on to fit this station as a buoy depot and winter harbor for light-vessels. The upper wharf has been completed; it is thirty-two feet wide and extends into the Christiana River one hundred and sixty-

four feet to eight feet water at ordinary low tide; the piling, grillage, stone piers, and stone-work of the cistern are completed for the first or upper building. The frame and other materials are so far advanced, it is believed, that it will be ready for occupation by the 1st of next September. This building will be fifty by one hundred and forty feet in plan, two stories of eight feet each in height, the first or lower floor divided into one room fifty by sixty-three feet, the balance arranged for storing iron and spar buoys, chains, ballast balls, and sinkers. The second story, fifty by one hundred and forty feet, for storing sails, rigging, small boats, &c. The piles for the foundation of the second building are all driven, the building to be fifty by one hundred and fifty feet in plan, one story of ten feet, to admit first-class iron buoys. The piles for the second wharf are also driven; the wharf is thirty-two feet wide and extends one hundred and forty feet into the river, to eight feet water at ordinary low tide. A new sluice has been placed in the bank for draining the inclosure.

Near Chester, Pennsylvania, Delaware River.—In conformity with the instructions of the Light-House Board, accompanied by a petition from citizens of Chester for a light at that harbor, an examination has been made by the Light-house Inspector and Engineer of the district, who report that a light upon the south end of Little Tinicum Island would subserve the wants of the trade at Chester as well as the general wants of commerce of the port of Philadelphia. It would also be serviceable in marking the channel to the quarantine grounds. The structure recommended by the Inspector and Engineer is a screw-pile Light-house with a lens of the sixth order, the estimated cost of which is \$17,000.

225. *Fort Mifflin, Delaware River.*—The foundation pier has been entirely rebuilt from line of low water, and the dwelling has been removed back from the southeastern front. Riprap stone has been placed around the front of the pier to prevent abrasion.

The stations not named heretofore are as follows:

- 209. *Tucker's Beach, New Jersey, near Little Egg Harbor.*
- 214. *Cape Henlopen Beacon, entrance to Delaware Bay.*
- 216. *Brandywine Shoal, screw-pile Light-house, Delaware Bay.*
- 221. *Cohansey, New Jersey, Delaware Bay.*
- 222. *Bombay Hook, Delaware, Delaware Bay.*
- 226. *Fenwick's Island, sea-coast of Delaware.*
- 227. *Assateague, sea-coast of Virginia.*

FIFTH DISTRICT.

The Fifth District extends from Metomkin Inlet, Virginia, to include New River Inlet, North Carolina, as well as Chesapeake Bay and its tributaries, and Albemarle and Pamlico Sounds.

Inspector.—Commodore F. Stanly, United States Navy.

Engineer.—Brevet Brigadier General James H. Simpson, Colonel of Engineers, United States Army, to December 10, 1870; Brevet Lieutenant Colonel Peter C. Hains, Captain of Engineers, United States Army, present Engineer.

In this district there are—

Light-houses and lighted beacons.....	67
Light-vessels.....	2
Day or unlighted beacons and stakes.....	72
Buoys actually in position.....	509
Spare buoys for relief and to supply losses.....	529
Tenders (steam) <i>Heliotrope and Tulip</i>	2
Tenders (sail) <i>Maggie and Spray</i>	2

The numbers preceding the names of stations correspond with the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1871.

231. *The Light-house on "The Thimble,"* entrance to Hampton Roads, Virginia.—The want of a good screw-pile Light-house on the Horseshoe Bar, a shoal extending out from the main-land at Fortress Monroe, about five or six miles in a direction east by north from that place, has long been felt. This large bar is a source of danger to all vessels coming into Hampton Roads. The shoalest point of the bar has on it eleven feet of water at mean low tide, at a point called "*The Thimble*," about two and a half miles east of the main-land. South of Horseshoe Bar, and only a little more than half a mile from it, is another long bar, running in a direction almost parallel to it, called *Willoughby's Spit*. Between these two bars there is ample water for the largest vessels afloat. A Light-vessel has been used to mark the channel between these bars and guide them clear of the dangers on either side. It is believed, however, that the same end may be attained at much less annual expense by the erection of an iron screw-pile Light-house on "*The Thimble*" of Horseshoe Bar, under the general law on the subject and out of the general appropriation, as a substitute for the Light-vessel, to be visible from the sea, at the entrance to Chesapeake Bay. The substructure will consist of seven wrought-iron screw-piles; one in the center, the other six ranged about it in the form of a hexagon and screwed into the shoal a depth of fifteen feet. The superstructure will be a frame building, hexagonal in plan, surmounted by a lantern, and will exhibit a fixed white light of the fourth order. In order to distinguish it from the light at Fortress Monroe, the latter will be changed to a red light. The position of this Light-house being very exposed, particularly to strong easterly winds, it is required to be of more than ordinary strength. It will be advisable, also, to protect the site and give more stability to the foundation by throwing in about it loose stones to a depth of about three feet. Borings, with an artesian well-boring apparatus, were made on the proposed site, when it was found that the shoal consisted of a fine light-colored sand with black specks on top and extending to a depth of ten feet. It then gradually becomes darker and finer to a depth of twenty-four feet, at which point the borings ceased. The construction will be commenced without delay, and it is hoped to have it finished by the last of December. This will render it unnecessary to retain the Light-vessel at *Willoughby Spit*, and she will be withdrawn. She is now in need of extensive repairs, the cost of which alone would almost suffice to build the Light-house, besides being very much less expensive to maintain. The completion of this Light-house and that off *Benoni's Point*, Choptank River, will complete the changes of all existing Light-vessels authorized in this district, to screw-pile Light-houses.

Lambert's Point.—In the last annual report of the Light-House Board, the attention of Congress was drawn to the fact that a Light-house had been strongly urged for the shoal off this point, and an appropriation for this purpose was made. The plans are now being prepared for a small substantial structure on six piles, similar to those at *Point of Shoals* and *White Shoals*, James River, omitting the ice-fending piles, which will not be required at this station.

235. *White Shoals*, James River, Virginia.

236. *Point of Shoals*, James River, Virginia.

The two screw-pile Light-houses authorized for *White Shoals* and *Point of Shoals* were built during the past year.

241. *York Spit Light-house*.—At the date of the last annual report the

iron-work of this structure was set up, properly coupled together and braced, staging removed, and the frame of the house in position. During the month of November the joiner's work was completed, painting finished, and the lens set up. The Light was exhibited for the first time November 15, 1870, and the Light-vessel which formerly marked this dangerous shoal was permanently withdrawn. This Light-house is built on fourteen wooden piles, incased in cast-iron sleeves, and stands in twelve feet water, near the end of the shoal at the mouth of York River, from which it derives its name.

256. *Choptank River Light-house*, Maryland.—It is designed, under the general law, to replace the Light-vessel at this place, which serves to mark the entrance to the Choptank River, by an iron screw-pile Light-house, similar in construction to those at York Spit and Wolf Trap, on the Chesapeake Bay, omitting four of the fender piles. The Light-house will stand in eleven feet water, mean tide, on a bar at the mouth of the river, distant about one and a half mile in a southwest direction from *Benoni's Point*, and marking three channels. After due public notice a contract was made in March with the lowest bidder, for the construction of this Light-house. The iron-work has been prepared and the superstructure framed. It is expected that this Light-house will be completed by the last of October, and enable the Light-vessel to be permanently withdrawn.

260. *Love Point Shoal Light-house*, mouth of Chester River, Maryland.—An appropriation of \$15,000 was made by Congress for a Light-house on the shoal at the mouth of the Chester River, near the north end of Kent Island, the exact location of which was fixed at a point on the shoal in ten feet water, mean tide, distant from *Love Point* about one mile, in a northeasterly direction. The Light-house will be a duplicate of the one constructing for Choptank River. A contract was made for the construction of this work (after publicly advertising for proposals) with the lowest bidder. The contract requires the work to be finished by October 1, 1871.

Craighill Channel, in the Chesapeake Bay, at the entrance to the Patapsco River.—This channel extends from a point about one mile north-east of *Seven-foot Knoll*, where it intersects the Brewerton Channel, leading into the Patapsco River in a direction almost due south about five miles, or just beyond the Belvidere Shoals. It is now about two hundred and sixty feet wide, and, with the exception of a few places where there are lumps, is twenty-one feet deep. Congress made an appropriation last year of \$50,000 for the improvement of this, together with the Brewerton Channel. It is understood that a sufficient amount of this sum is to be applied to widening the Craighill Channel to five hundred feet and deepening it to twenty-two feet, mean tide. Large vessels coming up the bay to enter the Patapsco will follow this channel until the range beacons at *Hawkins* and *Leading Points* are in line. They can then follow the Brewerton Channel without difficulty into the harbor of Baltimore. The latter channel is acknowledged to be of great benefit to navigation. It can be followed at night, by means of the range beacons above referred to, as well as by day. There seems to be no doubt but that the new channel will be of equal importance to navigation, and the urgency of making it available at night for the large commerce of the city of Baltimore is manifest. This can be done by the establishment of range beacons near the north end of the channel. This channel has the advantage of saving about five miles in distance to large vessels bound to Baltimore from the lower bay; avoids much, if not all, of the dangers usually experienced from the accumulation of

ice in the lower part of the Brewerton Channel during the winter; is much easier navigated, or rather would be if range beacons were established, and, being a direct prolongation of the resultant of the united currents of the Patapsco and Chesapeake Bay, is more permanent in its character. It is an established fact that the current produced by the outflow of water from the river and bay tends to deepen the channel by washing out the material on the bottom, and there is no doubt but that this channel, once improved to a depth of twenty-two and width of five hundred feet, will always maintain at least those dimensions. There is, therefore, no doubt but that this channel will always be used for navigation purposes, and the range beacons now so much needed will always be required.

An appropriation of \$40,000 for the purpose of establishing these beacons was asked during last session of Congress. It was then proposed to locate the beacons, one on the north, the other on the south side of Miller's Island, some five miles north of the upper end of the channel. This location has the advantage of being more protected from the heavy ice from the Susquehanna than any other position that could be selected, but the distance from the southern entrance to the channel is so great, being about twelve miles, that it would be necessary to use very strong lights and to place the rear one at a considerable elevation. Their value would be much enhanced by locating them some four or five miles nearer. This can readily be done by building artificial islands and protecting the banks with a riprap wall of loose stone. The material excavated by the dredges in deepening the channel can be used for the purpose of forming these islands. It is understood that the Engineer Officer in charge of this improvement has been authorized to deposit this material for that purpose at such places as may be selected. The establishment of these beacons need not increase the number of Lights in this vicinity for the reason that they will render the use of those at *North Point* unnecessary, and they can be discontinued. The estimated cost of the range beacons for this channel is \$45,000, for which an appropriation is asked.

280. *Body's Island Light-house.*—An appropriation was made by Congress to re-establish this very important coast Light, the old Light-house having been destroyed during the war. A careful study of the topography of the country, and the action of the water-flow in and out of Pamlico Sound through Oregon Inlet, resulted in the abandonment of the old site on the south side of the inlet and the selection of another on the north side. This will be one of the most important Lights on the coast, and the necessity of placing it in a safe position, free from the danger of destruction by the encroachments of the sea, could not be over-estimated. The old site was subject to this danger. Previous to 1846, there was no inlet at this place, but during the early part of September of that year, heavy southerly winds banked up the waters of Albemarle and Pamlico Sounds several feet above their ordinary level. Then came northerly winds driving the water back, overflowing the narrow sand-bank which separated the waters of the ocean from those of Pamlico Sound. By this outflow of water Oregon Inlet was opened in one night. Since that time it has maintained a character of instability, sometimes widening and deepening in places, filling up in others, all the time gradually working to the south. This inlet is not now used for navigation purposes, there being only a depth of four feet of water over the bulkhead or inside bar. During the rebellion, however, the rebels built on the south side a fort called Fort Oregon. The site of

this fort can no longer be seen. It has been washed away in the gradual movement of the inlet to the south.

The site of the old Light, which at one time was a considerable distance from the inlet, is now only about four hundred yards. The testimony of residents in the vicinity confirms the fact that the inlet is working to the south, and that its progress is not slow. The old site could doubtless have been made use of by protecting it with jetties, but only at great expense. In view of these facts it was not deemed advisable to erect this important Light-house on a site so insecure. Another site, about one and a half mile farther north and on the north side of the inlet, protected on the west by Roanoke Island from the action of storms tending to drive the waters of Pamlico Sound toward the sea, was accordingly selected. The land at this place being held at a merely nominal sum, the purchase of fifteen acres was made, the perfection of a title in the United States being delayed, however, in getting the necessary act of the State of North Carolina ceding jurisdiction, and in complying with certain other legal forms. The site and plan of the Light-house having been determined on, contracts were made, after due public notice inviting proposals, with the lowest bidders for furnishing the material to be used in the structure. The tower will be one hundred and fifty feet high, exhibiting a first-class sea-coast Light, focal plane one hundred and fifty-three feet above the level of the sea, and will be visible at a distance of more than eighteen nautical miles. About the middle of June a working party was dispatched to this station with orders to erect the necessary temporary buildings for storage and quartering the workmen, build a narrow tramway over which the material can be easily transported from the water to the site, and a temporary wharf, on which to land it. It is expected that these preparations will be completed in about two months, when the work on the foundation of the tower itself will be begun. The completion of this tower will supply a want long felt by the commerce of the country. Every effort will be made to finish the Light-house the present year, but the frequency of storms in this latitude generally causes delay in the prosecution of works of this nature, and it is scarcely propable that the entire work will be completed within that time. An appropriation of \$15,000 for the fiscal year 1872-'73 is asked to complete the work.

A First-class Light-house between Cape Henry and Body's Island, North Carolina.—With the completion of the Light-house at *Body's Island* there will remain only one important interval of unlighted coast on the Atlantic from the St. Croix, Maine, to about Mosquito Inlet, on the coast of Florida. That dark space will be embraced between *Cape Henry* and *Body's Island*, a distance of eighty miles and an unlighted space of forty miles, at the center of which there should be a first-order Light, so that from *Cape Henry* to *Cape Hatteras* the broad side of that long stretch of low land and dangers could not be approached within eighteen or twenty miles without seeing a warning of danger. In order to avoid the strong current of the Gulf Stream, vessels bound round *Cape Hatteras* from the northern and eastern ports run inside of the cold wall of water of that stream, within which they have a favorable current of one mile per hour on an average, and a smoother sea in bad weather; but in the absence of powerful sea-coast Lights sufficiently near each other to give warning of approach to danger, many vessels laden with valuable lives and cargoes have been lost between these points. It is now believed that the construction of this tower should be no longer delayed. A glance at the chart of the coast will show its importance. An appropriation therefor of \$60,000 is accordingly sub-

mitted. An appropriation was made about ten years ago for this Light, but the money reverted to the Treasury. The Light-house should be similar to that being built at *Body's Island*, with a focal plane one hundred and fifty feet above the sea, and visible at a distance of eighteen nautical miles.

281. *Cape Hatteras*, North Carolina.—This important Light-house was well advanced toward completion at the date of last annual report. During the month of December the new lens was received and set up, and on the 16th of the same month the light from the new tower was exhibited. The lens on the old tower was then removed and sent to the Light-house depot at Staten Island, New York. The new tower has been covered with a cement wash to protect it from the effects of the weather, the upper part (projected against the sky) colored red, the lower part (projected against the foliage in the rear) colored white; all the iron work of stairs, lantern, &c., painted, and the tower inclosed in a neat iron fence. During the month of February the old tower, being no longer of any use and in danger of falling during some heavy storm, was blown up and totally destroyed. In addition to the finishing of the new tower, a brick dwelling for the principal keeper of the Light-station was built and inclosed in a neat picket-fence. The above completed the work at this station.

Hatteras Inlet, North Carolina.—A Light was authorized March 3, 1859, to be established at the Hatteras Inlet, the entrance to the sounds of North Carolina, but it was not commenced before the breaking out of the rebellion, and afterward it could not be built. This is at present the best inlet leading to and from the sounds of North Carolina, with which there is a very large trade. This inlet is fourteen miles southwest from Cape Hatteras, within the range of the influence of that cape upon the weather, and as the channel is narrow and only marked by buoys, it is dangerous to attempt to enter or pass out at night for want of a small Light. The estimated cost of this Light-house is \$18,000, for which an appropriation is asked.

296. *Cape Lookout*, North Carolina.—The tower at this station has had some repairs made to it during the present year, but the keeper's dwelling is in a very dilapidated condition, and, though improved somewhat, is too old to be susceptible of the repairs it requires. There is positive danger of the building being destroyed in stormy weather. This would leave the keepers on a desolate coast without any shelter near their station. A new building is very essential to the health and comfort of the keepers, independent of the danger to which their lives are exposed in the present dwelling. An estimate of \$10,000 is respectfully submitted to supply this defect.

During the year repairs and renovations, more or less extensive, have been made at each of the following-named Light-stations:

233. *Craney Island screw-pile Light-house*, Virginia, mouth of Elizabeth River.

234. *Naval Hospital Light*, on wharf at the Naval Hospital, Virginia, Elizabeth River.

237. *Deep Water Shoals screw-pile Light-house*, Virginia, James River.

238. *Jordan's Point Light*, Virginia, James River.

264. *Fort Carroll*, Maryland, Patapsco River.

266. *Hawkins' Point*, Maryland, Patapsco River, lower range beacon for the Brewerton Channel.

268. *Lazaretto Point*, Maryland, Patapsco River.

283. *Ocracoke*, North Carolina, entrance to Ocracoke Inlet.

284. *Southwest Point Royal Shoal screw-pile Light-house*, North Carolina, Pamlico Sound.

285. *Northwest Point Royal Shoal screw-pile Light-house*, North Carolina, Pamlico Sound.

286. *Harbor Island screw-pile Light-house*, between Pamlico and Core Sounds, North Carolina.

287. *Brant Island Shoal screw-pile Light-house*, North Carolina, Pamlico Sound.

288. *Neuse River Light*, North Carolina, west side of entrance to Neuse River.

289. *Pamlico Point*, North Carolina, south side of entrance to Pamlico River, Pamlico Sound.

290. *Long Shoal screw-pile Light-house*, North Carolina, east end of Long Shoal, Pamlico Sound.

291. *Roanoke Marshes screw-pile Light-house*, North Carolina, east side of channel connecting Pamlico and Croatan Sounds.

293. *North River screw-pile Light-house*, North Carolina, on bar at entrance to North River.

294. *Wade's Point screw-pile Light-house*, North Carolina, west side of Pasquotank River, Albemarle Sound.

295. *Roanoke River screw-pile Light-house*, North Carolina, near mouth of Roanoke River, Albemarle Sound.

The following are the names of the Light-stations in this district not mentioned elsewhere, some of which are now in need of repairs:

228. *Hog Island*, Virginia, west point of Hog Island, Great Matchepungo Inlet.

229. *Cape Charles*, Virginia, entrance to Chesapeake Roads.

230. *Cape Henry*, Virginia, entrance to Chesapeake Bay.

232. *Old Point Comfort*, Virginia, entrance to Hampton Roads.

239. *Cherrystone*, Virginia, mouth of Cherrystone Inlet, Chesapeake Bay.

240. *Back River*, Virginia, entrance to Back River.

242. *New Point Comfort*, Virginia, entrance to Mobjack Bay, Chesapeake Bay.

243. *Wolf Trap screw-pile Light-house*, Virginia, Wolf Trap Shoal, Chesapeake Bay.

244. *Stingray Point*, Virginia, mouth of Rappahannock River, Chesapeake Bay.

245. *Windmill Point screw-pile Light-house*, Virginia, Windmill Point Shoals, Chesapeake Bay.

246. *Watt's Island*, Virginia, Tangier Sound, Chesapeake Bay.

247. *James' Island screw-pile Light-house*, Maryland, Tangier Sound, Chesapeake Bay.

248. *Somers' Cove screw-pile Light-house*, Maryland, Tangier Sound, Chesapeake Bay.

249. *Smith's Point screw-pile Light-house*, Virginia, mouth of Potomac River, Chesapeake Bay.

250. *Frog Point*, Maryland, Smith's Island, Chesapeake Bay.

251. *Clay Island*, Maryland, Tangier Sound, Chesapeake Bay.

252. *Point Lookout*, Maryland, entrance to Potomac River, Chesapeake Bay.

253. *Hooper's Straits screw-pile Light-house*, Maryland, off mouth of Honga River, Chesapeake Bay.

254. *Cove Point*, Maryland, mouth of Patuxent River, Chesapeake Bay.

255. *Sharp's Island screw-pile Light-house*, Maryland, mouth of Chop-tank River, Chesapeake Bay.

256. *Thomas's Point*, north side of mouth of South River, Maryland, Chesapeake Bay.

258. *Greenbury Point*, Maryland, mouth of Severn River, Chesapeake Bay.

259. *Sandy Point*, Maryland, Chesapeake Bay.

261. *Seven-foot Knoll screw-pile Light-house*, Maryland, mouth of Patapsco River, Chesapeake Bay.

262. *North Point*, (lower,) Maryland, entrance to Patapsco River, Chesapeake Bay.

263. *North Point*, (upper,) Maryland, Patapsco River, Chesapeake Bay.

265. *Hawkins' Point*, (upper,) Maryland, Patapsco River.

267. *Leading Point screw-pile Light-house*, Maryland, Patapsco River.

269. *Pool's Island*, Maryland, off mouth of Gunpowder River, Chesapeake Bay.

270. *Turkey Point*, Maryland, mouth of Elk River, head of Chesapeake Bay.

271. *Fishing Battery*, Maryland, mouth of Susquehanna River, Chesapeake Bay.

272. *Havre de Grace*, Maryland, Concord Point, mouth of Susquehanna River, Chesapeake Bay.

273. *Piney Point*, Maryland, Potomac River.

274. *Blackistone's Island*, Maryland, entrance to Clement's Bay, Potomac River.

275. *Lower Cedar Point screw-pile Light-house*, Virginia, Yates Shoal, Potomac River.

276. *Upper Cedar Point screw-pile Light-house*, Maryland, off mouth of Tobacco River, Potomac River.

277. *Fort Washington*, Maryland, Potomac River.

278. *Jones' Point*, Virginia, Potomac River, near Alexandria.

279. *Bowler's Rock screw-pile Light-house*, Virginia, Rappahannock River.

292. *Croatan screw-pile Light-House*, North Carolina, Pamlico Sound.

DEPOTS.

The depot at *Lazaretto Point*, which was in a very dilapidated condition, has been placed in thorough repair. The work-shop has been painted inside, brick-work covered with cement wash, new slate-roof put on, and lightning-rods repaired. The wharf at the landing has also been repaired, and a contract made to have the stone wall around the front of the lot rebuilt. This work is now almost completed; the depot will then be in excellent order. A quantity of old, unserviceable material was gathered together and sold at auction, and the proceeds turned into the Treasury.

At the depot at *Portsmouth*, Virginia, the site for which was selected about a year ago, there has been a good wharf built, the lot inclosed in a board fence, and skids made on which to lay iron buoys and have them repaired.

The Engineer steam-tender *Tulip* was, at the date of the last annual report, very much in need of extensive repairs. A contract was made, after public advertisement in the daily papers, to have her hauled out on the ways and the necessary repairs made. This work was accomplished on the 10th of June. She is now in excellent condition for service. Previous to making the repairs, and since they were completed,

she has been continually employed in transporting materials, &c., to new Light-stations, and to such old ones as required repairs, and in inspecting Light-houses in the district.

LIGHT-VESSELS.

Upon the completion of the two screw-pile Light-houses in this district, as substitutes for Light-vessels, there will be no Light-vessels in the district.

SIXTH DISTRICT.

The Sixth District extends from New River, North Carolina, to include Cape Canaveral Light-house, Florida.

Inspector.—Captain Richard T. Renshaw, United States Navy.

Engineer.—Brevet Major William J. Twining, Captain of Engineers, United States Army, until June 21, 1871; Brevet Lieutenant Colonel Peter C. Hains, Captain, Corps of Engineers, United States Army, present engineer.

In this district there are—

Light-houses and lighted beacons.....	27
Light-houses and lighted beacons destroyed during the rebellion and not rebuilt.....	14
Day or unlighted beacons and stakes.....	52
Light-vessels.....	6
Buoys actually in position.....	183
Spare buoys for relief and to supply losses.....	63
Tender (steam) <i>Alanthus</i>	1
Tender (sail) <i>Narragansett</i>	1

According to previous reports there were fifty-two unlighted beacons in this district. This number includes the staked channels of the St. John's River, Florida, and the inside coast passages. Of these day-marks the greater number were destroyed or have otherwise disappeared, and are being replaced as rapidly as they are required by navigation. Of the seven beacons in the Savannah River, the two on *Oyster Rocks* are serviceable and in good condition; of the remaining five, two have been destroyed by fire and will be rebuilt. There is at present an appropriation for two beacons on *Oyster Rocks*, which will be built at an early day.

The following numbers preceding the names of stations correspond with those of the "Light-house Lists of the Atlantic, Gulf, and Pacific Coast of the United States," published January 1, 1871.

308. *Sullivan's Island Beacon*, Charleston Harbor, South Carolina.—The present beacon-light at this place is a temporary open frame-work, wooden structure, erected upon the roof of a private residence. This light was established in its present position immediately after the surrender of Charleston in the spring of 1865, to enable the vessels of the Navy and those of commerce to navigate safely at night the channel leading from the inside of the outer bar of the main channel to the turning point near Fort Moultrie. An appropriation was made by Congress, March 3, 1859, for rebuilding the two beacon range-lights on *Sullivan's Island*, (which were destroyed during the rebellion,) and on July 20, 1868, an appropriation of \$15,000 was made for rebuilding these lights; but failing to obtain valid title to the necessary land upon which to place them, and the required cession of jurisdiction by the State, the appropriation reverted to the Treasury under the operation of the fifth and sixth sections of the act approved July 12, 1870. Another appropriation of \$10,000 for these beacons was made by Congress, approved March 3, 1871. The State passed a general act ceding jurisdiction to sites pur-

chased by the United States for Light-house purposes, but it is understood that only a title of questionable validity can be given by any citizen claiming to own land on this island. This question is now being investigated. As soon as the title to the necessary land on which to locate the keeper's dwelling is obtained, there will be no unnecessary delay in establishing these important range-lights. Their establishment will render the *Weehauken Light-vessel* now placed in the channel unnecessary, and she can be permanently withdrawn. It is understood that there is now twelve feet water over the old wreck which this Light-vessel marks, and the work of removing the same is still being carried on.

The beacons proposed for this range are detached from the keeper's dwelling. Their heights are respectively thirty-five and fifty feet from sill to focal plane. The illuminating apparatus is to be of the fifth order.

313. *Tybee Light-station*, entrance to the Savannah River, Georgia.—The recent gales, which have caused great damage along the southern coast, have so greatly damaged the Light-house tower at this important Light-station as to render it unsafe and to require the speedy erection of a new tower. The tower, which was built in 1793, is badly cracked, and may fall at any time. Its great age, (seventy-eight years,) the frequent necessary repairs to it during the time it has been standing, and its total neglect during the war of the rebellion, render it impossible to properly repair the present tower. An estimate is submitted for commencing the erection of a new tower near the present one.

Daufuskie Island, Calibogue Sound, South Carolina.—The appropriation asked for the range beacons on this island, to mark the entrance to Calibogue Sound, and to facilitate the passage from Port Royal Harbor to Savannah River, was made by act of Congress approved March 3, 1871. The plans and specifications have been made for the structures, and it only remains to secure a proper site before commencing work.

315. *Tybee Knoll*, Savannah River, Georgia.—An appropriation for erecting a screw-pile Light-house, to take the place of the Light-vessel stationed to mark this dangerous shoal, reverted to the Treasury under the act approved July 12, 1870. A screw-pile Light-house can be built at this place, which will better serve the purpose of navigation and at the same time be much less expensive to maintain than the Light-vessel. Borings show that below a thin stratum of clear, sharp sand, there is a layer of soft mud to a depth of nineteen feet at least, and perhaps considerably farther. This, though it will somewhat increase the expense, will not do so to an unwarrantable extent. The Light-house can be located in from two to five feet water, should stand on six piles, and be built somewhat similar to those in the Chesapeake Bay and sounds of North Carolina. The erection of this Light-house will insure the permanent removal of the Light-vessel now stationed at this place. An estimate is submitted.

Light on the Obstructions in Savannah River.—An ordinary steamboat-lantern is still retained to mark the obstructions in the Savannah River below the city. It is understood that an appropriation by Congress has been made for removing these obstructions. As soon as this work is completed the Light will be no longer required and will be discontinued. Until then, the present arrangement is very economical, and answers every purpose of navigation.

318. *Fig Island*, Savannah River, Georgia.—Such repairs as were necessary for the neatness and preservation of this station were made during the spring. More extensive repairs to the platforms and foundation of the dwelling are now being made.

323. *St. Simon's*, entrance to *St. Simon's Sound*, Georgia.—This Light-house has been under contract since the fall of 1869, and the time for completion has been extended on several occasions, but the tower is still unfinished, and has only been carried to a height of fifty-one feet above the ground. The death of the contractor, and one of his bondsmen—both of whom died at the work—has recently caused further delay. On account of the climate, work cannot be recommenced till the 1st of November, when it will be taken in hand by the surviving bondsman, and, it is hoped, will be finished early next spring.

325. *Amelia Island*, *North Range*, *St. Mary's Bar*, Florida.—Plans and estimates have been prepared for a keeper's dwelling, and beacons for this range. As the site is on Government land, near *Fort Clinch*, there will probably be no delay in regard to the sites, and the work may be done during the present winter.

Dame's Point, *St. John's River*, Florida.—An examination of the site for this Light-house was made by the Engineer of the district. On sinking an artesian well, the underlying strata were found to consist of soft mud to a depth of sixteen feet. The borings were not carried below this depth. It is believed that a screw-pile Light-house can be built here, but before it is commenced further examination of the foundation will be made.

328. *St. Augustine*, north end of *Anastasia Island*, Florida.—An examination was made by the Engineer of the district of *Anastasia Island*, with reference to the selection of a site for the new Light-house provided for by appropriation approved March 3, 1871. Reports have been received from time to time in regard to the cutting away of the shore line near the old Light. On the 1st of July, 1870, the distance from the angle of the dwelling to high-water mark was seventy feet, and on the 1st of November the distance had been reduced to forty-eight feet; since that time no cutting has taken place. The channel over the bar continues to shift rapidly toward the north; as a result, the inner shoal covers for the present the site, and the force of the ebb-tide is expended along the shore-line to the west,

The opening, or partial closing, of *Matanzas Inlet* diminishes or increases the amount of water discharged by the *Matanzas River* at *St. Augustine*. The channel will probably continue to shift to the north, until, by the action of heavy and continued northeast winds, the accumulated waters are driven to seek a new outlet toward the southeast. Such changes are of constant occurrence at all the inlets on the coast of East Florida.

Much difficulty has been experienced in procuring a site for the new Light-house. The old Spanish grants and the claims of settlers are in much confusion, but it is to be hoped that the question may be settled by the law officers of the Government at an early day, and that a good title may be obtained to a site which will be safe from encroachments of the sea. The construction of the tower, which will be of the first order, one hundred and fifty feet above the sea, will be commenced as soon as title can be secured.

Mosquito Inlet, east coast of Florida.—The Engineer of the district has visited *Mosquito Inlet* for the purpose of reporting on the necessity and practicability of a Light at that point. In common with all the inlets and harbors on the east coast of Florida, this bar shifts constantly, so that no soundings can be relied on. The general effect of westerly winds is to reduce the depth of water, and that of northeasterly gales to increase it; thus the inlet may be opened or closed one or more times each year. The wrecks lying on or near the bar give a practical illus-

tration of the uncertainty of the channel. For all practical purposes of construction of a Light-house, it may, however, be safely assumed that the material can be delivered without any very serious difficulty or delay, although additional expense would be incurred by reason of the remoteness of the station, and the small-sized vessels that would be required for transportation. As regards the necessity of a Light at this point, it is manifest that the commerce passing through the inlet would not justify an expenditure by the United States for a Light for merely local purposes, or at least that there are other points that may justly take precedence of it. But a Light-house between St. Augustine and Cape Canaveral Lights is necessary as one of a system of coast-lights, and *Mosquito Inlet* is undoubtedly the proper site, as, in the first place, the Light there would answer the double purpose of a harbor and coast guide, and in the second for a landing place, both for the original construction and subsequent supply and inspection, which could be made with more safety and certainty there than at any other point along the open sea-beach. A tower one hundred and fifty feet high, lighted by a first-order Fresnel lens, is recommended for this position, and for the commencement of its construction an estimate of \$60,000 is submitted.

At each of the following-named Light-stations there have been repairs and renovations, more or less extensive, during the last year, viz:

297. *Federal Point*, North Carolina, New Inlet, Cape Fear River.

299, 300. *Oak Island*, (Range-lights,) North Carolina, mouth of Cape Fear River.

301. *Georgetown*, South Carolina, entrance to Winyaw Bay.

303. *Sullivan's Island*, Charleston Harbor, South Carolina.

309. *Fort Sumter*, Charleston Harbor, South Carolina.

310. *Castle Pinckney*, Charleston Harbor, South Carolina.

311. *Combahee Bank*, entrance to St. Helena Sound, South Carolina.

314. *Tybee Beacon*, Georgia, Tybee Island.

316. *Cockspur*, Georgia, Savannah River.

317. *Oyster Beds*, Georgia, Savannah River.

318. *Fig Island*, Georgia, Savannah River.

319. *Sapelo*, Georgia, entrance to Doboy Sound.

320. *Sapelo Beacon*, in front of main light.

321, 322. *Wolf Island*, Georgia, entrance to Doboy Sound.

325, 326. *Amelia Island*, Florida, St. Mary's Bar, Fernandina.

327. *St. John's River*, Florida.

The following are the names of Light-stations in this district not mentioned elsewhere:

302. *Cape Romain*, South Carolina.

303. *Bull's Bay*, South Carolina.

305, 306. *Morris Island Range-lights*, South Carolina, entrance to Charleston Harbor.

313. *Tybee*, Georgia, entrance to Savannah River.

324. *Little Cumberland Island*, entrance to St. Andrew's Sound, Georgia.

LIGHT-VESSELS.

The Light-vessel belonging to the *Frying-Pan Shoals Station* was driven from her station during the winter by heavy weather, rendering it necessary to send the relief vessel which now occupies that station.

The *Frying-Pan Shoals Light-vessel* has been repaired at Charleston and sent to take the place of the *Martin's Industry Light-vessel* which was driven from her station during a recent heavy gale. This latter

vessel is now at Savannah undergoing repairs, which will be very extensive and expensive.

The Rattlesnake Shoals Light-vessel, off Charleston Bar, having been reported leaking very badly and unsafe, has been withdrawn, and Light-vessel No. 38 (Relief) has been towed to Charleston for that station until the former is repaired.

TENDERS.

The Engineer of the district has had the schooner *Narragansett* to attend to all the repairs, and carry supplies, &c., for works of construction. The steam-tender *Dandelion* is now there, being fitted out, and will soon be ready for service.

SEVENTH LIGHT-HOUSE DISTRICT.

This Light-house District extends from south of Cape Canaveral to, and including, Cedar Keys, Florida.

Inspector.—Commander C. A. Babcock, United States Navy.

Engineer.—Brevet Colonel C. E. Blunt, Lieutenant Colonel of the Corps of Engineers, United States Army.

In this district there are—

Light-houses.....	11
Day or unlighted beacons.....	35
Stakes.....	18
Buoys actually in position.....	98
Spare buoys for reliefs.....	61
Tender, (tug,) <i>Ivy</i> (employed by Engineer in constructions and repairs).....	1
Tender (sailing schooner) <i>Florida</i>	1

The numbers preceding the names of the Light-stations correspond with those of the Light-house List for 1871.

At each of the following-named Light-stations there have been repairs and renovations during the last year:

334. *Dry Bank*, iron-pile Light-house, Florida Reefs, off coast of Florida.

335. *Sand Key*, iron-pile Light-house, Florida Reefs, off coast of Florida.

336. *Key West*, Key West Island, Florida.

337. *Northwest Passage*, iron-pile Light-house, near Key West, Florida.

338. *Dry Tortugas*, Loggerhead Key, Florida.

339. *Dry Tortugas Harbor*, Fort Jefferson, Florida.

During the ensuing year repairs and renovations will probably be needed at the remaining stations in the district, which are —

330. *Jupiter Inlet*, east coast of Florida.

331. *Cape Florida*.

332. *Carysfort Reef*, iron-pile Light-house, Florida Reefs, off coast of Florida.

340. *Egmont*, entrance to Tampa Bay, Florida.

341. *Cedar Keys*, entrance to Cedar Keys, Florida.

Principal repairs at *Dry Bank Light-house*, scraping, painting, and coal-tarring of iron-work, lower section, &c.

At *Sand Key*, the same, (with a new boat-house.)

At *Northwest Passage*, the same.

At *Dry Tortugas*, new boat-house.

At *Dry Tortugas Harbor*, some slight repairs on keeper's dwelling and out-buildings, and on lantern.

Besides these repairs and renovations one more of the iron day-bea-

cons, marking the line of the Florida Reefs, has been erected, viz: *Beacon D*, at Crocker's Reef.

Preparations for the erection of the iron-pile Light-house on Alligator Reef have been commenced. Indian Key, the nearest land (four miles) from the proposed site, has been selected as a depot, and the temporary buildings and wharf have been well advanced. It is expected that the work of erection will commence early next winter, (by which time the contractors will have delivered the materials at the depot,) and will be prosecuted as rapidly as the unfavorable circumstances attending all engineering operations along the Florida reefs will permit.

The erection of the day-beacons on the reefs will also be prosecuted as rapidly as possible. An additional number of beacons, which will be needed to complete the line, have been ordered at the North.

BUOYAGE.

The buoyage in this district is in excellent condition. There are at present ninety-eight buoys actually in position. It has been found necessary to put down several buoys in *Hawk Channel*, (inside the Florida reefs,) leading into *Key West Harbor*, *Tortugas Harbor*, *Calvose Entrance*, and *Cedar Keys*, Florida. To effectually mark the entrance to, and channel leading into *Cedar Keys Harbor*, extra buoys have been put down, and fifteen palmetto stakes, marked, painted, and numbered according to instructions, driven on either side of the channel.

TENDERS.

The steam-tug *Ivy* has been employed in the Engineer's Department during the past year.

The sailing schooner *Florida* has been in this district for many years, employed in looking after buoys, delivering supplies, other than annual, and for visiting the Light-stations periodically. These Lights are all at remote and isolated points, and can only be reached by a vessel.

The great extent of this sparsely populated coast, embracing the dangerous Florida coast reefs, and the great increase in the number of aids to navigation to be looked after, renders it necessary to have the use of a small steam-tender in place of the small sailing schooner, now over twenty years in service in that district, and an estimate is submitted.

EIGHTH DISTRICT.

This District extends from Cedar Keys, Florida, to the Rio Grande, Texas.

Inspector.—Commander William P. McCann, United States Navy.

Engineer.—Brevet Major A. N. Durrell, Captain of Engineers, United States Army, (east of Pearl River,) to December 4, 1870; M. F. Bonzano, esquire, (west of Pearl River,) to July 1, 1871; Brevet Brigadier General James H. Simpson, Colonel of Engineers, United States Army, present Engineer.

In this district there are—

Light-houses and lighted beacons	47
Day or unlighted beacons	15
Buoys actually in position	97
Spare buoys for relief and to supply losses	139

Light-vessels	1
Tender (steamer) <i>Geranium</i>	1
Tender (steam-tug) <i>General Poe</i>	1
Freight schooner <i>Magnolia</i>	1

The numbers preceding the names of the stations correspond with those of the Light-house list of January, 1871.

342. *St. Mark's*, Florida.—Repairs have been made to the tower, and the new dwelling for the keeper has been completed.

346, 347. *Pensacola*, Florida.—The main and beacon lights have been repaired during the year.

348. *Sand Island*, Alabama, entrance to Mobile Bay.—The new masonry tower, with focal plane one hundred and twenty feet above the sea, is in progress at this station.

350. *Mobile Harbor*, Alabama, to mark the entrance to Mobile Harbor.—The screw-pile Light-house for this station is now being prepared at the work-shops at the North under contract.

355. *Cat Island Light-station*, Mississippi Sound.—The iron screw-pile Light-house at this place is nearly completed, and the Light will be exhibited at an early day.

357. *Merrill's Shell Bank Light-station*, Mississippi Sound.—Repairs have been made at this Light-station during the year.

359. *East Rigolet*.—The brick tower is in good order, exhibiting a Light of the fourth order, capable of affording all desirable facilities to navigation. The dwelling-house is old and not worth the extensive repairs necessary to put it in good condition. A new frame dwelling, and new cypress cistern of three thousand gallons' capacity, should be built at this station, and an estimate is submitted.

360. *Proctorville Beacon*.—The available appropriation (\$5,000) for a building on the plan of the Light-house at *Head of the Passes*, placed on a pile foundation, is insufficient, and if, on further examination, it is found best to place the Light at this point, the appropriation should be increased to \$7,500.

Since the last annual report a canal has been made by a company called the "Mississippi and Mexican Gulf Canal Company," with the intention of affording a passage to vessels of ten feet draught, from the Mississippi River into Lake Borgne. The northern terminus of this canal adjoins Tower Dupré, on which the Light destined for the old site at Proctorville, the former terminus of the abandoned Mexican Gulf Railway, might be placed with much greater advantage to commerce and navigation. There would probably be made no military objection to the placing of a Light on the tower itself.

The canal, though finished the entire distance, has not yet been connected by locks with the Mississippi River, nor has it attained, at its entrance into Lake Borgne, the projected depth of ten feet. The canal is, however, useful, for light-draught vessels, from Lake Borgne, and thus furnishes a harbor of refuge, which Proctorville is not. The appropriation, though insufficient for the structure contemplated on the original site, is sufficient for establishing a serviceable Light on Tower Dupré, and it is therefore recommended that a re-appropriation should be made of the amount now available, and that the Board be empowered to place the Light at Tower Dupré or at Proctorville, as may be found advisable.

361. *West Rigolets*.—The repairs recommended in former annual reports, *i. e.*, the putting a slate roof on the house, rebuilding the wharf, plank-walk, and breakwater, should be made at an early date. The building has sustained some additional damage in the late high water.

The foundation of the cistern has settled and should be rebuilt on a larger area, as the ground is very soft; a timber platform, sunk about two feet below the surface, covered with a layer of concrete, and upon that a brick foundation rising four feet above the ground, is probably the best foundation for this locality; an estimate is submitted.

362. *Port Pontchartrain*.—A new dwelling, on a substantial pile foundation, with kitchen fifteen by thirty feet, cistern of three thousand gallons, and a plank-walk, connecting with the wharf of the Pontchartrain Railroad, was contracted for during the last season. The house was nearly completed at the expiration of the fiscal year, and but for the extensive inundation, caused by an extraordinary rise of the waters of the lake, which interrupted the progress of the work, would have been finished before that time. All the work contracted for will be finished about the 1st of August.

363. *Bayou St. John*.—The difficulty of exhibiting this Light in bad weather, by reason of the unsuitable form of the structure and the great distance of the keeper's dwelling from it, the hazardous approach to it, over an embankment and rotten wharf of the canal company, which, in heavy weather, are washed by the sea, has been brought to the notice of the Board.

The most economical, suitable, and lasting structure would be a screw-pile structure, on the plan of those recently ordered for Matagorda Bay. The rise of Lake Pontchartrain, in hurricanes, may be estimated at fully *five feet* above ordinary high water. On this assumption the floor of the new Light-house should not be less than nine feet above ordinary high water, for the reason that the sea, backed up, first, by the easterly and northeasterly hurricane winds, and then acted upon by the free sweep of the norther, or northwester, over a space of twenty-two miles, will rise in waves of prodigious height, to which severe gales, in ordinary stages of the water, afford no comparison. During the inundation of June last the water rose within a couple of inches of the storm level of 1860, the effect of gales from the eastward, which did not reach the lake itself. But for this fortunate circumstance, the destruction of the Pontchartrain Railway wharf would have been imminent, and the embankments of the new and old canal would have received severe damage. It is deemed of great importance to provide against these extraordinary storms, which, though rare, are nevertheless to be expected from time to time, by establishing structures of such strength and elevation as to render them capable of resisting the force of wind and waves, and giving the requisite security to the inmates.

364. *New Canal*.—Some slight repairs to roof, plastering and cistern, are required, as also painting inside and outside.

365. *Tchefuncti*.—During the high water in June last the sheet-planking on the edge of the water was damaged, the outside steps of the dwelling swept away. They will be repaired during the coming season.

366. *Pass Manchac*.—The breakwater appropriated for will be built during the coming winter.

367. *Chandeleur Island*.—The repairs, consisting of strengthening the screw-piles by connecting them with each other by diagonal braces, new cistern, new roof, new floors, new steps, plastering, and painting, are required. They will be executed during the coming season.

Errol Island, Louisiana.—The proximity of this outlying island to the dangerous shoals of Grande Gosier, to the northward of *Pass à Loure* Light-house, distant twenty-three miles, and midway between the *Pass à Loure* and *Chandeleur* Lights, marks it as the proper location for a Light to fill up the dark space in the approaches to the northern mouth

of the Mississippi River. The only structure offering a reasonable prospect of stability in a locality so exposed to wind and sea, is an iron screw-pile tower, for the erection of which an estimate of \$30,000 has been submitted in the annual estimate for the next fiscal year.

368. *Pass à Louvre*.—Station is in very good order. The steam Fog-signal recommended in the annual report of last year is now under construction.

369. *South Pass*, mouth of the Mississippi, Louisiana.—The Light-house at this, the most seaward point of the delta of the Mississippi, and therefore of the importance of a first-class sea-coast Light, was built in 1831, and is only a low wooden tower on the top of the keeper's dwelling. The grave objections to a wooden structure at so distant a point from succor in the case of fire, and one occupying so important a position, (being only of the third-class,) have been mentioned in the several annual reports from this Board since 1867. The remarks previously made have acquired additional force from the fact that the natural decay of so perishable a material, and the age of the structure, render a new tower at no distant day indispensable, even in an economical point of view alone. An estimate of \$75,000 for commencing the work is submitted.

370. *Head of the Passes*.—Slight repairs were made during the year to the breakwater, and the house was thoroughly painted. The station is now in excellent condition. The space inclosed by the breakwater is still filling up with solid ground; a dense growth of young willows is now spreading over it.

371. *Southwest Pass*.—The foundation for the new iron Light-house was finished by the end of the month of May last, and is now ready for the superstructure which is now being constructed under contract in Ohio.

A steam Fog-signal has been authorized. This may be placed in the southeast or southwest corner of the coffer-dam, where it will be very conveniently accessible at all times. It is now being constructed at the North.

The pile foundation for a keeper's dwelling is also in readiness to receive the superstructure.

The old Light-house remains in the same condition as last reported. It will last, dilapidated as it is, until the new Light is ready, and no repairs of any kind are needed. In the event of its complete destruction, which, however, is hardly to be apprehended, a temporary Light may be established on the wharf of the new work in a few days.

373. *Ship Shoal*.—The tower requires coating with coal-tar. The depth of water under the tower has sensibly decreased since the screw-piles were surrounded with a layer of stone concrete. The tower was then thoroughly cleansed with a solution of caustic potash and coal-tarred. The tanks, rain-leaders, pipes, &c., were coated with hot coal-tar inside.

Timbalier Island, intermediate between Nos. 342 and 343 of the Light-house List of 1871.—An iron screw-pile Light-house, with focal plane one hundred and twenty-five feet above the sea, will be erected at this place. The land of the Government, upon which the old brick tower stood, has been entirely washed away. The island being uninhabited and subject to dangerous overflows, in fact a low, barren sand-reef, unfit for cultivation, no difficulty in obtaining a new site is apprehended. The new Light-house will be placed in a convenient depth of water inside the island, which, in this case, will be an effectual breakwater. The location will also be at some distance from the eastern point of West Timbalier Island, (toward the west,) because the point is subject to abrasion. The bay affords

secure shelter for the vessels used in construction. The plans for this Light-house are completed, and it will be soon under contract.

Trinity Shoal, intermediate between Nos. 364 and 365.—A survey of this shoal was commenced by the United States Coast Survey in April and May, but not finished. An iron screw-pile Light-house, one hundred and twenty-five feet above the sea, will be contracted for at an early day for this shoal; the plans are completed.

Calcasieu Pass, intermediate between Trinity Shoal and Sabine Pass.—Inquiries have been made with a view to obtain possession of a suitable piece of land for the new Light-house. There seems to be much confusion in the claims of various parties, so that the only certain mode to acquire possession is by the operation of the laws passed at the last session of the legislature of Louisiana. The new Light-house authorized at this point will be erected during the next working season.

375. *Sabine Pass*.—The tower is in good order. The keeper's dwelling requires a new roof, new floors, and general repairs, which will be executed during the next season.

377. *Bolivar Point*.—An attempt was made to purchase a new site for the Light-house at such a point that the establishment of two Range Lights would have given perfect ranges over the bar and through the channel of the harbor. The negotiations failed. In consequence of the failure to obtain a new site, the Board ordered the foundation for the new tower to be placed on the old site, which was accordingly done. The foundation is complete. A dwelling for the light-keeper, on the plan of that at *Pass à l'Ouvre*, has been finished. The iron Light-house for this place is now under construction at the North.

381. *Matagorda*.—The new Light-house authorized at this place will be constructed during the fiscal year.

383. *Swash*.—The screw-pile Light-house for this point is under construction at the North.

Decrow's Point.—The refusal of the owner to sell any land to the Government made it necessary to abandon the first plan of placing a couple of Range Lights on the land, and to substitute therefor a screw-pile Light-house, which is now under contract at the North.

385. *Brazos Island Beacon*.—A new iron structure is recommended for this point, on account of the rotten condition of the present temporary tower being subject to destruction in heavy gales. Estimates submitted.

Atchafalaya Bay.—The beacons marking the entrance to this bay are in good order.

Depot, at head of the Passes.—The buildings authorized were finished by the end of the year.

TENTH DISTRICT.

This District extends from the mouth of St. Regis River, New York, to include *Grassy Island Light-house*, Detroit River, Michigan.

Inspector.—Commodore Gustavus H. Scott, United States Navy.

Engineer.—Brevet Lieutenant Colonel George L. Gillespie, Captain of Engineers, United States Army.

In this district there are—

Light-houses and lighted beacons	55
Day or unlighted beacons	0
Buoys actually in position	72
Spare buoys for relief to supply losses	90
Tender (steamer) <i>Haze</i> , common to Tenth and Eleventh Districts	1

The numbers preceding the names of stations correspond with those

of the "Light-house List of the Northern and Northwestern Lakes of the United States," issued January 1, 1871.

446. *Ogdensburgh*, New York, St. Lawrence River.—The renovation of this station commenced August 23, 1870, as mentioned in the last annual report, was continued during the working season and finally completed June 9, 1871. The sea-wall protecting the lot has been raised throughout its whole length; the space inclosed filled with loam and rich earth, graded and sown with grass, and shade-trees planted on the land front. The station is now in excellent condition.

453. *Sackett's Harbor*, New York, Lake Ontario.—The renovation of this station, commenced in August, 1870, and mentioned in the last annual report, was continued during the working season and finally completed April, 1871. A neat picket-fence incloses the dwelling and a small garden; shade-trees have been set out on the land side, and the old house and débris have been removed. The grounds are now in excellent condition.

456. *Pier-Head*, Oswego, New York, Lake Ontario.—The pier-head of the west pier has been marked by a Light exhibited from a small glazed box fitted to the top of a mast, framed into the pier. The west pier is very much exposed to high seas, and at times it is impossible for the keeper to reach the pier-head. To insure the maintenance of the Light at the pier-head, two $\frac{3}{4}$ -inch galvanized wire ropes connect the top of the mast with iron bars, fastened inside the stone tower at the second window, and serve to support a lantern six inches in diameter, showing a fixed white Light, that is run upon them from the tower to the mast. The working of the device has, so far, been entirely satisfactory.

Fair Haven, New York, Little Sodus Bay.—An appropriation was made March 3, 1871, for the erection of a pier, Light-house, and dwelling for the keeper at this station. The station was visited May 26, 1871, when it was decided to mark the approach to the harbor by a frame beacon to be established on the pier on the west side of the channel, and a suitable site for the keeper's dwelling was accordingly purchased. As soon as the necessary papers vesting title in the United States shall have been submitted and approved by the Attorney General, proposals will be publicly invited for the construction of a frame dwelling for the keeper. The Light will be of the fourth order, fixed, white, in a frame tower, provided with hauling apparatus for pier-head Light. The focal plane of the Light will be forty feet above the pier.

459. *Big Sodus Bay*, Lake Ontario.—The renovation of this station commenced in August, 1870, and, as mentioned in the last annual report, was continued during the working season, and finally completed June 30, 1871. The old tower and house have been removed from the lot, and the stone and débris formed into a rough jetty extending into the lake at the west end of lot, to prevent a threatened wear of the bank. The jetty is seventy feet long, with a twenty-foot base, and extends to nine feet of water. The station is in fine order.

462. *Oak Orchard*, New York, Lake Ontario.—An appropriation was made July 15, 1870, for a Light-house at or near the mouth of Oak Orchard Creek, New York. After a careful examination of Oak Orchard Harbor, and the shore-line in the vicinity, it was deemed best to mark the approach to the harbor by a frame beacon placed upon the west pier. In accordance with this decision, one-half acre of land on the west bank of the creek, near its mouth, was purchased as a site for the keeper's dwelling. During the winter the title-papers of the lot were received and forwarded to the Attorney General, and by him examined and approved. For the supply of the necessary material for the

dwelling and beacon sealed proposals were publicly invited and contracts made. Work was commenced March 30, 1871. The dwelling is a one-story and attic frame structure, with a room especially arranged for the accommodation of the beacon supplies. The beacon was finished June 10, and the Light, which is of the fourth order, fixed, white, was exhibited for the first time on the evening of June 17, 1871. The dwelling was finished and the keeper installed June 22, 1871.

463. *Fort Niagara*, New York, mouth Niagara River.—An appropriation was made March 3, 1871, for rebuilding the Light-house at this station. Plans have been prepared for a stone tower with oil-room attached, to be placed on the extreme eastern end of the Light-house lot. Proposals are now invited for the necessary material for tower and oil-room. As soon as the material can be delivered under contract, the work will be commenced and pushed to completion. The tower will be of coursed rubble-stone, eighteen feet diameter at the base, and eleven feet at the top of the cornice. The height of the focal plane above the surface of the ground will be forty-five feet. The order of the Light will not be changed.

465. *Buffalo Breakwater*, (north end,) Buffalo, New York.—It was stated in last annual report that "an appropriation was made July 15, 1870, for a Beacon-light on each end of the breakwater in this harbor." As the breakwater is not finished, it was only possible to make arrangements for the construction of the beacon to occupy the north end. The appropriation would not admit of a very elaborate structure, and as it is difficult, if not impossible, to reach the breakwater at certain seasons of the year, in any way short of a steam-tug, it was found necessary to arrange a structure that should contain quarters for the keeper. These considerations, taken in connection with the depth of water at the site, made it imperative to use timber in the construction, on account of its cheapness. Proposals were publicly invited for the supply of the necessary material, and contracts have been made for the iron, stone, and timber, and for the framing of dwelling. On May 18, a crib forty feet square was sunk twenty feet *behind*, and twenty-three feet *from* the north end of the breakwater, and the framing carried to the surface of the water. To allow settlement to take place, work was suspended till June 15, when six more courses were added. Work was again suspended till June 24, when it was resumed. The pier of protection is twelve feet above the level of the lake, and the beacon, which will be elevated eight feet above it, will be supported by heavy upright oak timbers securely framed into the pier, the oak timber being firmly held by adjustable wrought-iron rods. On the west side of the beacon, twenty-four feet above the water, a Fog-bell will be arranged, striking three times in quick succession, at intervals of thirty seconds. The striking apparatus will occupy one of the rooms of the beacon. It is expected that this work will be completed by September 15, 1871. The Light will be of the fourth order, fixed, red, the focal plane thirty-seven feet above the level of the lake.

466. *Buffalo Breakwater*, (south end,) Buffalo, New York.—It is proposed to mark the unfinished south end of breakwater by a temporary frame beacon, with the focal plane twenty-eight feet above the lake level. For a height of ten feet above base it will be of open framework, strongly braced, to give the waves, as nearly as possible, uninterrupted passage over the breakwater. The Fog-bell for this station, which is to strike continuously at intervals of ten seconds, has been delivered.

The Light will be of the fourth order, fixed, white. The proposed

length of breakwater is four thousand feet; at present only seventeen hundred and fifty feet have been built. If the usual annual appropriations are made, the residue should be built in three to four years. In view of this distant date of completion of work, no appropriation is asked at present for the construction of the beacon to mark the south end.

467. *Buffalo, New York, Lake Erie.*—An appropriation was made March 3, 1871, for the reconstruction and improvement of the wharf in front of Light-house depot. Sealed proposals for the supply of the necessary material and for the labor were publicly invited, and contracts for the supply of the timber, stone, iron, and framing were made. Work was commenced June 10. The old crib-work has been entirely removed, and the contractor is now dredging along the front of the lot preparatory to sinking the cribs of the new pier. The pier will be two hundred and sixty-four feet long by twelve feet wide, and sunk six feet below water-level. It is expected that it will be completed by September 1, 1871.

A *Lake-coast Light on the northern side of Presqu'isle, Lake Erie*, has been petitioned for. An estimate has been submitted, accordingly, of \$15,000.

475. *Conneaut, Ohio, Lake Erie.*—An appropriation was made March 3, 1871, for building a light-keeper's dwelling at this station. Plans and specifications of the dwelling have been prepared, and proposals will be invited for the construction under contract, when the title papers of the lot purchased for the site have been examined and approved by the Attorney General of the United States.

476. *Ashtabula, Ohio, Lake Erie.*—An appropriation was made March 3, 1871, for building a light-keeper's dwelling at this station. Plans and specifications of the dwelling have been prepared, and sealed proposals will be publicly invited for the construction under contract, when the title-papers of the lot purchased for the site have been examined and approved by the Attorney-General of the United States.

477. *Grand River, Fairport, Ohio, Lake Erie.*—An appropriation was made March 3, 1871, for completing the tower upon which work had been stopped by act of July 12, 1870, and for the reconstruction of the keeper's dwelling. The new dwelling will be a one-story and attic brick structure, placed upon the site of the old one, and connected with the tower by a brick covered-way. Sealed proposals for the supply of the necessary material were publicly invited, and contracts were made for the lumber, rubble-stone, and brick. The stone for the tower being already on hand and dressed ready for laying, work was resumed on the 20th of May. The tower is now nearly finished, and it is expected that the Light can be exhibited by the 15th of August. The order of the Light will not be changed. A great part of the material for the dwelling has been delivered, and the construction has advanced above the water-table. The station will be in complete order by the 20th of September.

479. *Cleveland, Ohio, Lake Erie.*—An appropriation was made March 3, 1871, for rebuilding the Light-house at this station. Sealed proposals were publicly invited for the supply of the material necessary for the construction of a stone wall to inclose the grounds on the north and east sides, and for a third-order lantern complete, with stairs for the tower, and contracts have been made. The stone and cement were delivered early in June, and work was commenced on the 24th of June. It is recommended that the appropriation for this station be extended to June 30, 1873.

482. *Black River, Ohio, Lake Erie.*—This station has no keeper's dwelling. An appropriation of \$4,000 is recommended for the construc-

tion of a dwelling similar to the one to be constructed at Ashtabula, Ohio.

483. *Vermillion*, Ohio, Lake Erie.—An appropriation was made March 3, 1871, for building a light-keeper's dwelling at this station. The station was visited May 18 for the purpose of selecting and purchasing a suitable site. No suitable vacant lot could be purchased that was easily accessible from the piers, and from which the beacon could be seen, and in consequence a purchase was made of a lot with a new house upon it, containing every convenience for a keeper's dwelling. Occupation will take place when the papers necessary for vesting title in the United States have been examined and approved by the Attorney General.

484. *Huron*, Ohio, Lake Erie.—An appropriation was made March 3, 1871, for building a light-keeper's dwelling at this station. The station was visited May 17, for the purpose of selecting and purchasing a suitable site. A purchase was made, but the owner of the lot has since refused to give a title. Further efforts will be made to obtain a suitable lot.

485. *Cedar Point*, Lake Erie, near Sandusky, Ohio.—It is proposed to establish a Fog-bell at this station before the close of the season.

490. *Turtle Island*, Lake Erie, near Toledo, Ohio.—It is proposed to establish a Fog-bell at this station before the close of the season.

491. *Maumee Outer Range*, Toledo, Ohio.—An appropriation was made March 3, 1871, to build a light-keeper's dwelling at this station. Sealed proposals were publicly invited to June 3, for the construction of the dwelling, and a contract has been made. It will be a frame dwelling, one-story and attic, placed on the west end of the range, and behind the inner range tower. It is expected that the dwelling will be ready for occupation by the 20th of September.

498. *Gibraltar*, Lake Erie, mouth of Detroit River, Michigan. An appropriation of \$10,000 is recommended to rebuild the tower and keeper's dwelling at this station. The present buildings are very old, and not worth repairing.

At each of the following-named stations there have been repairs and renovations more or less during the last year:

449. *Sunken Rock*, St. Lawrence River.

450. *Rock Island*, St. Lawrence River.

452. *Galloo Island*, Lake Ontario, entrance to St. Lawrence River.

455. *Oswego*, New York, Lake Ontario.

460. *Genesee*, Charlotte, New York, Lake Ontario.

464. *Horseshoe Reef*, Buffalo, New York, Lake Ontario.

471. *Presqu'isle Beacon*, Range No. 1, Erie, Pennsylvania.

472. *Presqu'isle Beacon*, Range No. 2, Erie, Pennsylvania.

485. *Cedar Point*, Sandusky, Ohio, Lake Erie.

497. *Monroe*, Monroe, Michigan, Lake Erie.

The following-named Light-stations require repairs to be made during the ensuing year:

461. *Genesee Beacon*, Charlotte, New York, Lake Ontario.

464. *Horseshoe Reef*, Buffalo, New York.

468. *Dunkirk*, Dunkirk, New York, Lake Erie.

473. *Peninsula Beacon Range*, No. 1, Erie, Pennsylvania.

478. *Grand River*, Fairport Beacon, Fairport, Ohio, Lake Erie.

488. *Green Island*, Green Island, Lake Erie.

489. *West Sister Island*, Lake Erie.

493, 494. *Maumee Middle Range*, Toledo, Ohio.

497. *Monroe*, Monroe, Michigan, Lake Erie.

499. *Mamajuda*, Detroit River.

500. *Grassy Island*, Detroit River.

The following are the names of the Light-stations in this district not mentioned elsewhere:

- 447. *Cross-over Island*, St. Lawrence River.
- 448. *Sister Islands*, St. Lawrence River.
- 451. *Tibbett's Point*, entrance to St. Lawrence River.
- 454. *Stony Point*, Lake Ontario.
- 457, 458. *Big Sodus Range Beacons*, Lake Ontario.
- 469. *Dunkirk Beacon*, Dunkirk, New York, Lake Erie.
- 470. *Erie Harbor*, Erie, Pennsylvania.
- 471, 472. *Presqu'isle Beacon Ranges*, Nos. 1 and 2, Erie, Pennsylvania.
- 480. *Cleveland Beacon*, No. 1, Cleveland, Ohio.
- 481. *Cleveland Beacon*, No. 2, Cleveland, Ohio.
- 486. *Cedar Point Range*, Sandusky, Ohio.
- 487. *Marblehead*, Sandusky, Ohio.
- 495, 496. *Maumee Inner Range*, Toledo, Ohio.

An estimate is submitted for a steam-tender for the Inspector and Engineer of the Tenth Light-house District, rendered necessary by the large increase in the number of Lights requiring repairs and supplies, buoys and other aids to navigation in the Northern and Northwestern lakes since 1865, which it is found cannot be effectually attended to by the tender stationed at Detroit for Lakes St. Clair, Huron, Michigan, and Superior. The buoy service, which has heretofore, and is now, mainly performed under contract with private individuals, is not satisfactory, and can only be properly performed by a small steam-vessel.

ELEVENTH DISTRICT.

The Eleventh District embraces all aids to navigation on the Northern and Northwestern Lakes above Grassy Island Light-house, Detroit River.

Inspector.—Commodore Alexander Murray, United States Navy.

Engineers.—Brevet Brigadier General O. M. Poe, Major of Engineers, United States Army.

There are in this district—

Light-houses and lighted beacons	91
Day or unlighted beacons	2
Buoys actually in position	144
Spare buoys for relief and to supply losses	60
Tenders (steam) <i>Warrington</i> and <i>Haze</i>	2
Tender (sail) <i>Belle</i>	1

The numbers preceding the names of stations correspond with the "Light-house List of the Northern and Northwestern Lakes of the United States," issued January 1, 1871.

504, 505. *Saint Clair Flats*, new channel.—By the act of July 12, 1870, returning to the Treasury the available funds, work on these Light-houses was suspended while in full progress, and it was not until the appropriation of March 3, 1871, became available that operations could be resumed. An adequate working force is now upon the ground, and the two stations will be ready for occupancy before the close of the season. Meanwhile, temporary structures have been erected, and everything is in readiness to exhibit lights, as soon as the announcement is made that the channel is open to navigation.

506. *Fort Gratiot*, Lake Huron.—Under the provisions of the appropriation of March 3, 1871, for a Fog-signal at this station, one is now under construction, and will be in operation before the close of the season.

A Light-house between Fort Gratiot and Point Aux Barques, Lake

Huron.—The last annual report contained the following, which is again submitted, in the hope that the necessary appropriation may be made :

An additional coast Light, between *Fort Gratiot* and *Point Aux Barques*, Lake Huron, and recommended in last year's report, is very much needed.

The distance between the two places is seventy-five miles, for the whole of which vessels keep the shore well aboard while going in either direction.

The amount required for such a Light-house, including the purchase of the land, will be about \$30,000.

Range-lights at the mouth of Saginaw River, Saginaw Bay, Lake Huron.—An appropriation of \$12,000 for these ranges was made by act of Congress approved July 15, 1870. The title to the small portion of marsh required for these lights was so much involved that there was but little hope of its being cleared up in time to save the appropriation from reversion to the Treasury, under the provisions of the act of Congress of July 12, 1870. Moreover, the price (\$2,500) asked for the few acres of swamp, impassable on foot in the summer time, was so much above its real value that application was made to the governor of Michigan for a commission to condemn the property under the State laws. The commission fixed the sum of \$17,496 84 as a fair and just compensation for the site required. This amount being largely in excess of the entire appropriation, as well as greatly beyond its value, the award of the commission was promptly declined by the Board, and on the 30th June, 1871, the appropriation reverted to the Treasury. It is not recommended that any further steps be taken at present.

514. *Thunder Bay Island*.—Under the act appropriating for a Fog-signal at this station, one is now under construction. It consists of a 10-inch whistle, actuated by steam from a horizontal tubular boiler, and will be completed during the present season.

517. *Presqu'isle, Lake Huron*.—This important coast Light, which was under construction at the date of the last annual report, was unexpectedly completed, and was lighted for the first time upon the opening of navigation this season. It is of great benefit to navigation. After the new Light was exhibited the old tower at the entrance to the harbor was dismantled, and the lantern and lens are ready for use elsewhere.

Spectacle Reef, Lake Huron.—After the date of the last annual report work upon the crib-pier of protection was prosecuted at Scammon's Harbor (where a sufficient depot with dockage has been established) until the close of the season, and resumed on the opening of navigation about the 1st of April. It is expected that the entire crib, ninety-two feet square, will be ready to be placed on the reef early in July.

During the winter the coffer-dam was framed at Detroit, and after the opening of navigation it was taken to Scammon's Harbor, in readiness for use as soon as the crib shall have been completed and placed in position.

A contract for the stone required for the Light-house was made, and it was agreed to deliver granite at Scammon's Harbor, beds and builds cut, for the sum of \$1 25 per cubic foot. The contractor utterly failed to furnish the stone, and, owing to the rapid advance of the season, there was not time to again advertise for proposals with any hope of completing the contracts and securing the delivery of a sufficient quantity of stone to bring the work above water before the close of the season.

In this emergency application was made for authority to purchase limestone from Marblehead, Ohio, in sufficient quantity to secure the object. The honorable the Secretary of the Treasury authorized this purchase, and it was accordingly made at a rate of \$1 75 per cubic foot stone, with beds and builds cut, and \$1 50 for stone in the rough.

At the time the proposals were opened under the advertisement these same persons offered to furnish the same stone for \$2 25 per cubic foot, beds and builds cut, or 50 cents per cubic foot higher. While these stones are not as good or durable as granite, it is still believed that they will answer the purpose and endure for ages.

The wreck of the schooner *Nightingale*, reported last year as occupying the site selected for the Light-house, was removed during the month of June.

Every preparation looking to the successful placing of the crib on the reef has been completed. The requisite tugs, among the most powerful on the lakes, have been chartered to tow the crib, as well as barges and scows of capacity sufficient to float 250 cords of stone, all of which will go out with the crib, and it is hoped and expected that, taking advantage of suitable weather, the crib will be placed on the reef and secured within twelve hours after leaving the harbor.

The requisite derricks and shears for handling the stone at the depot have been erected, and two platforms of masonry upon which to fit together the several courses of stone and drill the holes for the iron domes are under construction.

A derrick has also been ordered for use in handling the stone upon the crib and setting them in the tower.

The failure of the contractor for granite involves the loss of the balance (about \$70,000) of the appropriation approved July 15, 1870, for this work, which, under the act of July 12, 1870, reverted to the Treasury on the 30th of June. It will therefore be necessary to reappropriate this amount for the fiscal year 1872-73.

Straits of Mackinac.—The necessity for a Light to mark the passage between Round Island and the Island of Mackinac, known as the North Channel, is as great as ever, and the recommendation contained in the annual reports for the last two years, that the sum of \$12,000 be appropriated for this purpose, is respectfully repeated.

522. *Detour, Lake Huron.*—The proposition contained in the last annual report to substitute a third-order lens for the fourth order then in use at this station, was carried into effect upon the opening of navigation this season, and gives great satisfaction.

Saint Helena Island, Lake Michigan.—For reasons given in the annual reports for 1868-69 and 1870, a Light to mark the anchorage at this island is deemed important. It is again recommended that the sum of \$14,000 be appropriated for this work.

Passage north of the Beaver Islands, Lake Michigan.—This passage is now much used, and the navigation through it will rapidly increase, since with certain winds it is possible to sail through it when the south passage is impracticable. Lights to mark it will soon be required, but it is proposed to defer for another year the estimates of their cost.

Little Traverse, Lake Michigan.—Attention was directed to the necessity of a Light-house to make this fine harbor of refuge available at all times, by an inquiry from the Senate Committee on Commerce.

By reference to the tracing of the lake survey detail chart of Little Traverse, and the engraved lake survey chart of the northeast end of Lake Michigan, including Big and Little Traverse Bays and the Fox and Manitou Islands, the relation of the harbor of Little Traverse to the navigation of Lake Michigan can be readily seen and appreciated. The harbor itself is excellent in every respect, easy of access, affording good anchorage and a complete shelter from all winds.

A Light-house of the fifth order, together with a Fog-bell of 600 pounds with Stevens's striking apparatus, will make the harbor available. In

addition to its relation to the general commerce of Lake Michigan, the harbor has some local importance. This is increasing, and, doubtless, will continue to do so.

530. *South Manitou*, Lake Michigan.—The work of improving this station is in progress, though the working party has been temporarily withdrawn for service elsewhere. All the materials are on the ground, and by the 20th July the entire working force will be again at the station, when it is expected the work will go on uninterruptedly until its completion before the close of the season. The improvements will consist of a third-order tower founded on piles, having its focal plane one hundred feet above the surface of the lake, and a covered passage-way connecting the tower and keeper's dwelling. This improvement will be of great value to the commerce between Lake Michigan and the other lakes.

Frankfort, Lake Michigan.—As soon as the harbor piers at this place are completed a Pier-light will be required, and is estimated for under the head of "Pier Lights."

534. *Père Marquette*, Lake Michigan.—Before the close of last season a Light was established on the head of the pier at this place, under an appropriation of \$6,000, approved July 15, 1870. It was also intended to erect a keeper's dwelling on shore, but it having been found impossible to perfect the title before the 30th June, the balance of the appropriation on that day reverted to the Treasury. It is respectfully recommended that the sum of \$4,000 be reappropriated for the purpose in question.

Little Point Au Sable, Lake Michigan.—A Lake-coast Light of the third order is much needed at this point, as a simple inspection of the chart of Lake Michigan will show. Last year an appropriation of \$35,000 for this purpose was recommended, but not made, and the recommendation is now respectfully repeated.

White River, Lake Michigan.—The appropriation of \$10,000 formerly existing for a Light at this point, reverted to the Treasury June 30, 1870, under the act of July 12, 1870. It is respectfully recommended that this amount be reappropriated for the purpose indicated.

535. *Muskegon*, Lake Michigan.—The rebuilding of the main Light at this station, in progress at the date of the last annual report, was duly completed, and the Light exhibited from the new structure before the close of the season.

Muskegon Beacon.—This is to be a Pier-head Light, on the outer end of the south pier, with an elevated walk connecting it with the shore. Its erection is now in progress, and will be completed within a couple of weeks. The exhibition of the Light will be somewhat delayed for want of the required illuminating apparatus.

537. *Grand Haven*, Lake Michigan.—After the completion of the Pier-head Light at *Muskegon*, the working party will be transferred to *Grand Haven* for the purpose of erecting a beacon on the pier-head. An elevated walk starting from a point on the pier, which can be safely reached in any weather, will connect the beacon with the shore. The whole will be completed, and the Light shown early in September.

It was intended to move the Fog-signal which is located on the pier, but the performance of the machinery is quite satisfactory, and when the larger bell proposed for the station is duly hung, it is supposed it will answer all purposes.

538. *Holland*, Lake Michigan.—A Pier-head Light has been established on the outer end of the south harbor pier at this place, and was exhibited before the close of last season. The appropriation under which the work was done was intended to cover the cost of a keeper's dwelling also,

but it was not possible for the owner of the site required to make a clear title thereto in time to prevent the balance of the appropriation reverting to the Treasury on the 30th of June last, under the act of July 12, 1870. The sum of \$4,000 should be reappropriated for a keeper's dwelling, and a new effort be made to obtain title.

South Haven, Lake Michigan.—An appropriation of \$6,000 is available for a Beacon-light at this place, under which it is proposed to establish a Light during the present season.

Beacon at Michigan City, Lake Michigan.—The working party engaged in erecting Pier-head Lights will be transferred from *Grand Haven*, upon the completion of the work at that point, to *Michigan City*, and will complete the proposed beacon and elevated walk at this place before the close of the season.

Calumet, Lake Michigan.—After a conference by the Engineer of the district with the president of the Improvement Company, which owns the old Light-station at this point, he promised to put the title in proper shape to be submitted for the approval of the Attorney General of the United States, but he has not yet informed him of what progress is being made. As soon as the transfer to the United States is made, the work of renovating the old station will be taken in hand, under the appropriation now available, and can be completed in a very short time.

Grosse Point, Lake Michigan.—An appropriation for the removal of *Chicago* Light-house to this point is now available, and the title-papers to the land required are in course of preparation. As soon as they have been approved, the work will be taken in hand.

A Light-house at Racine Point.—The last annual report contained the following remarks :

This is a prominent point on the west coast of Lake Michigan, about three and a half miles north of Racine, and eighteen miles south of the north-cut beacon at Milwaukee. The point shuts out to the northward the *Racine* Light, which lies in a bay and is not seen by vessels coming from the north, and keeping the shore well aboard as they mostly do, until nearly abreast of it.

Frequent shipwrecks have occurred at this point for the want of a Light. For vessels coming from the south it would also be a good guide for steering clear off Racine Reef.

A Fog-signal should also be provided. For these two objects an estimate of \$40,000 is submitted.

A Coast-light at Twin River Point, Lake Michigan.—The following remarks are copied from the report of last year, and are repeated as presenting a fair statement of the necessity for this Light :

This point is seven miles north of *Manitowoc*, and occupies a position on the west coast of Lake Michigan similar to *Grand Point au Sable* on the east. It is the prominent landmark for vessels navigating Lake Michigan, and should be marked by a tower one hundred feet high with an apparatus of the third order. There is an old discontinued station at the village of Twin River, but the site is too far south of the Point to answer the purposes of a coast Light.

An estimate for a proper Light at this station is submitted of \$40,000.

North Bay, Lake Michigan.—By act of Congress approved July 15, 1870, an appropriation of \$7,500 was made for the purpose of establishing a Light or Lights to enable vessels to enter this harbor, and a price for the land required was agreed upon. But the owner found it impracticable to clear the title before the 30th of June, when the appropriation reverted to the Treasury. Submitted for reappropriation.

A Light-house on Poverty Island, at the entrance to Green Bay.—Attention is respectfully invited to the following remarks, copied from the annual reports for the last two years. The necessity for this Light is daily increasing, the shipments of iron ore from Escanaba alone being sufficient to justify the erection of the Light :

The already large and rapidly-increasing commerce to and from the northern end of

Green Bay and lower lake ports now takes, in daylight, the northern passage from Lake Michigan into Green Bay, because of its being much shorter and more direct. To enable vessels to use the same passage in the night, a Light-house on Poverty Island is necessary.

Estimates submitted of \$18,000.

A Coast-light between White Fish Point and Grand Island, Lake Superior.—In the last four annual reports this Light has been recommended. It is more needed than any other Light in the district not already provided for. The sum of \$40,000 will be required to build it, and an estimate submitted.

A Light-house on Stannard's Rock, Lake Superior.—The rapid increase of the commerce between Du Luth, the eastern terminus of the Northern Pacific Railroad, and the lower lakes, will demand, at no distant day, the erection of a Light-house on this danger, so much dreaded by all vessels bound to or from points above Keweenaw Point and ports below. The case will be similar to that of Spectacle Reef, and all the costly apparatus and machinery purchased for the latter can be made available for the former, thereby greatly reducing the cost of construction.

It is not proposed, however, to do anything further at this time than to make the preliminary examinations and mature plans for the work, for which purpose an estimate of \$20,000 is submitted.

L'Anse, Lake Superior.—The railroad from Escanaba and Marquette to Ontonagon passes the head of L'Anse Bay, and will, for the present, terminate there. Efforts, which will probably prove successful, are now being made to complete the road to L'Anse before the close of this season, when the place will at once become an important point for the shipment of iron ore. A good harbor is found at the head of the bay, and it should be lighted.

To establish such a Light as is needed will require an appropriation of \$12,000, which amount is submitted, with estimate.

Mendota, Lake Superior.—This Light-station having been discontinued by the order of the honorable the Secretary of the Treasury, it will be dismantled when visited by the steamer Haze upon her present cruise, and the apparatus, &c., used elsewhere.

585. *Eagle Harbor, Lake Superior.*—Under an appropriation approved July 15, 1870, this station has been entirely rebuilt, and is now in excellent order.

Outer Island, Lake Superior.—The through commerce to and from the western end of Lake Superior, increasing so rapidly as the railroads having their termini at Du Luth are extended to the westward, all passes outside of the Apostle Islands, and is greatly in need of a Light-house on the northern end of Outer Island. This should be a Light of the third order, and will cost \$40,000, which sum is respectfully recommended to be appropriated.

Sand Island, Lake Superior.—For reasons given in the preceding case, a Light (of a lower order, however) is demanded on the northern end of Sand Island, the most westerly of the group, for which purpose an appropriation of \$18,000 is recommended.

Du Luth, Lake Superior.—The act of Congress appropriating for this Light-house provides that it shall be located at the terminus of the Northern Pacific Railway. Consequently, the Chief Engineer of that road was written to, informing him of the provision of the appropriation, and asking him to designate a site for the Light-house; also, in case the proposed site were not the property of the United States, to take the requisite steps to ascertain the owner, and, if practicable, initiate negotiations for the purchase of the site. After some delay, he replied that he

had referred the communication to the president of the road, but no further answer has been received.

Passage Island.—The discovery of the silver mines on Lake Superior, and consequent sudden and remarkable increase of travel and traffic to that region, renders it desirable that a Light-house should be built on Passage Island, to mark the channel between it and Isle Royale. The island is difficult of access, and therefore any structure put there will cost more than if erected at some more accessible point.

It is respectfully recommended that an appropriation of \$18,000 be made for the purpose indicated.

Pier-head Lights.—These are being erected as fast as illuminating apparatus can be supplied. That at *Muskegon* will be completed early in July, but the apparatus is not yet received. That at *Grand Haven*, as well as the one at *Michigan City*, will be completed before the close of the season, and the others provided for by the act of the 3d of March, 1871, will all be completed before the appropriations for 1871-'72 become available.

As the extension of this system of pier Lights must depend upon that of harbor improvements, it is somewhat difficult to estimate in detail until it is known just where these improvements are to be made. Therefore the estimate for Pier-head Lights is submitted in one amount, and place it at \$20,000, which will be sufficient for this district for the fiscal year.

Light-house depot at Detroit.—Work on this has progressed, though not so rapidly as was desired. A bulk-head has been built across the entire front of the lot, and the basin has been dredged out to a uniform depth of ten feet, thus giving sufficient room to accommodate all the Light-house vessels. Enough of the dredged material was deposited behind the bulk-head to fill up the low ground to the height of the bulk-head, thus forming an excellent yard for the storage of buoys and other heavy material.

The depot building, forty by sixty feet in plan, and entirely fire-proof, has been carried up to a sufficient height to admit of the completion of the second floor. The cellar for the storage of the supply of oil forms the basement of the building. It is very desirable to complete this building, so much needed. The dark room in which to test the oils delivered under contract is to be located in the story above that now completed, and the work should go on. Wherever the work is stopped now, a temporary roof must be thrown over it to protect it from the weather, which will add considerably to the cost of the building.

When the building was designed it appeared to be of ample size, but it is now plainly seen that there will be no room to spare. An estimate is submitted:

REPAIRS.

Repairs more or less extensive have been made at the following-named stations, and they are now in good order. The repairing parties are in the field, at work, and, before the close of the season, all pressing repairs will have been made.

501. *Windmill Point.*

506. *Fort Gratiot.*

508. *Tarvas.*

509. *Charity Island.*

522. *Detour.*

523. *Waugoshance.*

525. *Beaver Island Harbor.*

- 526. *Beaver Island.*
- 536. *Grand Haven.*
- 530. *Kalamazoo.*
- 543. *Chicago.*
- 545. *Waukegan.*
- 549. *Milwaukee.*
- 550. *Milwaukee, (North Cut beacon.)*
- 551. *Port Washington.*
- 561. *Point Peninsula.*
- 564. *Chamber's Island.*
- 580. *Manitou Island.*
- 581. *Gull Rock.*

FOG-SIGNALS.

Four steam Fog-signals (boilers with whistles attached) have been ordered. They are to be established as follows:

1st. Upright tubular boiler, with 10-inch whistle, at *Fort Gratiot* Light-station, Lake Huron.

2d. Horizontal (locomotive) boiler, with 10-inch whistle, at *Thunder Bay Island.*

3d. Upright tubular boiler, with 10-inch whistle, at *Detour* Light-station, Lake Huron.

4th. Horizontal (locomotive) boiler, with 10-inch whistle, at *White Fish Point*, Lake Superior.

Bells, with Stevens's striking apparatus, are to be placed at *Waugoshance*, *Granite Island*, and *Pottawatomie Island*.

TENDERS.

The steam-barge *Warrington* has been principally used this season in connection with the work on *Spectacle Reef*. During last winter she was strengthened by arches and additional bilge kelsons, and her deck-beams supported by stanchions, thus preparing her for carrying on her deck the heavy stones to be used in building the tower. She has also been fitted with a steam-derrick with which to handle the stone. This derrick has proved of the very greatest service already.

The hard work of the season developed such defects in her boiler that a new one was deemed necessary. Hence, in August last the tender was laid up, and a new boiler eight feet in diameter and eighteen feet long was put in, when the vessel returned to her work. As the new boiler has a larger steam capacity, it will require less coal to run it when towing in heavy weather than was required for the old one, as it will no longer be necessary to force the fires as before.

The schooner *Belle* has been, and will continue to be, used as quarters for the workmen at *Spectacle Reef*. Because of her light draught she can be moored directly on the reef, and she thus answers a purpose which very few vessels would, and indeed is of the greatest value. She is now getting old, and will need extensive repairs before long, but nothing is proposed before the close of the season.

The steam-tender *Haze* has been employed in delivering the light-house supplies on all the lakes, and in transporting freight and looking after the buoys.

TWELFTH DISTRICT.

This district embraces all aids to navigation on the Pacific coast of the United States, from the Mexican frontier to the boundary of Oregon.

Inspector.—Commodore Alfred Taylor, United States Navy.
Engineer.—Brevet Lieutenant Colonel R. S. Williamson, Major o
 Engineers, United States Army.
 There are in this district—

Light-houses.....	14
Buoys actually in position.....	33
Spare buoys, for relief and to supply losses.....	33
Tender (steam) <i>Shubrick</i>	1

The following numbers, which precede the names of stations, correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1871.

Point Fermin, sea-coast of California, near entrance to San Pedro Harbor.—An appropriation of \$25,000 is recommended to establish a fourth-order Light-house and a steam Fog-signal at this point to mark the approaches of San Pedro Harbor. The appropriation should, if possible, be made so as not to revert to the Treasury at the end of the fiscal year, for the reason that it is impossible to obtain a suitable site except by condemnation under the laws of California, which is a long and tedious process.

The number of vessels navigating near the southern coast of California, between there and San Diego, and passing through the Santa Barbara Channel, has been greatly increased within the last two years. All coast steamers stop at San Pedro, near Wilmington, the port of Los Angeles, and a Light-house and Fog-signal, as guides to the entrance of the harbor, are of great importance.

Anacapa Island, west side of southern entrance to the Santa Barbara Channel, California.—An appropriation of \$70,000 is recommended for the establishment of a first-order Light-station at the eastern end of this island. The island is a barren rock about one hundred and fifty feet above the sea, destitute of verdure, and all the water and other materials necessary to prosecute the work will have to be brought from the main land.

The same reasons which make it advisable to establish a light at Point Fermin, are in still greater force with reference to *Anacapa*, which is at the south entrance of the Santa Barbara Channel, there but ten miles in width. A Fog-signal is not recommended on the island, as the coast steamers usually pass nearer the main land, and because of the high and very precipitous sides of the island, against which the waves are constantly dashing and producing a deafening noise.

Point Hueneme, sea-coast of California, east side of southern entrance to Santa Barbara Channel.—An appropriation of \$10,000 is recommended for the erection of a first-class steam Fog-signal at this point, which is directly opposite *Anacapa Island*. With a first-order Light on the eastern end of *Anacapa Island*, and a steam Fog-signal on the western extremity of Point Hueneme, the southern approaches to Santa Barbara Channel will be well marked, and the navigation of the waters of that portion of California coast rendered less dangerous.

392. *Point Conception*, sea-coast of California.—An appropriation for establishing a first-class steam Fog-signal at this station was made March 3, 1871. A thorough examination and survey of this point is to be made, with a view to ascertaining the best location for the proposed signal, the supply of water, and of obtaining all other necessary information. The engine and boiler for this signal have been contracted for.

Piedras Blancas, sea-coast of California.—This point is about midway between Point Conception and Point Pinos Light-houses, distant one hundred and fifty miles from each other. But Point Pinos is only a harbor Light, and the coasting steamers take their departure from Pie-

dras Blancas, and keep so far out that *Point Pinos Light* is not seen, and it may be considered that there is no sea-coast Light between Point Conception and Pigeon Point, which are nearly two hundred miles distant. An appropriation of \$75,000 is submitted for the erection of a first-order Light and Fog-signal at Piedras Blancas.

393. *Point Pinos*, sea-coast of California, entrance to Monterey Bay.—The suit for condemnation of land, and right of way thereto, at this station, which was tried in the October term of the district court of the third judicial district of the State of California, resulted in a verdict by which the jury awarded to the owners of the land the sum of \$1,230 as the value of the land, and the damage resulting by reason of taking of the same. The owners sought to obtain the value of the Light-house building and improvements, and the cost of fencing the Light-house tract and roadway. The former was denied by the court, and the latter disallowed by the jury. The owners have appealed the case to the supreme court of California, and the suit is now pending before that body.

Pigeon Point, sea-coast of California.—An appropriation of \$90,000 was made March 3, 1871, for the erection of a first-class Light-house and Fog-signal at this point. The structures are to consist of a masonry tower, which is to be one hundred feet high, from base to focal plane. The elevation of the Light above mean sea-level will be one hundred and fifty-eight feet. The keeper's dwelling is to be a double two-story house, built of wood. Work on the above structures was commenced on the 9th of June. A first-class steam Fog-signal will be established at this point, and also on *Año Nuevo Island*, six miles southeast of *Pigeon Point*. It is expected that the steam Fog-signal at *Pigeon Point* will be ready for operation about the 31st of August. The steam Fog-signal for *Año Nuevo Island* may not be ready for operations until after the first rains of the coming winter, for the reason that it may be necessary to construct a water-shed and build a large cistern to collect water.

396. *Point Bonita*, entrance to San Francisco Harbor, California.—An appropriation for the establishment of a first-class steam Fog-signal at this station was made on the 3d of March last. In June of this year a thorough examination of the point was made, with a view of determining the best location for the signal, the means of supplying it with water, and the best way to get materials to this difficult site selected. A syren with its engine has been constructed for this station, and will be forwarded in a few days.

Point San Pablo, between the bays of San Francisco and San Pablo, California. An appropriation was made March 3, 1871, for the erection of a Light-house and Fog-signal at this point, as a guide through the straits of San Pablo. As it was found impossible to obtain a suitable piece of land at this point by purchase, a survey was made of the point, showing the metes and bounds of the land required, and a suit for the condemnation of the land thus surveyed has been commenced in the fifteenth judicial district of California. The court to try this case meets on the 5th of December next. The commencement of work on the proposed structures will therefore be delayed until the opening of next spring. The structures will be completed and the Light-house and Fog-signal in operation before the end of the present fiscal year.

Mare Island, entrance to the straits of Carquines, California.—An appropriation of \$10,000 is recommended for the erection of a fifth-order Light at this point, to mark the approaches to Carquines Straits. The erection of a Light-house at this point has been strongly urged for many years.

399. *Point Reyes*, sea-coast of California.—The iron tower for this sta-

tion was shipped to Drake's Bay, landed there, and hauled to the top of the bluff, near the keeper's dwelling, on October 9, 1870. The work of taking the tower, lantern, and lens apparatus from the top of the bluff down to the site proposed for the tower was successfully completed shortly afterward, and its erection was commenced by the contractor. The work was completed in November, and the Light was exhibited for the first time on the night of December 1, 1870. On February 1 the work of preparing a site for the steam Fog-signal at this station was commenced. A large cistern was constructed, which, with a basin around it, will hold 100,000 gallons. A water-shed, ten thousand square feet in area, was made, from which water enough will be collected in a year to fill the cistern, even in a season in which the rain-fall will be much below the average.

The water from the cistern is conducted to the Fog-signal by means of a galvanized iron pipe, which is securely fastened to the sides of the cliff. A chute has been built from the site of the tower to the Fog-signal. This chute is constructed in the most substantial manner, and is for the purpose of conveying fuel to the Fog-signal. A winding road-way has been constructed from the cliff to the signal site. Much blasting was done before it was completed. The work of preparing the site for the signal-house, coal-shed, &c., was very slow, difficult, and dangerous. Huge masses of rocks overhanging the signal site had to be blasted off; so that at the rear of the signal is a vertical wall of rock, one hundred feet high. An iron railing was put around the edges of the plot prepared for the signal, to keep any one from rolling off into the sea, as on all seaward sides of the signal the cliff is very steep and jagged.

On June 12 the work of taking the boiler and signal apparatus from the top of the cliff down to its position was successfully accomplished. The boiler was put in position, the apparatus fitted to it, and on June 14 the signal was tried, and found to work satisfactorily. On June 30 the work of housing the boiler and signal-apparatus was completed. The signal is now ready for operation, and can be started as soon as the rains of next winter shall have sufficiently filled the cistern with water. The work of establishing this Fog-signal has been, from the nature of the location, very expensive and dangerous.

400. *Point Arena*, sea-coast of California.—An appropriation for the establishment of a first-class steam Fog-signal at this station was made March 3, 1871. An examination of the point, with a view of determining the location for the signal and the supply of fuel and water, has been made. It is expected to complete the work and have the signal in readiness for operation November 1 next.

401. *Cape Mendocino*, sea-coast of California.—The brick dwelling-house at this station was so badly injured by an earthquake on March 2, that it was deemed necessary to pull it down, and erect in its stead a double house of wood. The place selected for the site of the new dwelling is on the spur of the cape on which the Light-house tower stands, and some distance above it. The spur is a rocky ledge, and has the appearance of being very permanent. The work of tearing down the old structure commenced on the 23d of June; the keepers having removed to a shanty near by that was fitted up as a temporary residence for them. It is expected that the new house will be finished by November next. This structure is of the same plan as the *Cape Blanco* dwelling, which was built last year.

The claimants of the land at this Light-station have appealed from the decision of the judge of the eighth judicial district to the supreme court of the State, and the case is now pending before that body.

Trinidad Head, sea-coast of California.—An appropriation for the erection of a Light-house at *Trinidad Head* was approved June 20, 1860, but nothing was done toward building the structures until February of this year. The materials were purchased and the work commenced in June, and the work is now progressing favorably. The Light will be of the fourth order, fixed, varied by red flashes, and will be shown from a low, square, brick tower.

Fauntleroy Rock, Crescent City Harbor, California.—An appropriation for erecting a day-beacon on this rock was made March 3, 1871. It is to be of wrought iron, will be thirty feet high from the base of the rock, and is to be surmounted by a circular cage composed of wrought-iron rings. The work was completed on the 20th of September.

At each of the following-named stations there have been repairs and renovations, more or less extensive, made since the date of the last annual report:

391. *Santa Barbara*, coast of California, near Santa Barbara landing.

392. *Point Conception*, coast of California, west side of northern entrance to Santa Barbara Channel.

393. *Point Pinos*, coast of California, south side of entrance to Monterey Harbor.

394. *Santa Cruz*, on Point Santa Cruz, at the entrance of Santa Cruz Harbor, California.

395. *Farralones*, on the largest or southeast Farralon islet.

396. *Point Boneta*, California coast.

397. *Fort Point*, California.

398. *Alcatraz*, on Alcatraz Island, in the harbor of San Francisco, California.

399. *Point Reyes*, California.

The following are the names of the Light-stations in these districts not mentioned elsewhere:

390. *Point Loma*, California, west side of entrance to San Diego Bay.

402. *Humboldt*, California, north side of entrance to Humboldt Bay.

404. *Crescent City*, California, entrance to Crescent City Harbor.

THIRTEENTH DISTRICT.

This district embraces all aids to navigation on the Pacific coast of the United States north of the boundary between California and Oregon.

Inspector.—Commodore Alfred Taylor, United States Navy.

Engineer.—Major H. M. Robert, Corps of Engineers, United States Army.

There are in this district—

Light-houses	10
Buoys actually in position	10
Spare buoys for relief, and to supply losses	10
Tender (steam) <i>Shubrick</i> , common to Twelfth and Thirteenth Districts	1

The numbers preceding the names of the stations correspond with those of the Light-house List of January, 1871.

407. *Yaquina Bay*, Oregon.—The Light-house at this point was commenced May 1, 1871, and will be completed about September 30, 1871.

408. *Cape Foulweather*, sea-coast of Oregon.—For the erection of a first-class sea-coast Light at or near this point there was appropriated at the last session of Congress \$90,000. It is proposed to erect a brick tower eighty feet from the ground to the focal plane, giving the focal plane a height of about one hundred and fifty feet above the sea level. The plans have been completed; work was commenced about September 1, and will be completed during the present fiscal year.

409. *Cape Disappointment*, mouth of Columbia River, Washington Territory.—A new dwelling for light-keepers has been commenced, and will be completed during the present season.

411. *Cape Flattery*, entrance to Puget Sound, Washington Territory.—A first-class steam Fog-signal has been commenced, and will be completed at this station before December next.

The following are the names of Light-stations in this district not mentioned elsewhere:

405. *Cape Blanco*, sea-coast of Oregon.

406. *Cape Arago*, (*Gregory*), sea-coast of Oregon.

410. *Shoalwater Bay*, Washington Territory.

412. *Ediz Hook*.

413. *New Dungeness*.

414. *Smith's (or Blunt's) Island*.

415. *Admiralty Head*.

All of which is very respectfully submitted.

W. B. SHUBRICK,

Rear-Admiral U. S. Navy, Chairman.

THORNTON A. JENKINS,

Rear-Admiral, U. S. Navy, Naval Secretary.

GEORGE H. ELLIOT,

Major Corps of Engineers, U. S. A., Engineer Secretary.

Hon. GEORGE S. BOUTWELL,

Secretary of the Treasury.

○

REPORT OF THE LIGHT-HOUSE BOARD.

LIGHT-HOUSE BOARD OF THE UNITED STATES.

(Organized in conformity to the act of Congress approved August 31, 1852.)

LIST OF MEMBERS.

Hon. GEORGE S. BOUTWELL, *Secretary of the Treasury, ex-officio President.*
 Professor JOSEPH HENRY, LL.D., *Secretary Smithsonian Institution.*
 Brevet Major-General A. A. HUMPHREYS, *Chief of Engineers, United States Army.*
 Brevet Major-General J. G. BARNARD, *Colonel of Engineers, United States Army.*
 Professor B. PEIRCE, LL.D., *Superintendent Coast Survey.*
 Rear-Admiral T. BAILEY, *United States Navy.*
 Rear-Admiral HENRY WALKER, *United States Navy.*
 Rear-Admiral CHARLES S. BOGGS, *United States Navy.*
 Major GEORGE H. ELLIOT, *Corps of Engineers, United States Army.*

CHAIRMEN OF COMMITTEES.

Finance—General HUMPHREYS.
Engineering—General BARNARD.
Experiments—Professor HENRY.

Lighting—Professor PEIRCE.
Floating Aids—Rear-Admiral BAILEY.

The Chairman and Secretaries are *ex-officio* members of all committees.

MEMBERS OF THE BOARD EMPLOYED IN THE OFFICE.

Professor JOSEPH HENRY, *Chairman.*
 Rear-Admiral CHARLES S. BOGGS, *United States Navy, Naval Secretary.*
 Major GEORGE H. ELLIOT, *Corps of Engineers, United States Army, Engineer Secretary.*

CLERKS.

ARNOLD B. JOHNSON, *Chief Clerk.*

WM. D. O'CONNOR.
 BRUCE SMALL.
 Mrs. E. J. BEARE.

FRANK BAKER.
 ALBERT H. SAWYER.
 SAMUEL STONE.

PAUL J. PELZ, *Chief Draughtsman.*

CLERKS TEMPORARILY DETAILED FROM OTHER OFFICES.

H. C. JOHANNES.
 E. P. RANKIN.
 Miss MAY E. COLE.

Z. B. BROOKE.
 HENRY KALLUSSOWSKI.

REPORT

OF

THE UNITED STATES LIGHT-HOUSE BOARD.

TREASURY DEPARTMENT,
Office of the Light-House Board, August 31, 1872.

Hon. GEORGE S. BOUTWELL, *Secretary of the Treasury:*

SIR: The following report of the operations of this Board during the last year is respectfully submitted:

There are now in the Light-House Establishment of the United States:

ON THE ATLANTIC COAST.

Sea-coast lights	61
Harbor and river lights.....	262
Light-ships	21
Fog-signals, operated by steam or hot-air engines	17
Day or unlighted beacons	284
Buoys actually in position.....	2,262

ON THE COAST OF THE GULF OF MEXICO.

Sea-coast lights	18
Harbor and river lights.....	31
Light-ships	1
Fog-signals, operated by steam or hot-air engines	2
Day or unlighted beacons.....	68
Buoys actually in position.....	205

ON THE PACIFIC COAST.

Sea-coast lights	18
Harbor and river lights.....	7
Light-ships	none
Fog-signals, operated by steam or hot-air engines	7
Day or unlighted beacons.....	1
Buoys actually in position.....	81

ON THE NORTHERN AND NORTHWESTERN LAKES.

Lake-coast lights.....	82
Harbor and river lights.....	94
Light-ships	none
Fog-signals, operated by steam or hot-air engines	7
Day or unlighted beacons.....	1
Buoys actually in position.....	214

REPORT ON THE FINANCES.

TOTALS FOR THE ENTIRE ESTABLISHMENT.

Sea and lake-coast lights	179
Harbor and river lights.....	394
	—
Total light-houses	573
	==
Light-ships	22
Fog-signals, operated by steam or hot-air engines	33
Day or unlighted beacons.....	354
Buoys actually in position.....	2,762

The number of light-keepers now in service is 809.

It has been the endeavor of the Board to conduct the administration of the establishment at all times with the most rigid regard to true economy and efficiency, holding officers and light-keepers to the strictest personal responsibility in the performance of duty; making frequent supervisory visits to, and examination of, works of construction and repair, and requiring inspections and reports, at short intervals of all existing light-houses, light-ships fog-signals, beacons, and buoys in position. The light-houses and light-ships (so far as the exhibition of efficient lights is concerned) are, it is believed, equal to any in the world, and those beacons and buoys actually in position are efficient day-marks to guide clear of the obstructions for which they were established.

The detailed statements under the heads of the twelve geographical districts into which the United States Light-House Establishment is divided, based mainly upon the annual reports of the engineers and inspectors, embrace the work which has been done since the last annual report, the works now in progress, those for which there are existing appropriations, (but which are not yet executed,) and those for which appropriations for their early erection are recommended to Congress.

It will be seen that while the lights and other aids are in a condition of efficiency, so far as they are required to meet the wants of the mariner, there are many stations at which reconstructions and renovations are greatly needed. The necessity for these arises from the natural decay of old buildings, some of them dating back into colonial days, and the erosion of sites, so greatly exposed to the action of storms, winds, and heavy seas, as are most of the light and beacon stations, during the equinoctial and winter seasons.

The new lights recommended for appropriations were, many of them, recommended in our last annual report and in the reports of preceding years; and it will be observed that of the eight new sea-coast lights recommended, four are north of Cape Hatteras, viz: two at Cape Elizabeth, coast of Maine, (reconstruction—built in 1828;) one at Monomoy Point, coast of Massachusetts, (a very important light for the immense commerce which passes through Vineyard Sound,) and one at a point midway between Cape Henry and Body's Island, coast of North Carolina. During the last year an important step has been taken in lighting the previously unlighted coast of eighty miles between Capes Charles and Hatteras, by the construction of the light-house at Body's Island, and there remains forty miles of this dangerous coast yet unlighted.

The necessity of a light-house at the third point mentioned will be manifest by referring to the remarks under the head of *Body's Island*, in the fifth district, where it will be seen that in the thirteen months during which that light-house has been under construction, the loss of property by wrecks in the vicinity has been more than \$130,000, or

more than the cost of the light-house. The great number of wrecks occurring along this dangerous part of our coast, owing to the peculiar currents which set against it, has for many years attracted attention, and there should be no delay in completing its illumination.

On the completion of the light-house recommended to be placed between Cape Henry and Body's Island, there will be no unlighted space on our Atlantic coast from the mouth of the river St. Croix, on our northern frontier, to Cape Hatteras.

South of this cape the board have estimated for four primary or sea-coast lights, viz: at Morris Island, coast of North Carolina; at Tybee Island, coast of Georgia; at Mosquito Inlet, coast of Florida, and on the "Fowey Rocks," one of the great reefs off the coast of Florida. Also for the completion of six others now under construction at the following points, viz: Hunting Island, coast of South Carolina; Alligator Reef, one of the Florida reefs; Saint Augustine, coast of Florida; Trinity Shoal and Timbalier, Gulf of Mexico, and Matagorda Island, coast of Texas.

The southern portions of our sea-coast are not so thickly inhabited as the northern, and the lights are not therefore of so much benefit for local commercial purposes; but it must be remembered that our great sea-coast lights everywhere, are for the benefit of the commerce of all sections and all countries. The commerce between the great commercial centers and the West Indies, South America, the Gulf of Mexico and California, passing along our southern coast is immense, and no part of our sea-coast is more dangerous to lives and treasure, on account of the great shoals and reefs which extend to long distances into the ocean. The other lights recommended in the report are for our harbors and for the northern and northwestern lakes, and are made necessary by the increasing wants of commerce.

You will observe that for several of our light-stations the board have recommended the erection of powerful fog-signals. The great loss of life and property through shipwrecks and collisions, caused by vessels getting out of their courses in foggy and thick weather, is attracting attention throughout the world, and the board is not only placing as many of these most useful aids to navigation as its appropriations will allow, but it is experimenting, with a view of obtaining more powerful machines, which can be heard with certainty above the noise of the surf and the storm. The problem is one of much more difficulty than the lighting of our coasts, and it is attracting the attention of light-house engineers abroad as well as in this country; but it is believed that our present signals—the trumpet, the whistle, and the syren—all operated by steam or hot-air engines, though not as powerful as are desired, are by far the best in the world.

There is a small estimate for a light and fog-signal at the mouth of the river Columbia, Oregon, which the board deems of importance, and to which it desires to call the attention of Congress. The trade into the River Columbia is rapidly increasing, and the entrance is unusually dangerous, on account of its very bad bar, and the dense fogs which envelope it at almost all seasons of the year.

The south channel, which is now almost exclusively used, has no aid to navigation whatever, except its buoys and the light at Cape Disappointment, which are of no assistance in foggy weather.

At the last session of Congress the following provisions of law were made, which have very greatly assisted the board in the construction of its works, viz:

* * * * *

Appropriations for light-house purposes shall be available for expenditure for two years after acts of legislatures ceding jurisdiction over sites: *Provided, however*, That this section shall not apply to any general appropriations for light-house purposes: *And provided further*, That in no case shall any special appropriation be available for more than two years without further provision of law; and the unexpended balances of appropriations for special works under the Light-House Board made by the act approved March third, eighteen hundred and seventy-one, entitled "An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and seventy-two, and for other purposes," are hereby re-appropriated for the purposes therein specified:

Provided, That all appropriations for public buildings under the Treasury Department shall hereafter be available immediately upon the approval of the acts containing such appropriations.

Under the law which required appropriations to be limited to one year, and that all balances were then to revert to the surplus fund, it was found almost impossible to carry on our works satisfactorily and economically.

Light-house works of construction cannot be carried on safely and with economy north of Chesapeake Bay during the winter months, nor on the southern coast during the months when epidemics almost always prevail, more or less severely. Besides these drawbacks and difficulties, these works, from their greatly exposed positions on the sea or lake coast, require not only to be built of the best and most durable materials that can be procured, but those materials ought not to be put together too hurriedly; and hence, as a rule, the large and expensive structures require a much longer time than one year to commence and complete them properly, and with this view it is earnestly recommended that *all light-house appropriations for special works shall in future laws be made available for two years after acts of appropriation and cessions of jurisdiction by the States, provided that no appropriation shall be available for more than two years.*

In regard to the general estimates for repairs of light-houses, for supplies (including oil, &c.) for light-ships, and for buoys, the board has to say that it has always been the custom of this office, in preparing the annual estimates for supporting the existing and authorized aids to navigation, and the construction of new ones, to make as close a calculation of items, quantities, and prices as the information at hand would allow, and to endeavor to so manage the disbursements as at all times to have ample funds available to supply any losses and repair any damage, however serious, to which this service is so peculiarly liable during the winter months.

For *repairs and incidental expenses of light-houses* we have estimated the same amount (\$225,000) as was estimated last year. Congress failed to appropriate the whole amount of this estimate by \$25,000, and, in consequence, many of our old light-houses and sites were not repaired and protected as was required by economical considerations, and the cost this year for the same will be enhanced.

For *expenses of fog-signals* we have estimated the same amount as last year, viz, \$50,000.

For the *salaries of light-keepers* the estimate is \$535,800, and the increase is owing to the increase in the number of light-keepers authorized by the appropriations for new lights. There are in actual employment and required for new lights appropriated for, 893 light-keepers, and the average pay authorized by law is \$600 per annum.

For *supplies of light-houses* the estimate is \$360,837, and the increase is due, as above, to the increased number of lights authorized by law.

For the *expenses of light-ships* the estimate is \$217,732 50; and the

decrease is owing to the substitution during the last year of screw-pile light-houses for light-ships in two instances, and of shore range-lights for a light-ship in the remaining case.

For *expenses of buoyage* our estimate is \$300,000, and the increase is due to the increased demand for these aids to navigation, the decay of those in use, and losses by ice and storm.

The application, by your direction, of the new rules of the civil service to the Light-House Establishment will greatly increase its efficiency.

The board is of the opinion that of all the branches of the civil service of the Government, there is none in which it is more important to have men of ability, integrity, and experience.

We have, as we have stated, about eight hundred principal and assistant light-keepers distributed among our five hundred and ninety-five light-houses and light-ships, and the number is increasing from year to year as new light-houses are constructed.

These keepers are scattered along our coasts, many of them in exposed positions, of which examples are our rock light-houses, such as Minot's Ledge, off the coast of Massachusetts, and the reef light-houses off the Florida coast. Many of them, especially those on the capes of our Pacific coast, are hundreds of miles away from civilization, and the supervising officers can inspect them only at long intervals. Theirs is a life of exposure and hardship, and they should be strong and able-bodied. They should be honest, for they have charge of, in the aggregate, a large amount of Government property. They should have sufficient intelligence and skill to manage our delicate and costly lenses and the machinery connected therewith, as well as the steam machinery of our fog-signals. At many of our distant stations, if, through the carelessness or incapacity of a keeper, these are disarranged, the light may not be exhibited or the signal sounded for weeks before repairs can be made, and commerce can have that security which should be assured to it. On the intelligence, fidelity, and experience of the keepers depend the thousands of lives and millions of property which are nightly approaching, leaving, or sailing along our eight thousand miles of sea, gulf, and lake coasts.

In the light-house service of other countries which have the same excellent system of illumination as our own, (the Fresnel,) the keepers when appointed are young men who have been required to pass medical and intellectual examinations, and they remain in service during good behavior. In Great Britain their moral characters must be vouched for by the clergymen of their parishes. There is promotion for merit, and when superannuated they are pensioned.

Previous to your administration political considerations governed, in a great measure, the appointment and discharge of keepers, and even up to this time it has been found impossible to eradicate all the evils of this custom.

While it cannot be expected to introduce at once all the reforms which would place our light-house service, as far as the character of the keepers is concerned, in as high a condition as those of some other countries, it is to be hoped that, while the nomination (which is now a virtual appointment) is not removed from the collector of customs, to whom it is now confided, so much of reform may be continued as will require that every applicant shall pass a competitive examination before a board composed of experienced officers of the light-house service, before appointment, and that, when once in service, the commerce of the country may have the benefit of his experience and his ambition to

do well, which will result when he finds that he has hope of promotion, and that he will be subject to discharge only for dereliction of duty.

During the last year the following changes have occurred in the board:

Rear-Admirals Shubrick and Stribling, both long connected with the board, (the former having been its chairman from its establishment in 1852, and the latter a member since 1866,) having retired, were succeeded by Rear-Admirals Bailey and Walke, and Professor Henry was elected chairman.

Rear-Admiral Jenkins, a member and naval secretary of the board since its establishment, (except for a few years during the war,) and to whom the present efficiency of the light-house service is in a very great degree due, retired from the board in February last, having been ordered to the command of the Asiatic fleet, and was succeeded by Rear-Admiral Boggs. The other members of the board (viz, Professor Henry, General Humphreys, General Barnard, Professor Peirce, and Major Elliot, engineer secretary,) remain as at the date of the last annual report.

Lieutenant-Colonel Williamson, of the Corps of Engineers of the Army, for many years light-house engineer on the coast of California, and one of the board's most zealous and efficient officers, was relieved from light-house duty in May last, on account of ill-health, having been granted leave of absence in Europe by the War Department.

The board has to deplore the loss by death of one of its officers during the last year, Commodore Macomb, inspector of lights in the fourth district, who died at Philadelphia on the 15th of the present month.

While the board recognizes the great value of most of the officers who have been detailed by the War and Navy Departments to report to you for duty under its direction, it is due to the memory of the late Commodore Macomb to bear witness to the ability which he always displayed in the discharge of his duties and in his intercourse with this office.

FIRST DISTRICT.

The first district extends from the northeastern boundary of the United States (Maine) to, and including, Hampton Harbor, New Hampshire, and includes all the aids to navigation on the coasts of Maine and New Hampshire.

Inspector.—Commander A. E. K. Benham, United States Navy, until December 17, 1871; Commander Thomas O. Selfridge, United States Navy, present inspector.

Engineer.—Lieutenant-Colonel J. C. Duane, Corps of Engineers, brevet brigadier-general, United States Army.

In this district there are:

Light-houses and lighted beacons	49
Light-ships	none
Fog-signals operated by steam or hot-air engines	8
Day or unlighted beacons	51
Buoys actually in position	351
Spare buoys, for relief and to supply losses	322
Tender (steam) Myrtle, for engineer's construction and repairs, (used also in second district; & launch Mary	2
Tender (steamer) Iris, buoy-tender	1
Tender (sail) repair-schooner Wave	1

The following numbers, which precede the names of stations, correspond with those of the Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States, issued January 1, 1872.

3. *Little River, west side of entrance to harbor of Little River, Maine.*—A fog-bell tower has been erected, and a fog-bell operated by Stevens's striking apparatus has been placed at this station.

6. *Nash's Island, off the mouth of Pleasant River, Maine.*—There is required at this station a new lantern, deck, and parapet, also repairs on tower.

———. *Burntcoat Harbor, Swan's Island, coast of Maine.*—Two range-lights have been erected at this important harbor of refuge during the year, and have been lighted.

25. *White Head, Penobscot Bay, Maine.*—Extensive repairs of the keeper's dwelling have been made, a fog signal-house 24 feet by 23 feet, of stone, has been erected, a pier or wharf of stone 45 feet by 25 feet by 23 feet high, with a wheeling stage connecting it with the coal-shed, have been built.

34. *Manheigan Island, Manheigan Island, Maine.*—A steam fog-whistle has been established at this station in place of a Daboll trumpet, which has been removed to Portland Head.

40. *Seguin, on Seguin Island, off the mouth of river Kennebec, Maine.*—The upper part of the tower at this station leaks badly. The stone parapet should be replaced by one of iron. There will be required an iron parapet, deck, and lantern-base.

41. *Half-Way Rock, near Portland, Maine.*—This station was lighted for the first time on the 15th of August, 1871. A boat-slip and masonry boat-house have been built.

42. *Cape Elizabeth, near Portland, Maine.*—These towers were built of rubble-stone in 1828, and are now in such condition that it has become necessary to rebuild them. An estimate is submitted for the erection of two new towers.

44. *Portland Head, near entrance to Portland Harbor, Maine.*—The Daboll trumpet, which was removed from Manheigan, has been established at this station.

49. *Whale's Back, near Portsmouth, New Hampshire.*—A new tower has been erected at this station, and the light is now exhibited from it.

50. *Portsmouth Harbor, New Hampshire.*—The old dwelling has been taken down and a new one erected on the same foundation.

REPAIRS.

At each of the following-named light-stations in the first district there have been repairs and renovations more or less extensive during the year:

1. *St. Croix, on Docket's Island, river St. Croix, Maine.*
2. *West Quoddy Head, west entrance to Passamaquoddy Bay, Maine.*
3. *Little River, west side of entrance to harbor of Little River, Maine.*
4. *Libby Island, entrance to Machias Bay, Maine.*
5. *Moose Peak, on Moose Peak Head, Maine.*
6. *Nash's Island, west end of Moose Peak Reach, Maine.*
7. *Narraguagus, entrance to Narraguagus Bay, Maine.*
8. *Petit Menan, on Petit Menan Island, Maine.*
9. *Prospect Harbor, east side of entrance to Prospect Harbor, Maine.*
12. *Winter Harbor, west side of Winter Harbor, Maine.*
13. *Mount Desert, on Mount Desert Rock, Maine.*
14. *Baker's Island, southwest side of entrance to Frenchman's Bay, Maine.*
15. *Bear Island, east side of entrance to Northeast Harbor, Maine.*
16. *Bass Harbor Head, east side of entrance to Bass Harbor, Maine.*

17. *Eggemoggin*, near east end of Eggemoggin Reach, Maine.
18. *Saddleback Ledge*, in Isle-au-Haut Bay, Maine.
19. *Heron Neck*, west entrance to Carver's Harbor, Maine.
20. *Deer Island*, west entrance to Thoroughfare, Maine.
21. *Eagle Island Point*, west side of Isle-au-Haut Bay, Maine.
22. *Pumpkin Island*, west entrance to Eggemoggin Reach, Maine.
23. *Matinicus Rock*, off Penobscot Bay, Maine.
26. *Owl's Head*, west side of Muscle Ridge Channel, Penobscot Bay, Maine.
27. *Brown's Head*, south side of west entrance to Fox Island Thoroughfare, Maine.
28. *Negro Island*, south side of entrance to Camden Harbor, Maine.
29. *Grindel's Point*, north side of entrance to Gilkey's Harbor, Maine.
30. *Dice's Head*, north side of entrance to Castine Harbor, Maine.
31. *Fort Point*, west side of entrance to Penobscot Bay, Maine.
32. *Tenant's Harbor*, south side of entrance to Tenant's Harbor, Maine.
33. *Marshall's Point*, east entrance to Herring Gut Harbor, Maine.
34. *Manheigan Island*, off George's Islands, Maine.
35. *Franklin Island*, on east side of west entrance to George's River, Maine.
36. *Pemaquid Point*, on Pemaquid Point, Maine.
37. *Burnt Island*, west side of entrance to Townsend Harbor, Maine.
38. *Hendrick's Head*, east side of entrance to Sheepscot River, Maine.
39. *Pond Island*, west side of entrance to River Kennebec, Maine.
40. *Seguin*, off River Kennebec, Maine.
42. *Cape Elizabeth*, on southwest side of Casco Bay, Maine.
44. *Portland Head*, on southwest side of entrance to Portland Harbor, Maine.
45. *Portland Breakwater*, on outer end of breakwater, Portland Harbor, Maine.
46. *Wood Island*, west side of entrance to River Saco, Maine.
47. *Goat Island*, east side of entrance to Cape Porpoise Harbor, Maine.
48. *Boone Island*, off York Harbor, Maine.
51. *Isle of Shoals*, on White Island, off Portsmouth, New Hampshire.

The following named light-stations in the first district require repairs to be made during the current and ensuing year :

3. *Little River*, west side of entrance to Harbor of Little River, Maine.
6. *Nash's Island*, off the mouth of Pleasant River, Maine.
18. *Deer Island Thoroughfare*, on Mark Island, western entrance of Deer Island Thoroughfare, Maine.
33. *Franklin Island*, on east side of western entrance to George's River, Maine.
40. *Cape Elizabeth*, on southwest side of Casco Bay, Maine.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- West Quoddy*.—Ten-inch steam-whistle, in good condition.
Petit Menan.—Ten-inch steam-whistle, in good condition.
Matinicus.—Ten-inch steam-whistle, in good condition.
White Head.—Ten-inch steam-whistle, in good condition.
Manheigan.—Six-inch steam-whistle, in good condition.

Seguin.—Ten-inch steam-whistle, in good condition.

Cape Elizabeth.—Ten-inch steam-whistle, in good condition.

Portland Head.—Daboll air-trumpet, in good condition.

DAY, OR UNLIGHTED BEACONS.

Names and positions of the day, or unlighted beacons, in the first district:

Jerry's Point, Portsmouth Harbor, New Hampshire.

South Beacon, Portsmouth Harbor, New Hampshire.—Stone beacon, in good condition.

North Beacon, Portsmouth Harbor, New Hampshire.—Wooden mast, in good condition.

Willey's Ledge, Portsmouth Harbor, New Hampshire.—Iron spindle, in good condition.

York Ledge, off river York, Maine.—Iron spindle, in good condition.

Fishing Rocks, Kennebunkport, Maine.—Iron spindle, broken off, spar-buoy substituted.

Stage Island Monument, entrance to river Saco, Maine.—Stone tower, 40 feet high, in good condition.

Sharp's Rocks, entrance to river Saco, Maine.—Iron socket and wooden shaft, socket broken off, spar-buoy substituted.

Back Cove Beacon, Portland Harbor, Maine.—Pile-beacon, in good condition.

White Head Ledge, in White Head passage to Portland Harbor, Maine.—Iron spindle, slightly bent, in good condition otherwise.

Trott's Rock, in White Head passage, Maine.—Iron spindle, broken off within a few feet of the ledge.

Mark Island Monument, Casco Bay, Maine.—Stone tower, 50 feet high, in good condition.

Black-Jack Rock, river Kennebec, Maine.—Iron socket, wooden shaft, socket broken.

Seal Rock, river Kennebec, Maine.—Iron spindle, copper cylinder, in good condition.

Lee's Rock, river Kennebec, Maine.—Iron socket, wooden shaft, socket broken, spar-buoy substituted.

Ram Island Ledge, river Kennebec, Maine.—Iron socket, wooden shaft, in good condition.

Winslow's Rocks, river Kennebec, Maine.—Iron socket, wooden shaft, socket broken off, spar-buoy substituted.

Ames' Ledge, river Kennebec, Maine.—Iron socket, wooden shaft, in good condition.

Beef Rock, river Kennebec, Maine.—Iron socket, wooden shaft, in good condition.

Lime Rock, Back River, Maine.—Iron socket, wooden shaft, in good condition.

Carleton's Ledge, Back River, Maine.—Iron socket, wooden shaft, in good condition.

Clough's Rock, river Sheepscot, Maine.—Iron socket, wooden shaft, in good condition.

Merrill's Ledge, river Sheepscot, Maine.—Iron socket, wooden shaft, in good condition.

Yellow Ledges, Penobscot Bay, Maine.—Iron shaft, copper cylinder, in good condition.

Garden Island Ledge, Penobscot Bay, Maine.—Iron shaft, copper cylinder.

der; and one ball. Shaft good, lower part of cylinder partially broken away, and ball gone.

Otter Island Ledge, Penobscot Bay, Maine.—Iron shaft, copper cylinder, and two balls. Shaft bent, lower part of cylinder partially broken away, and one ball gone.

Ash Island Point, Penobscot Bay, Maine.—Iron socket, wooden shaft, in good condition.

Dodge's Point Ledge, Penobscot Bay, Maine.—Wooden shaft attached to stump of iron spindle, in good condition.

Pottersfield Ledge, Penobscot Bay, Maine.—Stone beacon, in good condition.

Lowell's Rock, Penobscot Bay, Maine.—Iron spindle and cage, in good condition.

Seals' Ledge, Penobscot Bay, Maine.—Iron spindle and cage, in good condition.

Harbor Ledge, Penobscot Bay, Maine.—Stone beacon, in good condition.

Shipyard Ledge, Penobscot Bay, Maine.—Iron spindle, broken off, not necessary.

Fiddler's Ledge, Penobscot Bay, Maine.—Stone beacon. Two or three stones of the upper course are out of place; otherwise in good condition.

North Point of Northeast Ledge, Camden Harbor, Maine.—Iron spindle, in good condition.

Morse's Point Ledge, Camden Harbor, Maine.—Iron spindle, in good condition.

Hosmer's Ledge, Castine Harbor, Maine.—Stone monument, in good condition.

Steel's Ledge, Belfast Harbor, Maine.—Stone beacon, in good condition.

Fort Point Ledge, river Penobscot, Maine.—Stone beacon, in good condition.

Odom's Ledge, river Penobscot, Maine.—Stone beacon, in good condition.

Buck's Ledge, river Penobscot, Maine.—Iron beacon, in good condition.

Centre Harbor Ledge, Edgemoggin Reach, Maine.—Iron socket, wooden shaft, in good condition.

Ship and Barges, Blue Hill Bay, Maine.—Iron socket, wooden shaft, in good condition.

Bunker's Ledge, Mount Desert, Maine.—Stone beacon, in good condition.

Half-Tide Ledge, Narraguagus Harbor, Maine.—Iron socket, wooden shaft, in good condition.

Norton's Reef, Pleasant River, Maine.—Iron tripod, shaft, and ball, in good condition.

Snow's Rock, Moosepeak Reach, Maine.—Iron socket, wooden shaft, in good condition.

Gilchrist's Rock, Moosepeak Reach, Maine.—Iron shaft and ball, in good condition.

Moose Rock, Moosepeak Reach, Maine.—Iron tripod, in good condition.

Western Bar, Lubec Narrows, Maine.—Wooden crib filled with stone, in good condition.

The Ledge, river Saint Croix, Maine.—Wooden crib filled with stone, in good condition.

DEPOT.

A wharf at the light-house depot at House Island, Portland Harbor, Maine, has been built during the year. Experiments with, and tests of steam and air fog-signals have been made at this depot since the last annual report, and are now in progress. Two steam fog-signals have been sent to the eighth light-house district, and a duplicate machine has been sent to Boston light-station, second district.

SECOND DISTRICT.

The second district extends from Hampton Harbor, New Hampshire, to include Gooseberry Point, entrance to Buzzard's Bay, and embraces all the aids to navigation on the coast of Massachusetts.

Inspector.—John G. Walker, United States Navy, until May 1, 1872; Commander George H. Perkins, United States Navy, present inspector.

Engineer.—Lieutenant-Colonel J. C. Duane, Corps of Engineers, brevet brigadier-general, United States Army.

In this district there are:

Light-houses and lighted beacons.....	58
Light-ships, (in position)	8
Light-ships, (for relief)	2
Fog-signals operated by steam or hot-air engines.....	2
Day or unlighted beacons.....	49
Buoys actually in position.....	506
Spare buoys for relief and to supply losses.....	375
Tender (steam) Verbena.....	1
Tender (sail) Florida.....	1

The numbers preceding the names of stations correspond with those of the "Light-House List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1872.

52. *Newburyport, Massachusetts*.—A frame dwelling for the keeper has been erected.

— *Newburyport range-lights*.—Negotiations are in progress for obtaining titles to the range-light sites in this harbor, and as soon as obtained the work of erecting suitable buildings will be commenced.

58. *Cape Ann, Thatcher's Island, Massachusetts*.—As there are now five keepers for the two lights and steam fog-signals at this station and but two dwelling-houses, a new dwelling for the principal keeper is required.

64. *Hospital Point, Salem Harbor, Massachusetts*.—A wooden dwelling for the keeper and a brick tower have been erected. The light, which has been exhibited from a temporary building, has been removed to, and is now established on, the new tower.

65. *Fort Pickering, Salem Harbor, Massachusetts*.—A wooden dwelling for the keeper and a concrete and iron tower have been erected. The light, which has been exhibited from a temporary structure, has been removed to, and is now established on, the new tower.

66. *Derby Wharf, Salem Harbor, Massachusetts*.—A permanent building of brick has been erected, and the light, which was exhibited from an old building near by, has been removed to it.

70. *Boston, Massachusetts*.—A Daboll fog-trumpet has been established at this station, and a duplicate machine furnished.

75. *Duxbury Pier, Plymouth Harbor, Massachusetts*.—This light-house was completed last season, and the light first exhibited September 15, 1871.

— *Wood End, Cape Cod, Massachusetts*.—Preparations are being made for the erection of a light-house at this place.

82. *Nanset Beach, Cape Cod, Massachusetts.*—The dwelling-house should be enlarged, or a small cottage built for the accommodation of the assistant keeper, as the building now occupied is entirely too small.

88. *Monomoy Point, Cape Cod, Massachusetts.*—The last annual report of the Light-House Board contains the following statement in relation to increasing the efficiency of this light:

Monomoy Point.—The light at this station, which is of the fourth order, on a tower about 40 feet high, was originally intended as a guide to *Old Stage Harbor*. The harbor has been filled with sand, and cannot now be entered, and the light is therefore of no further use for that purpose. But, inasmuch as nearly all vessels (both steamers and sailing) plying between New York and the eastern ports pass this point, and have now no other guide than the light-ships, which cannot be seen a sufficient distance, it is considered a matter of the greatest importance that this light should be replaced by one of sufficient power to guide vessels safely through this intricate passage. For this purpose, there is recommended a second-order fixed light, varied by red flashes, for which an estimate is submitted.

— *Point Gammon, near Hyannis, Massachusetts.*—This old light-house site has been disposed of at public sale.

91. *Nantucket, Island of Nantucket, Massachusetts.*—The beacon has been removed to the new site, and a keeper's dwelling erected.

106. *Holmes's Hole, Inner Harbor, Massachusetts.*—The lantern has been taken off and stored at the Wood's Hole Depot, and the land and buildings disposed of at public sale.

— *Holmes's Hole, (East Chop,) Massachusetts.*—A private light-station near Holmes's Hole, Vineyard Sound. Three 21-inch reflectors have been loaned to the keeper.

REPAIRS.

At each of the following-named stations, in the second district, there have been repairs more or less extensive during the last year:

54. *Ipswich*, entrance to Ipswich Harbor, Massachusetts.
56. *Annisquam*, entrance to Ipswich Harbor, Massachusetts.
57. *Straitsmouth*, Straitsmouth Island, Massachusetts.
58. *Cape Ann*, Massachusetts.
60. *Eastern Point*, Gloucester Harbor, Massachusetts.
61. *Ten-Pound Island*, Gloucester Harbor, Massachusetts.
62. *Baker's Island*, Salem Harbor, Massachusetts.
67. *Marblehead*, Marblehead Harbor, Massachusetts.
68. *Egg Rock*, off Nahant, Massachusetts.
69. *Minot's Ledge*, Boston Bay, Massachusetts.
71. *Narrows*, Boston Harbor, Massachusetts.
72. *Long Island Head*, Boston Harbor, Massachusetts.
73. *Plymouth*, Plymouth Harbor, Massachusetts.
76. *Race Point*, Cape Cod, Massachusetts.
77. *Long Point*, Cape Cod, Massachusetts.
78. *Mayo's Beach*, Wellfleet Bay, Massachusetts.
79. *Billingsgate*, Wellfleet Harbor, Massachusetts.
80. *Sandy Neck*, Barnstable Bay, Massachusetts.
81. *Cape Cod*, (Highlands Truro) Massachusetts.
- 82, 83, 84. *Nauset Beach*, (beacons,) Cape Cod, Massachusetts.
- 85, 86. *Chatham*, Cape Cod, Massachusetts.
87. *Pollock Rip*, light-ship, Massachusetts.
88. *Manomoy Point*, Cape Cod, Massachusetts.
89. *Shovelful Shoals*, light-ship, Massachusetts.
90. *Handkerchief*, light-ship, Massachusetts.
91. *Nantucket*, (Great Point,) Massachusetts.
92. *Sankaty Head*, Nantucket, Massachusetts.

93. *Nantucket*, South Shoal, light-ship, Massachusetts.
94. *Gay Head*, Martha's Vineyard, Massachusetts.
95. *Brant Point*, Nantucket Harbor, Massachusetts.
96. *Nantucket*, range-beacon, Massachusetts.
97. *Nantucket*, cliff, range beacon, (front,) Massachusetts.
98. *Nantucket*, range-beacon, (rear) Massachusetts.
99. *Bass River*, Vineyard Sound, Massachusetts.
100. *Bishop and Clerk's*, Vineyard Sound, Massachusetts.
101. *Hyannis*, Hyannis Harbor, Massachusetts.
102. *Cross Rip*, light-ship, Massachusetts.
103. *Cape Poge*, Martha's Vineyard, Massachusetts.
104. *Succonnessett*, light-ship, Massachusetts.
105. *Edgartown*, Edgartown Harbor, Massachusetts.
106. *Holmes' Hole*, (west chop,) Vineyard Haven Harbor, Massachusetts.
107. *Nobsque Point*, Wood's Hole Harbor, Massachusetts.
108. *Tarpaulin Cove*, Naushon Island, Massachusetts.
109. *Vineyard Sound*, light-ship, (Sow and Pigs,) Massachusetts.
110. *Hen and Chickens*, Light-ship, Massachusetts.
111. *Cuttyhunk*, Buzzard's Bay, Massachusetts.
112. *Dumpling Rock*, Buzzard's Bay, Massachusetts.
113. *Clark's Point*, New Bedford Harbor, Massachusetts.
114. *Palmer's Island*, New Bedford Harbor, Massachusetts.
115. *Ned's Point*, Mattapoisett Harbor, Massachusetts.
116. *Bird Island*, Sippican Harbor, Massachusetts.
117. *Wing's Neck*, Buzzard's Bay, Massachusetts.

The following-named light-stations in the second district require repairs to be made during the current and ensuing year :

57. *Straitsmouth*, Straitsmouth Island, Massachusetts.
77. *Long Point*, Cape Cod, Massachusetts.
116. *Bird Island*, Sippican Harbor, Massachusetts.
111. *Cuttyhunk*, Buzzard's Bay, Massachusetts.
91. *Nantucket*, (Great Point,) Massachusetts.
88. *Monomoy Point*, Cape Cod, Massachusetts.
99. *Bass River*, Vineyard Sound, Massachusetts.
82. *Nauset Beach*, (beacons,) Cape Cod, Massachusetts.
86. *Chatham*, Cape Cod, Massachusetts.
105. *Edgartown*, Edgartown Harbor, Massachusetts.
103. *Cape Poge*, Martha's Vineyard, Massachusetts.
- *Wood End Bar*, Provincetown Harbor, Massachusetts.

LIGHT-SHIPS.

87. "*Pollock Rip*," off *Chatham*, Massachusetts.—This vessel was carried by the ice in March last among the breakers of Great Round Shoal, and was rescued with great difficulty by the tender *Verbena*, with the loss of her moorings. She was supplied with new moorings, and returned to her station within two days from the time she was carried away. The cost of repairs, new moorings, &c., was \$1,765.38.

89. "*Shovelful*," on *Shovelful Shoal*, off *Chatham*, Massachusetts.—This vessel parted her moorings on account of the ice on the 7th March, and was towed into Vineyard Sound by United States revenue steam-cutter *Mahoning*. She was supplied with new moorings and returned to her station on the 12th of the same month. Cost of repairs and fittings, including new moorings, was \$1,858.40.

90. "*Handkerchief*," on *Handkerchief Shoal*, in *Vineyard Sound*.—This vessel was taken to New Bedford on the 22d of June, and is now being thoroughly repaired, at an estimated cost of \$7,500.

93. "*Nantucket Shoals*," *New South Shoal*.—This vessel broke adrift in a severe gale on the 5th March, experienced much heavy weather, and was driven far to the southward, arrived at Tarpaulin Cove on the 16th, then was towed to New Bedford, and all damages made good—supplied with new moorings, and returned to her station on the 25th of the same month. The cost of all the repairs, including the new moorings, amounted to \$2,705.23.

102. "*Cross Rip*," off *Cross Rip Shoal*, in *Nantucket Sound*.—This vessel will soon require extensive repairs, and will be brought in for the purpose as soon as a relief light-vessel is available. Cost of repairs and fittings amounted, during the past year, to \$168.77.

104. "*Succonnessett*," between *Succonnessett* and *Eldridge Shoals*, *Nantucket Sound*.—This vessel was taken into port in December last, and her station temporarily supplied by the York Spit light-ship No. 24. After a careful examination, it was thought expedient to repair her, as her services were absolutely necessary, Congress having failed to pass the appropriation asked for at the last session for a new light-ship. She is now being thoroughly repaired, at an estimated cost of \$6,000.

109. "*Vineyard Sound*," (*Sow and Pigs*), on *Succonnessett Shoal*, western entrance to *Vineyard Sound*.—This vessel is in good order generally, but will require repairs during this fiscal year. Cost of repairs and fittings amounted, during the past year, to \$607.81.

110. "*Hen and Chickens*," entrance to *Buzzard's Bay*.—This vessel is in good condition, and will require a new foremast before the winter sets in. Cost of repairs and fittings during the past year was \$337.12.

Relief No. 9.—This vessel has had her upper works recalced; is now in excellent order; at present she is on the *Handkerchief Shoal*. Expenses of repairs and outfits for the last year, \$532.90.

Relief No. 29.—This vessel was repaired and put in good order last autumn, at cost of \$2,658.57, and is now on the *Succonnessett Shoal*.

FOG-SIGNALS OPERATED BY STEAM OR HOT AIR ENGINES.

Cape Ann, Massachusetts.—A steam fog-whistle.

Boston, Massachusetts.—An air-trumpet.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the second district:

No. 1. *Old Cock*, *Buzzard's Bay*, *Massachusetts*.—Iron spindle 36 feet high, with cage at top.

No. 2. *Egg Island*, *Buzzard's Bay*, *Massachusetts*.—Granite cone, with iron spindle and vane at top.

No. 3. *Range Beacon*, *Fairhaven*, *Fort Point*, *Massachusetts*.—Iron triangular pyramid 40 feet high.

No. 4. *Cormorant Rocks*, south side of northeast entrance to *Mattapoisett Harbor*, *Buzzard's Bay*, *Massachusetts*.—Iron spindle, cage at top.

No. 5. *Lone Rocks*, northeast entrance to *Wood's Hole*, *Massachusetts*.—Iron spindle, cage at top.

No. 6. *Collier's Lodge*, entrance to *Centreville Harbor*, *Vineyard Sound*, *Massachusetts*.—Granite base, iron spindle, ball, and vane.

No. 7. *Great Rock*, west of *Point Gammon*, *Vineyard Sound*, *Massachusetts*.—Iron spindle, cage at top.

No. 8. *Hyannis Breakwater, east end, Massachusetts*.—Wooden spindle, four arms, and cask at top.

No. 9. *Sunken Pier, northeast part of Bass River Bar, Massachusetts*.—Wooden spindle, cask at top.

No. 10. *Spindle Rock, entrance Edgartown Harbor, Massachusetts*.—Iron spindle, cask at top.

No. 11. *Billingsgate Shoal, Massachusetts*.—Old site, timber beacon, with masts and slats.

No. 12. *Egg-Island Rock, entrance Wellfleet Harbor, Massachusetts*.—Wooden spindle, cask at top.

No. 13. *Duxbury Beacon, Massachusetts*.—Square granite and granite post at top.

No. 14. *Breakwater Beacon, Massachusetts*.—Square granite, with wooden spindle and cage.

No. 15. *Hogshead Beacon, Massachusetts*.—Iron spindle, with arm, cask, and cage at top.

No. 16. *North Beacon, entrance Scituate Harbor, Massachusetts*.—Iron spindle, with two rounds.

No. 17. *South Beacon, entrance Scituate Harbor, Massachusetts*.—Iron spindle, with two lozenges.

No. 18. *Londoner, off Thatcher's Island, Cape Ann, Massachusetts*.—Iron spindle, with cage at top.

No. 19. *Point Alderton, Massachusetts*.—Square granite pyramid, with cone at top.

No. 20. *False Spit, Massachusetts*.—Granite base, with iron spindle and cage at top.

No. 21. *Spit Beacon, Massachusetts*.—Square granite pyramid.

No. 22. *Nix's Mate, Massachusetts*.—Square granite base, with octagonal pyramid.

No. 23. *Great Farm Bar, Massachusetts*.—Square granite base, and granite cone, with iron spindle and cage at top.

No. 24. *Deer Island Point, Massachusetts*.—Square granite pyramid.

No. 25. *Bird Island, southeast point of Bird Island, Massachusetts*.—Iron spindle, with cage at top.

No. 26. *Sunken Island, Massachusetts*.—Granite base, with wooden spindle and cage at top.

No. 27. *Pig Rock, Massachusetts*.—Granite pyramid, with wooden spindle and cage at top.

No. 28. *Half-tide Rock, Massachusetts*.—Wooden shaft, with cask at top.

No. 29. *Cat Island, Massachusetts*.—Wooden spindle.

No. 30. *Marblehead Rock, Massachusetts*.—Conical granite, with wooden spindle.

No. 31. *Little Aquavitæ, entrance to Salem Harbor, Massachusetts*.—Granite, with wooden spindle and cage at top.

No. 32. *Great Aquavitæ, entrance to Salem Harbor, Massachusetts*.—Granite, with wooden spindle and cage at top.

No. 33. *Hardy's Rock, Massachusetts*.—Wooden spindle, with two triangles at top.

No. 34. *Bowditch Beacon, Massachusetts*.—The angular pyramid of granite, with wooden spindle and cage at top. Fallen down; should be rebuilt.

No. 35. *Half-way Rock, Massachusetts*.—Granite beacon, in ruins.

No. 36. *Little Haste, Massachusetts*.—Wooden mast, cask at top.

No. 37. *Abbott's Monument, Massachusetts*.—Square granite, with wooden mast and cask at top.

No. 38. *Monument Bar, Massachusetts*.—Square wooden crib filled with stone, mast and cage at top.

No. 39. *Ram's Horn, Massachusetts*.—Square wooden crib filled with stone, wooden shaft at top.

No. 40. *Lobster Rocks, Beverly Harbor, Massachusetts*.—Stone, with wooden spindle.

No. 41. *Black Rock, Gloucester Harbor, Massachusetts*.—Iron spindle, with cage at top.

No. 42. *Harbor Rock, Gloucester Harbor, Massachusetts*.—Iron spindle, with ball and cage at top.

No. 43. *Five-Pound Island, Gloucester Harbor, Massachusetts*.—Granite base, with iron spindle and ball at top.

No. 44. *Lobster Rock, Annisquam, Massachusetts*.—Square granite beacon is being rebuilt.

No. 45. *Lane's Point, Massachusetts*.—Square wooden beacon.

No. 46. *Point Neck Rocks, Massachusetts*.—Iron spindle, with ball at top.

No. 47. *Black Rocks, Newburyport Harbor, Massachusetts*.—Iron spindle, with cask at top.

No. 48. *North Pier, Newburyport Harbor, Massachusetts*.—Wooden crib filled with stone.

No. 49. *South Pier, Newburyport Harbor, Massachusetts*.—Wooden crib filled with stone.

DEPOT.

At Wood's Hole depot some repairs required on the wharf have been made. An adjoining lot of land has been purchased, and a frame building which stands on this lot has been repaired, and is now occupied by the lampist.

TENDERS.

The Verbena (steam) proving insufficient for the buoy-service of the second district, the schooner Florida (captured during the war and turned over at New Orleans for light-house purposes), was sent to Boston. Very soon after her arrival she capsized in a heavy squall off Boston Bay and foundered, and, with her cargo of coal for the light-houses in the vicinity, was a total loss. The crew were saved.

THIRD DISTRICT.

The third district extends from Gooseberry Point, Massachusetts, to include Squam Inlet, New Jersey, and embraces all the aids to navigation on the sea and sound coasts of Rhode Island, Connecticut, and New York; Narragansett and New York Bays; rivers Providence and Hudson, Whitehall Narrows, and Lake Champlain.

Inspector.—Commodore James H. Strong, United States Navy.

Engineer.—Colonel I. C. Woodruff, Corps of Engineers, brevet brigadier-general, United States Army.

In this district there are:

Light-houses and lighted beacons	125
Light-ships, (in position)	6
Light-ships, (for relief)	3
Fog-signals, operated by steam or hot-air engines	7
Day or unlighted beacons	41
Buoys actually in position	436
Spare buoys, (for relief and to supply losses)	436
Buoy-tenders (steam) Putnam, Cactus	2

Tender (steam) for engineer's constructions and repairs, Mistletoe	1
Launch (steam) for engineer's constructions and repairs, Rose	1
Supply-vessels (schooners) for supplying the light-houses of the Atlantic and Gulf coasts, Pharos and Guthrie.....	2

The numbers preceding the names of stations correspond with the Light-house List of the Atlantic, Gulf, and Pacific Coasts, and the Northern and Northwestern Lakes of the United States, issued January 1, 1872.

— *The Whale, Narragansett Bay, Rhode Island.*—This is a reef of rocks awash at all stages of tide, and a dangerous obstruction to navigation in the approach to the west channel of Narragansett Bay. This channel is habitually used by the daily line of Providence steamers which pass the locality during the night, carrying large numbers of passengers and valuable freights, and it is recommended that a light and fog-bell be erected on the ledge. The estimate of the engineer of the district for the structure is \$35,000, which is embraced in the estimates of the board.

119. *Beaver Tail, Rhode Island.*—The annual report of last year stated that a steam fog-signal (syren) would be erected at this station during the season. The examination of the locality for water for the use of the steam-engine proved entirely unfavorable, and sufficient water could not be collected from the roofs of the buildings and from the surface of the ground into cisterns, except at great expense. It was, therefore, decided to retain the character of the present signal, an air-trumpet, operated by a hot-air engine, but to increase very materially the power, by duplicating the engine and attaching a third reservoir to the apparatus, which it is believed will render the signal fully effective.

The housing, as well as the apparatus, is well advanced, and will be erected and put in operation as early as the middle of September.

— *Muscle Bed Beacon, Narragansett Bay, Rhode Island.*—In the annual report of last year it is stated as follows:

The construction of a light-house on Hog Island Reef has been petitioned for during several years past, but hitherto Congress has not granted an appropriation therefor. The erection of a portable light and a fog-bell on the existing stone-tower on the Muscle Bed, one-half mile distant, on the opposite side of the channel, at a cost of \$3,000, will, it is believed, obviate the necessity for this light-house, which would be a very expensive structure.

The steamboat company at Fall River keep a light and fog-signal at Hog Island Reef for their own benefit, and for that of others using the channel to Fall River, and it is deemed proper that the expense for the maintenance of a light and signal at this locality should devolve upon the Light-House Establishment. The recommendation for an appropriation is therefore renewed.

128. *Conimicut, River Providence, Rhode Island.*—In the annual report of last year, it was stated that—

When the light on the shoal off Conimicut Point was lighted as a substitute for the light on the main-land, at Nayat Point, (distant about one mile,) the only available means of attending upon it was to allow the keeper to retain the dwelling at the old light-station, and to visit the new light by boat. The land constituting the site of the old light-station at Nayat Point is valuable, and would bring at public sale a good price. The old tower is not worth the cost of tearing down, and the dwelling not having been repaired, in anticipation of an appropriation for completing the building at Conimicut Point, to include a proper dwelling for the keeper, it now becomes necessary, either to make considerable expenditure upon the Nayat Point dwelling, or ask for a special appropriation for the necessary protection-pier against running ice, and for a dwelling at that light-station. The estimated cost of the work is \$30,000.

The recommendation is renewed.

— *Bullock's Point, River Providence, Rhode Island.*—The beacon,

heretofore a day-mark, will be lighted by the 1st of October next, an appropriation of \$1,000 having been made for the purpose at the last session of Congress, on the petition of persons interested in the navigation of the channel, and after favorable reports from the inspector and engineer of the district had been made, to whom the subject was referred for examination.

129. *Sabin's Point, River Providence, Rhode Island.*—The contractor for this structure has made good progress with the work. The foundation and pier are completed, and the dwelling is advanced as far as the second story. It is contemplated to exhibit the light at the station by the 1st of October next.

130. *Pumham Rock, River Providence, Rhode Island.*—The light was first exhibited at this station on the 1st of December last. A boat-house and landing are needed, the estimate of which is \$1,200.

131. *Fuller's Rock, River Providence, Rhode Island.*—During the construction of this beacon it was lighted by a steamboat company for the benefit of the navigation of the channel to Providence. The failure of the contractor to comply with the terms of this contract has made it necessary to reject the work.

132. *Sassafras Point, River Providence, Rhode Island.*—During the construction of this beacon it was lighted by a steamboat company for the benefit of the navigation of the channel to Providence. In consequence of the failure of the contractor to comply with the terms of this contract, payment has not been made for the work.

133. *Point Judith, Rhode Island.*—In accordance with the recommendation in the last annual report an appropriation of \$5,000 was made at the last session of Congress for a steam fog-signal. The construction of this signal is in progress. It will be of that class characterized a syren, and of the first order. The housing is nearly completed, and the signal will be in operation early in September. The present signal will be retained as a spare apparatus, to be sounded in case of accident to the new one.

134. *Block Island, (north end,) eastern entrance to Long Island Sound.*—The sand-drifts threatened serious damage to the dwelling by the encroachment of the chasm, caused by the high winds. Partial remedies have been made by grading and facing the surface of the site in the immediate vicinity of the dwelling, and upon the north or exposed side with paving-stone. The work is not yet finished, and with the view of completing it, an appropriation recommended in the last annual report was made at the last session of Congress.

—, *Block Island, (south end,) eastern entrance to Long Island Sound.*—An appropriation of \$75,000 was made by the last Congress for a light-house and fog-signal at this locality, under a petition of persons interested in the navigation of this part of the coast. A preliminary survey of the southeast end of the island has been made, and a site favorable for the service of a steam fog-signal—a syren; a pond of fresh water being upon the site recommended, has been selected. Plans for the light-house and for fog-signal are in progress.

136. *Montauk Point, (New York,) eastern end of Long Island.*—The appropriation for the repairs of this station, and for the erection of a fog-signal as recommended in the last annual report, having been made, immediate measures will be taken for carrying into effect the object intended. It is proposed to erect a signal operated by a hot-air engine; in consequence of the difficulty of obtaining sufficient water for steam purposes, no other engine than that operated by hot air could be adopted at this locality.

141. *New London, Connecticut*.—The fog-signal having been in use fifteen years, needs renewing, and an estimate of \$4,500 is submitted for the purpose.

143. *Race Rock, Long Island Sound, New York*.—The proposals for the construction of the foundation and pier of this structure were so excessive in rates, and so much above the amount of the appropriation on hand, that no more than the landing and the enrockment of the foundation, and two courses of the pier, could be contracted for. This embraces 8,000 tons of dimension-stone, weighing from eight to ten tons each, for the enrockment alone. The landing has been commenced, and good progress made upon it.

The riprap foundation, consisting of ten thousand tons of riprap stones, irregular in shape, and weighing from three to five tons on an average, was completed in November last, and remained without displacement during the storms of winter and spring, and no appearance of settling is manifest. An appropriation for continuing the construction of the pier and erecting the dwelling is required, and the sum of \$75,000 is estimated, basing the estimate upon the proposal of the lowest bidder for the work now under contract.

144. *Little Gull Island, Long Island Sound, New York*.—This station needs an appropriation of \$5,000 for completing the landing, reference to which was made in the last annual report. There is special need for the facilities of a landing for the reason that the shelter from the sea is so limited that the difficulty of landing supplies of the station, including a large quantity of coal for the steam fog-signal, is unusually great. The recommendation for the appropriation of \$5,000 for completion of the landing is renewed.

147. *Long Beach Bar, Long Island, New York*.—The breakwater, for which an appropriation of \$20,000 was made, is under contract, and the iron-pile light-house will be placed under its shelter from the floating ice-fields that threaten destruction to buildings of this class, without such protection, in northern climates. The past winter endangered the structure, and the alarm of the keeper and his assistant was so great as to cause its desertion for two nights, during which no light was exhibited nor fog-bell sounded. The above light-house was completed, and the light exhibited for the first time, on the 1st day of December, 1871. The station is provided with a fog-bell struck by machinery.

150. *Calves Island, River Connecticut*.

151. *Brockway's Reach, River Connecticut*.

152. *Devil's Wharf, River Connecticut*.

The foundations of these structures are liable to disturbance by the river-currents, and efforts have been made to prevent their being undermined by throwing at their base riprap stone. There is now required for protection of the last-named structure a large quantity of stone; for this purpose, and for the protection of all these foundations, the sum of \$2,500 is recommended to be appropriated.

155. *Faulkner's Island, Long Island Sound, New York*.—The wasting away of the clay-bank continues slowly during the freezing and subsequent thawing of the soil. The beach requires to be protected at an estimated cost of \$2,500, which is recommended to be appropriated.

156. *New Haven Harbor, Connecticut*.—In answer to a resolution of Congress relating to the transfer of the light-house to Southwest Ledge, under date of April 16, 1872, it is stated as follows:

Southwest Ledge lies in the middle of the main ship-channel into New Haven Harbor, and forms a great danger to navigation. There are but 7 feet 6 inches of water on the rock at mean low water, and the question is between the removal of the rock by the

Engineer Department of the Army, and the erection by the board of a light and fog-signal to keep vessels from running upon it and other dangerous rocks in the vicinity. The main light at the entrance is now at Five-mile Point, on the mainland, on the east side of the harbor, and distant one mile from, and inside of Southwest Ledge. It was established in 1805, and last refitted in 1855. There is no doubt but that a light in the channel on this ledge would serve the interests of navigation better than the present light, and that it and a fog-signal also placed on the rock would be of more benefit to commerce than the removal of the ledge, since vessels could always run for the light, and keep clear of all the many dangers to navigation, which it will be observed exist at the entrance to New Haven Harbor. A light-house at Southwest Ledge would involve a very large expense on account of its submarine foundation, and the strength which would be required to resist the large fields of ice by which it would be assailed. The expense is estimated at \$117,800.

158. *Stratford Point, Connecticut*.—The buildings of this station are very old and unfit for occupation. An estimate for a suitable dwelling over which the tower may be placed, was submitted in the last annual report. It is recommended that the amount then submitted be appropriated, viz, \$15,000.

— *Stratford Point Shoal, Long Island Sound, New York*.—A special report was called for from the engineer of the district, with estimate of cost for a structure to supersede the light-ship. After a preliminary survey of the Middle Ground, he proposed to erect a light-house thereupon, and to discontinue the light-ship. The character of the formation is deemed suitable for a structure, the foundation of which should be riprap of large irregular blocks of granite from three to five tons each in weight. The least depth of water found at low tide is 5 feet 5 inches. An area of 100 feet diameter gives an average depth of 8 feet of water. The Middle Ground is composed of large gravel, unyielding to the iron rod driven by hand. The estimated cost of the structure is \$125,000.

160. *Bridgeport Harbor, Connecticut*.—The iron-pile light-house adopted for this locality has been completed and occupied by the keeper. The light has been exhibited in the new structure since November, 1871. A stone breakwater surrounding the light-house and protecting it from the floating ice-fields has recently been constructed. The light in the old structure has been discontinued.

161. *Penfield Reef, Connecticut*.—The foundation of riprap was laid during the previous season, and stood uninjured throughout the winter gales. The landing, wharf, and pier are in progress of construction under contract, and will be completed so far this season as to admit of the commencement of the dwelling, which is also under contract. The contractor for the pier, owing to his want of adequate means, has delayed the work, and the forbearance of the engineer toward him has alone prevented the annulling of his contract and the commencement of suit to recover the amount of the bonds.

162. *Old Field Point, Long Island, New York*.—Measures have been taken for the purchase of a right of way from the station to the public highway, there being two land-holders from whom the purchase must be made. Difficulties of removing claims have postponed the matter until next autumn, when it is believed satisfactory purchase may be concluded.

163. *Black Rock, Connecticut*.—The buoy-shed and wharf have been completed, coal-bins and derrick erected, and the station put in readiness for the storage of buoys, coal, and other articles to be used as an auxiliary depot for the district. The tower and keeper's dwelling (erected in 1808) are in an advanced state of decay, and need rebuilding. The new structure may be planned with the tower over the keeper's dwelling, and erected at a cost of \$9,500.

165. *Lloyd's Harbor, Long Island, New York.*—The sea-wall built only the previous season has been damaged by the ice of last winter, but measures will be taken to repair the same with the means on hand, as it is believed that the cost will be small.

— *Hart Island, Long Island Sound, New York.*—An appropriation having been made for a light-house at this station, the preliminary examination and survey have been made, and plans prepared for foundation, pier, and dwelling, preparatory to advertising for the construction.

169. *Sand's Point, Long Island, New York.*

173. *Great West Bay, Long Island, New York.*

174. *Fire Island, Long Island, New York.*

A special appropriation having been made for the repair of these stations measures will be speedily taken to place them in a good condition, and to repair the inclosures before the winter sets in.

176 and 177. *Highlands of Navesink, New Jersey.*—Application has been made to the Light-House Board to cause the substitution of a revolving light in one of the towers, and the question is now under consideration.

179. *East Beacon, Sandy Hook, New Jersey.*—The abrasion of the beach at this station is increasing; since the last annual report was submitted the abrasion has been about 80 feet. This increase was anticipated, as will be seen by the report referred to, and is due to the erection of the jetties for its protection near the fort, which cut off the supply of sand from the eastward. It is necessary that recourse be had to similar works to protect the light-house property, for which the estimate rendered last year of \$20,000 is renewed.

185. *Elm Tree Beacon, New York Bay, New York.*—The abrasion of the beach at this station is caused by a long wharf on the northward, which is struck by the rolling seas from the southeast, which diverts their course to the beach, and creates a violent disturbance; at the same, on the cessation of the storm, the usual littoral accretion is cut off by the same wharf and retained to the northward. The small jetty constructed on the south line of the station had been damaged by the sea, and a breach made severing its connection with the shore. This breach is in progress of repairs as well as general repairs of the jetty. It is likely that recourse must finally be had to a riprap along the entire front of the station for its preservation.

187. *Princess Bay, New York Bay, New York.*—The progress of the protecting wall commenced last season has been slow. The contractor having lost a capacious barge on the occasion of a storm, considerable delay has ensued in the work, and less than 500 feet of the wall has been completed. The work is in progress, and so far as built has produced good results.

188. *Fort Tompkins, New York Bay, New York.*—The plans for the light-house appropriated for at the last session of Congress have been made, and the work will be put under contract for completion before the winter season. As the station lies within the inclosure of the defensive works, the space occupied will be reduced to the smallest limit, and the plans contemplate the placing of the tower over the keeper's dwelling. The old site will then be relinquished for the purposes of a battery.

195. *West Point, River Hudson, New York.*—The rebuilding of the beacon is progressing, and will be completed at an early day. The site of the beacon is connected with that of the former stake-light, and no change in the sailing directions is made.

196. *Esopus Meadow, River Hudson, New York.*—The new light-house,

with tower over the keeper's dwelling, is nearly completed, and the light will probably be exhibited during the month of August. The distance from the old light-house site is small, and no important change in sailing directions is made.

198. *Saugerties, river Hudson, New York.*—The old light-house dwelling at this place has been sold, and the proceeds of the sale deposited and carried to the surplus fund.

— *Middle Ground, near Hudson, River Hudson, New York.*—The preliminary survey of the site has been made, and the plans have been prepared.

201. *Stuyvesant, River Hudson, New York.*—The old dwelling has been refitted, with the view of using it as a store-house for the river Hudson beacons during the winter season on the suspension of navigation. The roadway has been raised above the level of the freshets, and a small bridge built, with projection of piles against the bridge and its approaches.

202–213. *River Hudson Beacons, New York.*—Ten crib and stone piers for the portable beacons have been rebuilt during the past season, and the beacons reset on the opening of navigation. One of the sites, that of 209, *Cow Island*, has been encroached upon by the freshets, some 25 feet of the island having been washed away. A pile protection will be necessary to save the foundation from entire destruction. 211, *Van Wies Point* beacon, is also being undermined by the waves caused by the passing steamers. For its protection 100 tons of stone are needed.

— *Whitehall Narrows, Lake Champlain, New York.*—Eight of the beacons were removed during the winter and replaced after the ice disappeared. The recommendation to replace two stake lights by portable beacons, in the last annual report, is renewed, the estimated cost of same being \$1,600.

Two stake-lights, maintained at the expense of the commerce through the Narrows, should be assumed by the Light-House Establishment and portable beacons placed in their stead. The cost of the two will be \$1,600.

446. *Crown Point, Lake Champlain, New York.*—The buildings authorized by the appropriation of the last session of Congress will be erected, and all the necessary repairs will be attended to during the present season.

447. *Barber's Point, Lake Champlain, New York.*—The contract for the erection of the dwelling and tower is being carried out, with a prospect of completing the work before the close of navigation; but it is questionable whether the light can be exhibited before next season.

448. *Split Rock, Lake Champlain, New York.*—The boat-house and ways, with capstan and rigging, authorized by the special appropriation of last year, have been constructed.

449. *Juniper Island, Lake Champlain, New York.*—The boat-house and wharf authorized by the appropriation of March 3, 1871, were completed during the past season.

450, 451. *Burlington Breakwater, Vermont.*—The extension of the breakwater by the Engineer Department of the Army northward has been postponed, and in consequence thereof that end of the work has been marked by a portable beacon instead of erecting the dwelling contemplated by the appropriation of March 3, 1871. This, however, answers every purpose that is needed, although it is not so convenient for the keeper to serve the beacon.

452. *Colchester Reef, Lake Champlain, Vermont.*—The past winter has subjected the structure, so recently built, to a severe test. The fields

of ice have caused some injury, and the foundation is said to have settled. The examination has not thus far been made by the engineer of the district, and the precise extent of the injury is not known.

453. *Bluff Point, Valcour Island, New York.*—The title to the site not having been declared valid by the proper authorities, no measures have been taken to commence the work, a contract for which was made in anticipation of such declaration.

456. *Cumberland Head, Lake Champlain, New York.*—Negotiations are yet pending for the purchase of the land on the lake shore for the purpose of removing trees that obstruct the light from the channel to the northward.

458. *Isle La Motte, Lake Champlain, New York.*—The recommendation for a dwelling at this station, at an estimated cost of \$8,000, in the last annual report, is renewed.

REPAIRS.

At each of the following stations in the third district, repairs, more or less extensive, have been made during the year :

121. *Newport, Rhode Island.*
122. *Rose Island, Rhode Island.*
127. *Warwick Neck, Rhode Island.*
128. *Conimicut, Rhode Island.*
133. *Point Judith, Rhode Island.*
135. *Watch Hill, Rhode Island.*
136. *Montauk Point, New York.*
140. *North Dumpling, Long Island Sound.*
141. *New London, Connecticut.*
144. *Little Gull Island, New York.*
145. *Gardiner's Island, New York.*
154. *Horton's Point, New York.*
155. *Faullkner's Island, New York.*
162. *Old Field Point, New York.*
163. *Black Rock, Connecticut.*
165. *Lloyd's Harbor, New York.*
166. *Norwalk Island, Connecticut.*
168. *Execution Rocks, New York.*
169. *Sands' Point, New York.*
170. *Throgg's Neck, New York.*
171. *North Brother Island, New York.*
173. *Great West Bay, New York.*
174. *Fire Island, New York.*
- 176-177. *Highlands of Navesink, New Jersey.*
178. *Sandy Hook, New Jersey.*
181. *Conover Beacon, New Jersey.*
188. *Fort Tompkins, New York.*
189. *Robbins's Reef, New York.*
194. *Stony Point, New York.*
196. *Esopus Meadows, New York.*
197. *Rondout, New York.*
198. *Saugerties, New York.*
200. *Coxsackie, New York.*
201. *Stuyvesant, New York.*
- 430-445. *Whitehall Narrows, New York.*
446. *Crown Point, New York.*
449. *Juniper Island, New York.*

- 450, 451. *Burlington Beacons*, Vermont.
- 457. *Point au Roches*, New York.
- 459. *Windmill Point*, New York.

The following-named stations in the third district require repairs to be made during the current and ensuing year:

- 121. *Newport Harbor*, Rhode Island.
- 124. *Poplar Point*, Rhode Island.
- 125. *Prudence Island*, Rhode Island.
- 126. *Bristol Ferry*, Rhode Island.
- 127. *Warwick Neck*, Rhode Island.
- 134. *Block Island*, Rhode Island.
- 146. *Plum Island*, New York.
- 149. *Saybrook*, Connecticut.
- 150. *Calves Island*, Connecticut.
- 151. *Brookway's Reach*, Connecticut.
- 152. *Devil's Wharf*, Connecticut.
- 158. *Stratford Point*, Connecticut.
- 163. *Black Rock*, Connecticut.
- 169. *Sand's Point*, New York.
- 173. *Great West Bay*, New York.
- 174. *Fire Island*, New York.
- 178. *Sandy Hook*, New Jersey.
- 182. *Chapel Hill*, New Jersey.
- 184. *Waackaack*, New Jersey.
- 192. *Passaic*, New Jersey.
- 197. *Rondout*, New York.
- 198. *Saugerties*, New York.
- 199. *Four-Mile Point*, New York.
- 200. *Coxsackie*, New York.
- 201. *Stuyvesant*, New York.
- 209. *Cow Island*, New York.
- 211. *Van Weis Point*, New York.
- 249. *Juniper Island*, New York.

The following-named stations in the third district are not mentioned elsewhere:

- 120. *Lime Rock*, Newport Harbor, Rhode Island.
- 123. *Dutch Island*, Narragansett Bay.
- 137. *Stonington Harbor*, Connecticut.
- 139. *Morgan's Point*, Connecticut.
- 148. *Ceder Island*, New York.
- 157. *New Haven Long Wharf*, Connecticut.
- 167. *Great Captain Island*, Long Island Sound.
- 183. *Point Comfort Beacon*, New Jersey.
- 190. *Bergen Point*, New Jersey.
- 191. *Corner Stake*, New Jersey.
- 193. *Elbow Beacon*, New Jersey.

LIGHT-SHIPS.

118. "*Brenton's Reef*," on *Brenton's Reef*, off entrance to *Newport Harbor*, Rhode Island.—This vessel is now undergoing repairs at New London, and her place is supplied by Relief No. 19.

138. "*Eel Grass*," on *Eel-Grass Shoal*, in *Fisher's Island Sound*, *Connecticut*.—This is a third-class light-ship formerly stationed in *Roanoke Sound*, *North Carolina*. A screw-pile light-house having been erected there, her services were no longer necessary, and she was removed to this station, and will probably last for two or three years.

142. "*Bartlett's Reef*," off *New London*, *Connecticut*.—This vessel requires her upper deck to be calked; otherwise she is in good condition.

153. "*Cornfield Point*," *Long Island Sound*, off mouth of *Connecticut River*.—This vessel, which was removed from *Eel-Grass Shoal*, is in good condition, except damage amounting to \$175, caused by being run into by the schooner *J. G. Drew*, of *Belfast, Maine*. This damage is now being repaired.

159. "*Stratford*," on "*Middle Ground*," *Long Island Sound*, off *Stratford Point*.—This vessel is in fair condition, but in a few years she will require rebuilding, as will be observed elsewhere in this report. It is recommended that a fourth order light be erected on this shoal, as being more economical and far more durable than a light-ship.

175. "*Sandy Hook*," off *New York Bay*.—This vessel, stationed seven miles outside of *Sandy Hook*, has been repaired during the last year, at a cost of \$17,159.60. A new mooring-chain, costing \$1,158.80, has been supplied. She is now in excellent condition. A "Thiers automatic fog-signal, bilge-pump, and ship ventilator" has been placed on the vessel for experiment and test-trial. It has been found successful as a bilge-pump and ventilator, and will be retained. As a fog-signal it did not prove satisfactory.

Relief No. 19.—This vessel is in good condition, and is now on *Brenton's Reef*, off *Newport*, while the vessel belonging to that station is being repaired.

Relief No. 20.—This vessel, which is also in good order and ready for any emergency, is now at the light-house depot at *Staten Island*, *New York Harbor*.

Relief No. 25.—The condition of this vessel, owing to age and service, is found on a strict examination to be so bad as to render her unworthy of further repairs; she has been removed from *Cornfield Point* and taken to *New London*, *Connecticut*, and her sale is recommended.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

119. *Beaver Tail*, *Rhode Island*.—First-class Daboll trumpet.

133. *Point Judith*, *Rhode Island*.—Third-class Daboll trumpet.

141. *New London*, *Connecticut*.—Third-class Daboll trumpet.

144. *Little Gull Island*, *New York*.—Second-class syren, (in duplicate.)

164. *Eaton's Neck*, *New York*.—Second-class syren, (in duplicate.)

168. *Execution Rocks*, *New York*.—Second-class Daboll trumpet, (in duplicate.)

179. *Sandy Hook*, entrance to *New York Harbor*.—First-class syren, (in duplicate.)

DAY OR UNLIGHTED BEACONS.

All the beacons in the third district comprised in the following list are in good condition, unless otherwise stated:

1. *East Lime Rock*, near *Newport*.—A granite structure, surmounted by a spindle and cage.

2. *South Point*, *Rose Island*, *Narragansett Bay*.—Granite structure, surmounted by a spindle and cage.

3. *Half-way Rock, three-fourths of a mile southward of Prudence Island Point, Narragansett Bay.*—Spindle and square cage.

4. *Bullock's Point, Narragansett Bay.*—Stone beacon with iron spindle. This beacon will be lighted under an appropriation of the last session of Congress for the purpose.

5. *Pawtuxent Beacon, Narragansett Bay.*—Of stone, surmounted by a black ball.

6. *Punham Beacon, River Providence.*—A stone beacon, with vane and black ball.

7. *Muscle Bed, east side of the channel, below Bristol Ferry, Rhode Island.*—A stone beacon, with iron spindle and day-mark.

8. *Borden's Flats, opposite Fall River.*—A stone beacon, with iron column and day-mark.

9. *Castle Island, near north end of Hog Island, Bristol Harbor.*—A stone beacon, surmounted by a red ball.

10. *Allen's Rock, River Warren.*—Stone beacon, one-eighth of a mile north of Adams's Point.

11. *Warwick or Spindle Rock, west channel of Narragansett Bay, and entrance to Greenwich Harbor, between Warwick Neck and Pojack Point.*—Iron spindle, with square wooden cage.

12. *White Rock Beacon, at the entrance of Wickford Harbor, Narragansett Bay.*—Stone beacon, with iron column and day-mark.

13. *Watch Hill Spindle, entrance to Fisher's Island Sound from light-house, southwest by south three-fourths of a mile.*—Stands on a rock which is bare at low water, and is surmounted by a cage.

14. *Sugar Reef Beacon, Fisher's Island Sound.*—Iron pile-beacon, with cage-work day-mark in the form of a cone.

15. *East or Catumb Reef Spindle, entrance to Fisher's Island Sound, by Lord's Channel, one and one-fourth miles east of east point of Fisher's Island.*—An iron pile-beacon, with square cage-work.

16. *West or Wicopesset Spindle Rock, entrance to Fisher's Island Sound by Lord's Channel, northwest of east spindle, two-thirds of a mile.*

17. *Latimer's Reef, Fisher's Island Sound, one mile northwest of east point of Fisher's Island, and three-fourths of a mile southeast of Eel Grass Shoal light-vessel.*—An iron spindle, bearing a square cage-work.

18. *Ellis's Reef, Fisher's Island Sound, three-fourths of a mile northwest of Eel Grass Shoal light-vessel.*—An iron spindle with a square cage-work.

19. *Ram Island Reef, Fisher's Island Sound, one-half of a mile southeast of Ram Island.*

20. *Spindle on The Whale, River Mystic.*—An appropriation of \$5,000 has been made for substituting a stone-beacon for the iron spindle destroyed by ice. The structure is under contract, and will be completed before the season of fall gales.

21. *Crook's Spindle, River Mystic.*—Is an iron spindle, with keg on top.

22. *Groton Long Point, Fisher's Island Sound.*—An iron spindle, bearing a cage-work in the form of an inverted cone.

23. *Sea Flower Beacon, Fisher's Island Sound, Connecticut.*—An appropriation of \$4,200 has been made for rebuilding this beacon. It is under contract, and will be completed at an early day.

24. *Black Ledge, entrance to New London Harbor, Connecticut.*—The iron spindle on this ledge was carried off during the last season subsequent to submitting the annual report. It is recommended that a stone beacon of a substantial kind be substituted for the iron spindle, for which an estimate of \$5,500 is submitted for the beacon and the renewal

of the iron shaft bearing a cage-work, formed by two cones connected at the vertices.

25. *Saybrook Beacon, River Connecticut*.—Stone beacon, with globe, on Saybrook Bar.

26. *Hen and Chickens, Long Island Sound*.—Iron spindle, bearing a square cage, painted black.

27. *Branford Reef Beacon, Long Island Sound*.—Granite beacon, surmounted by an iron shaft bearing a black day-mark.

28. *Quize's Ledge, entrance to New Haven Harbor, Connecticut*.—An iron spindle, with a cask on top. Stands on a rock which is dry at half tide.

29. *Southwest Ledge Spindle, entrance to New Haven Harbor, Connecticut*, marked by a second-class buoy.

30. *Stratford River Beacon, entrance to River Stratford*.—Granite beacon, with iron column and mark.

31. *Inner Beacon, Bridgeport Harbor, Connecticut*.—A frustum of a square pyramid of wood, surmounted by a wooden mast, with a cask painted black.

32. *Outer Beacon, Bridgeport Harbor, Connecticut*.—The same as the inner beacon.

33. *Black Rock Beacon, Long Island Sound*.—An iron pile-beacon, with a cage on top.

34. *Southport Beacon*.—Granite beacon, with iron column and day-mark.

35. *Southport Breakwater Beacon*.—Granite beacon, with iron column and day-mark.

36. *Norwalk Beacon, southwest of Norwalk Island, Connecticut*.—A granite structure, supporting a shaft and day-mark of iron.

37. *Great Reef, off Norwalk Island, entrance to Norwalk Harbor*.—A wooden spindle, with cage day-mark.

38. *Sand's Spit Beacon, Sag Harbor, Long Island, New York*.—The contractor for building this beacon has not placed the same on the site designated, nor has he built it in accordance with agreement. Payment has therefore been withheld until he complies with the contract, or until an adjustment for the value of the work executed can be concluded between him and the engineer of the district that may be satisfactory to the Light-House Board. The contractor has been notified to this effect.

— *Oyster Pond Point, Plum Gut, entrance to Gardiner's Bay*.—An appropriation of \$5,000 has been made for a beacon of granite as a substitute for the iron spindle destroyed by ice. The structure has been put under contract, and will be completed before the season of autumn gales.

40. *Success Rock, Long Island Sound*.—An iron shaft, with conical cage-work.

41. *Romer Shoal Beacon, New York Bay*.—The riprap protection for this beacon, authorized by the appropriation of March 3, 1871, has been made, and consists of 950 tons of granite blocks of large irregular shape. The painting of the upper section of the tower remains to be done.

42. *Mill Reef Beacon, Kill van Kull, opposite New Brighton*.—This is a sheet-iron beacon, filled in with concrete, and secured to a granite base. It is conical in shape, and supports an iron shaft with an iron cage on top.

LIGHT-HOUSE GENERAL DEPOT, AT STATEN ISLAND, NEW YORK HARBOR.

This depot contains the manufacturing establishment, vaults for the storage, and apparatus for photometrical tests, of oil, and store-houses for the general supplies, &c., for the service of the lights in the Atlantic,

Pacific, Gulf and Lake coasts of the United States. The office building has been completed, and occupied by the engineer and inspector of the third district during the last fiscal year. The dwelling of the inspector has been repaired, and occupied by him. The other buildings have been repaired; also the fences and wharves, including additional piling for the convenience of the tenders in coaling, &c. One derrick of ten tons' lifting capacity has been erected on one of the wharves, and another of similar capacity is in readiness to be erected on the other wharf. The grounds have been partly graded and drained. The coal-bin has been enlarged to increase the capacity for 400 tons additional of coal. A new boiler has been supplied for the workshop, and the old one repaired and ready for resetting as a duplicate or reserve. The oil-vaults will soon undergo considerable repair, rendered necessary by defective drains, the capacity of which were found to be insufficient, and with so little declivity that the filling up by sediment has been rapid. Drains of 18 inches radius and semicircular in form have been authorized by the board, as also drains in the rear of the vault, and lateral drains to connect with the large 12 and 18-inch drains of the grounds. This will involve considerable expense. For this purpose and for the completion of the grading and drainage of the grounds, the construction of a large cistern for collecting the rain-fall from the buildings now mostly wasted, and which can be utilized for the use of the light-house tenders, the sum of \$10,000 will be required, and is recommended to be appropriated.

The following is a statement of the number of boxes, barrels, packages, &c., containing articles of supply and outfit for light-stations, and received at and shipped from light-house general depot, Tompkinsville, Staten Island, from July 1, 1871, to July 31, 1872, inclusive:

	Boxes.	Barrels.	Packages, cases, &c.	Totals.
Received	3, 136	2, 918	5, 542	11, 596
Shipped	2, 632	2, 663	5, 058	10, 553
Total	5, 968	5, 581	10, 600	22, 149

Lenses received from France and delivered from light-house depot, Staten Island, from July 1, 1871, to June 30, 1872.

	1st order.	2d order.	3d order.	3d order.	4th order.	5th order.	6th order.	Steamer lenses.	Pressed lenses.	Canal lenses.	Totals.
Received	4	3	2	1	20	12	25	3	11	3	84
Delivered	3	3	3	1	8	6	14	2	10	2	49
Total	7	3	5	2	28	18	39	5	21	5	133

Number of boxes containing illuminating apparatus received at and shipped from light-house depot, Staten Island, from July 1, 1871, to June 30, 1872.

	1st order.	2d order.	3d order.	3d order.	4th order.	5th order.	6th order.	Steamer lenses.	Pressed lenses.	Canal lenses.	Total.
Received	145	70	25	10	61	29	60	7	12	10	.....
Delivered	99	34	34	22	19	42	3	11	6	.....	.....
Total	244	70	59	10	83	48	102	10	23	16	665

List of articles manufactured and repaired in lamp-shop, light-house depot, Staten Island, from July 1, 1871, to June 30, 1872.

	Lenses.	Lamps.	Lamp burners.	Miscellaneous articles.	Totals.
Manufactured		236	295	657	.....
Repaired	9	90	11	1,135	.....
Total	9	326	306	1,792	2,433

FOURTH DISTRICT.

The fourth light-house district extends from Squam Inlet, New Jersey, to and including Metomkin Inlet, Virginia. It includes the sea-coast of New Jersey below the Highlands of Navesink, the bay coasts of New Jersey and Delaware, the sea-coasts of Delaware and Maryland, and part of the sea-coast of Virginia.

Inspector.—Commodore William H. Macomb, United States Navy, till his death, August 12, 1872; Captain Reigart B. Lowry, United States Navy, present inspector.

Engineer.—Colonel I. C. Woodruff, Corps of Engineers, brevet brigadier-general, United States Army.

In this district there are:

Light-houses and lighted beacons	18
Light-ships, (in position)	2
Light-ships, (for relief)	1
Buoys actually in position	111
Spare buoys for relief and to supply losses	66
Tender (steam) Violet	1

The numbers preceding the names of stations correspond with those of the Light-House List of the Atlantic, Gulf, and Pacific Coasts of the United States, issued January 1, 1872.

214. *Barneгат, sea-coast of New Jersey.*—The semi-monthly measurements along the beach near the light-house have been continued throughout the year, and there have been no important changes in the water-lines along the light-house lot. Thus far the works of protection have proved a success.

215. *Tucker's Beach, sea-coast of New Jersey.*—In September last the color of the tower and keeper's dwelling were changed from gray to red, to serve better as a day-mark for passing vessels.

216. *Absecum, sea-coast of New Jersey.*—The semi-monthly measurements along the beach in the vicinity of the light-house have been continued throughout the year, and favorable changes in the beach have been found to have taken place along the entire front of Atlantic City. There has been a gradual widening of the beach on the ocean-front, and at the point of the inlet. The north-channel cut of the inlet has been buoyed, and is now used by the largest vessels entering the harbor, as it is a more direct course in and out of the inlet.

The time is not distant when the south channel will be closed; it is a crooked and narrow one, and the strength of the current in the ebb-tide is not so great as formerly. It is reported that most of the vessels, passing in and out of the inlet, go through the north channel, and recently a schooner of 260 tons, loaded with ice for Atlantic City, draw-

ing 8½ feet water passed in through the north channel at about half-tide. It is a matter of regret that possession of the necessary land along the inlet front cannot be obtained for the works of protection of the beach. From careful examinations it is manifest that if small stone jettées were placed along the inlet, a much greater quantity of the ebb-tide water would be thrown through the north channel, and the time would not be long before the south channel would be closed. At the present time no fears need be apprehended for the safety of the light-house site. The color of the tower was changed in September last, to better serve as a day-mark for passing vessels, as follows: the lower section for 52 feet from the base, white; the middle section 52 feet, red; and the upper section, including the lantern, parapet, and gallery-railing, white. The authorities of Atlantic City have not yet furnished the deed from the property owners for the occupation of the land required for sites, &c., for works of protection. The mayor states that there is now but one person to sign the grant, to enable him to have the papers prepared giving possession to the Government for commencing the work.

—*Hereford Inlet, sea-coast of New Jersey, ten and three-quarters nautical miles north of Cape May's light-house.*—Congress at its last session having appropriated \$25,000 for erecting a light-house at or near this point, measures will be taken without delay to locate its site, and make arrangements for the purchase of a suitable piece of ground, with the necessary steps for the cession of jurisdiction by the legislature of New Jersey to the Government of the United States.

219. *Cape Henlopen, sea-coast of Delaware, entrance to Delaware Bay.*—Trouble has been anticipated at this station by the encroachment of the "Big Sand Hills" near it. There are changes constantly going on, but no serious inconvenience has yet resulted from them, nor is it thought there will be as long as the space between the tower and dwelling is kept open by removing the sand as fast as it accumulates.

220. *Cape Henlopen Beacon, Delaware Bay.*—On the 28th of July last the building was struck by lightning, and it tore off the cornice of the building, but did no other damage.

221. *Delaware Breakwater, Delaware Bay.*—A new frame structure for the fog-bell and striking-machinery has been erected. The bell and machinery have been thoroughly cleaned, the machinery has been repaired, the motive weight has been reduced about 600 pounds, and the fog-signal is now in good condition.

—*Mispillion, Delaware Bay.*—Congress, at its last session, appropriated \$5,000 for re-establishing the small light-house at this point, and it will be commenced at an early day.

—*Light-houses at Cross Ledge Shoal, Ship John Shoal, and Bulk-head Shoal, Delaware Bay and River.*—During the last session of Congress a petition was received for lights at Ship John Shoal and Bulk-head Shoal, in the river Delaware, of which the following is a copy:

PHILADELPHIA, January, 1872.

To the HON. GEORGE S. BOUTWELL,

Secretary of the Treasury:

The aids to navigation in the Delaware River and Bay, which have long been insufficient, are now, when steamships are to a great extent superseding sail-vessels, altogether inadequate to the requirements there. These ships run at all seasons of the year, and at all hours, by night as well as by day, and the buoys which mark the shoals and serve, when they can be seen, as guides to the mariner in keeping the channel, are useless in dark nights always, and in winter they are deceptive and dangerous; for at that season the drift-ice which covers these waters changes the location of some of these buoys and sweeps others entirely away. Experienced mariners, convers-

ant with the navigation here, are, therefore, clearly of opinion that permanent light-houses are the most efficient guides to navigation in the long and intricate channels of the Delaware, and the only ones that are available at all times and all seasons of the year. The last annual report of the Light-House Board (pages 27 and 28) recognizes this fact by its recommendation of a light-house in place of the light-ship on the Cross Ledge, which is often displaced by drifting ice, and also recommends the erection of a light-house on Tinicum Island, above Chester. These recommendations, if carried into effect, will be great and permanent benefits to the commerce of this port; but there is also urgent need of light-houses at other points, viz, at the Ship John Shoals, at Reedy Point, and at the upper end of the Bulk-head Shoals.

The undersigned corporations and citizens of Philadelphia, interested in its commerce, respectfully ask your attention to the foregoing statements, and earnestly request you to institute such measures as will supply the requisite aids to the navigation of our river and bay as herein set forth.

JOEL PARKER,

Governor of New Jersey.

JAMES PONDER,

Governor of Delaware, and others.

The question as to the necessity of these lights, and their cost, was submitted to the district officers, and in their replies it was stated that there was great necessity for the lights at the points named, and more so now than formerly, on account of the greater number of steamers navigating the river and bay at all hours of night and day; and when there is floating ice, the buoys being either cut off or drifted from proper positions, and during darkness invisible, the soundings cannot be taken, the lead frequently lighting on the cakes of ice, while the vessel in motion is liable to run on shore before getting another cast of the lead; whereas, were lights in their positions they could steer their courses.

The necessity for a light on Ship John Shoals is to guide vessels up the channel and prevent them from getting ashore on Ship John Shoals and the one opposite, the tide being such as to drift them at times on either shoal. This drifting is frequently experienced in this part of the channel.

On the north end of Bulk-head Shoals, a light is necessary to further show the channels past Bulk-head Shoals, and in order that vessels may shape their course past Deep-Water Point.

In view of the fact that neither the light-house at Ship John Shoals nor Bulk-head Shoals can be constructed in a single fiscal year, and the impossibility of leaving either structure in an unfinished condition over winter without a probability of the loss of the whole of it by the ice, making it necessary to use one entire season, including spring, summer, and fall, (parts of two fiscal years,) for its erection at the site, after the preparation of the material during the previous season, it is earnestly recommended that the appropriation for Ship John Shoals and Bulk-head Shoals, if Congress should deem it proper to make them, in view of the facts presented in the accompanying reports, shall be available during two entire fiscal years.

It was further stated that the cost of each light-house would be \$125,000.

The want of a light-house at Cross Ledge Shoals, in Delaware Bay, is very great, for the reasons, 1st, that the light-ship now stationed there is often driven from her moorings by fields of ice, endangering her own safety and (by absence from her station) the safety of commerce. 2d. The erection of a light-house to take the place of the light-ship, would save the very considerable expense of her crew, and the repairs which from year to year are necessary, and involve much expense. The policy of the board is to replace, in all cases where it is possible, our light-ships by light-houses on the shoals which the former are intended to mark, being more certain in their service and involving much less

expense for maintenance. The board recommends appropriations for the erection of lights at Cross Ledge, Ship John, and Bulk-head Shoals, the estimated cost of which is \$125,000 each.

226. *Mahon's River, Delaware Bay.*—As was stated in the last annual report, the abrasion of the marsh in which this light-house stands is so great as to compel a change of site. There is a good location about a quarter of a mile north of the present site, which will serve equally well the purposes of navigation. If all the material can be prepared ready to commence the work of erection of the structure at the site by the 1st of July next, the whole can be completed ready for lighting by the following November. If a site and right of way can be purchased, at a moderate cost, the amount asked for by the board, viz, \$15,000, will be sufficient to erect a building.

Proposed light-house, Reedy Point, Delaware Bay.—An appropriation of \$3,000 for a beacon-light on this point was approved on the 3d August, 1854. The price asked by the owners for the necessary site, with the right of way, was \$3,000, being the whole amount appropriated, which was allowed to revert to the Treasury, as the demands of the owners were considered unreasonable. During the last year petitions for this light have been received; but it is believed that a sixth-order lens light placed on the south end of Pea Patch Island (Fort Delaware) would serve the purpose of navigation as well. To construct a suitable structure, including the lens, will cost about \$8,000, and an estimate therefor is presented.

REPAIRS.

At each of the following-named light-stations in the fourth district there have been repairs and renovations more or less extensive since the last annual report.

- 214. *Barnegat*, sea-coast of New Jersey, Barnegat Inlet.
- 215. *Tucker's Beach*, sea-coast of New Jersey, Little Egg Harbor Inlet.
- 216. *Absecum*, sea-coast of New Jersey, Absecum Inlet.
- 218. *Cape May*, sea-coast of New Jersey, entrance to Delaware Bay.
- 219. *Cape Henlopen*, sea-coast of Delaware, entrance to Delaware Bay.
- 220. *Cape Henlopen Beacon*, entrance to Delaware Bay.
- 221. *Delaware Breakwater*, Delaware, entrance to Delaware Bay.
- 223. *Maurice River*, New Jersey, mouth of River Maurice, entrance to Delaware Bay.
- 229. *Reedy Island*, Delaware, Delaware Bay.
- 230. *Christiana*, Delaware, mouth of River Christiana, Delaware Bay.
- 231. *Fort Mifflin*, Pennsylvania, River Delaware.
- 233. *Fenwick Island*, sea-coast of Delaware.

The following named light-stations in the fourth district require repairs during the ensuing year:

- 218. *Cape May*, sea-coast of New Jersey.
- 222. *Brandywine Shoal*, Delaware Bay.
- 223. *Maurice River*, New Jersey, Delaware Bay.
- 224. *Egg Island*, New Jersey, Delaware Bay.
- 226. *Mahon's River*, Delaware, Delaware Bay.
- 227. *Cohansey*, New Jersey, Delaware Bay.
- 228. *Bombay Hook*, Delaware, Delaware Bay.
- 231. *Fort Mifflin*, Pennsylvania, Delaware Bay.

The following are names of light-stations in the fourth district not mentioned elsewhere in this report:

234. *Assateague*, about two miles from the southwest point of Assateague Island, Virginia.

LIGHT-SHIPS.

217. "*Five-Fathom Bank*," on *Five-Fathom Bank*, off the capes of the Delaware.—This vessel is in excellent condition, and well adapted for the position. During the month of March she parted her moorings and drifted from her anchorage. The United States revenue steamer *Colfax*, while on a cruise, took her in tow and replaced her on her station. A new chain (made at the Washington navy-yard and purchased from the Navy Department) and a mushroom anchor of 4,000 pounds have been supplied, and will make her moorings more secure than before.

225. "*Cross Ledge*," on *Cross Ledge Shoal*, in *Delaware Bay*.—No repairs have been made on this vessel since the last annual report, and she is in good condition. She was driven from her station by the ice during the month of December, 1871, and took refuge under the Delaware Breakwater, where she remained until February 28, 1872, when she was replaced on her station. March 6th she was driven again from her anchorage and took refuge in Maurice River Cove, and was replaced on her station a few days after. The erection of a light-house, to replace the light-ship on this dangerous shoal, is strongly recommended, as will be observed elsewhere in this report.

Relief light-ship, No. —, is in good condition, and ready for service at the depot at Christiana.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district:

DAY OR UNLIGHTED BEACONS.

There are no day or unlighted beacons in this district.

DEPOT.

Christiana, Delaware.—The construction of the wharves and buildings for fitting this station for a buoy-depot and a winter harbor for light-vessels, reported in operation in the last annual report, was continued until the 1st of last November. The depot consists of two wharves on Christiana River, and a large store-house for one of the wharves. This wharf extends from the front of the store-house into the river a distance of 164 feet (to 8 feet of water at ordinary low tide) by a width of 32 feet. The store-house is 50 feet by 140 feet, on plan, and two stories of 8 feet in height to the eaves of the roof. The first or lower floor is divided into two parts. The front room is 50 by 63 feet, designed for storing miscellaneous articles. The balance, 50 by 77 feet, is fitted with a coal-bin, skids for second and third class iron buoys, and space for storing spar-buoys, ballast, balls, chains, &c. This apartment has a well-constructed brick water-cistern of 5,000 gallons capacity, and is supplied by rain-water from the roof. The second story is in one room, with suitable stairway leading from first story. A railroad track from the outer end of the wharf, and two cars for transporting supplies into the building, have been supplied. The other wharf is completed, and

extends from the proposed front of the building in its rear into the river a distance of 140 feet (to 8 feet water at ordinary low tide) by a width of 32 feet. The piles for the foundation of the store-house in rear of this wharf are all driven and girdage logs placed. The design for this building is in plan 50 by 150 feet, and one story of 10 feet in height to take in first-class buoys. It is recommended that an appropriation be made for its completion. To erect the building the cost is estimated at \$10,000. This will provide room for storage of first-class iron buoys, which the other store-house is not designed for.

FIFTH DISTRICT.

The fifth district extends from Metomkin Inlet, Virginia, to include New River Inlet, North Carolina, and embraces part of the sea-coasts of Virginia and North Carolina, the sounds of North Carolina, Chesapeake Bay, and the Rivers James and Potomac.

Inspector.—Commodore Fabius Stanley, United States Navy.

Engineer.—Major Peter C. Hains, Corps of Engineers, brevet lieutenant-colonel, United States Army.

In this district there are—

Light-houses and lighted beacons	69
Light-ships, (in position)	1
Light-ships, (for relief)	0
Fog-signals operated by steam or hot-air engines.	0
Day or unlighted beacons	100
Buoys actually in position	634
Spare buoys for relief and to supply losses.	264
Tender (steam) Heliotrope, (buoy-tender)	1
Tender (steam) Tulip, for engineer's construction and repairs	1
Tender (sail) Maggie, (buoy-tender)	1
Tender (sail) Spray, engineer-tender for construction and repairs	1

The numbers preceding the names of stations correspond with the Light-House List of the Atlantic, Gulf, and Pacific Coasts of the United States, issued January 1, 1872.

237. *Cape Henry on south side of main entrance to Chesapeake Bay, Virginia.*—Under instructions from the Light-House Board, the engineer of the district visited this station and made a personal examination of the tower and keeper's dwelling, with the view of determining what repairs or alterations are necessary at the station. The tower is a frustum of an octagonal pyramid, built on a raised foundation of loose stone some 30 feet above the level of the sea. The masonry of the outside is a soft sandstone, with an inside brick cylinder, the latter having been built in 1857, at which time the station was last refitted. Of the eight faces of the tower, six of them show on the outside large cracks or openings, extending from the base upward. Four of them are apparently less dangerous than the other two, and alone would not warrant any great apprehensions of danger, but the latter, viz, those on the north and south faces, where the strength of the masonry is lessened by openings for windows, are very bad, extending from the base almost to the top of the tower. These cracks cannot be seen on the inside, on account of the brick cylinder, (which is of more recent construction than the outside masonry,) and doubtless terminate at the air-space between the outer and inner walls. At present the tower is in an unsafe condition, and there is no way of repairing the damage satisfactorily, and a new one must be built. This old tower has done good service, having been built in 1791, and is now the oldest tower on the coast south of Cape Henlopen; but it has seen its best days, and now, from age and per-

haps defective workmanship, it is in danger of being thrown down by some heavy gale.

The light is of the second order, and cannot be seen as far at sea as its importance in respect to location demands. It is undoubtedly one of the first lights, in point of importance, on the coast. A new tower should be built at this station without delay, and the light made of the first order. A good site can be had near the present location, on Government land, and materials for building purposes can be landed without difficulty. It also should be noted that the keeper's dwelling is in a dilapidated condition, and at too great a distance from the tower to insure proper attendance. It is a frame building, and is now more than thirty years old. It is too small for the number of keepers at this station, and should be enlarged. At present it affords very poor protection to the keepers from inclemency of the weather in winter. A new dwelling is an absolute necessity for this station.

It is estimated that the cost of a first-order tower, with lens, keeper's dwelling, &c., complete, will be, at this place, \$85,000, and an appropriation of \$50,000 is asked to commence the work.

238. "*The Thimble*," entrance to Hampton Roads, Virginia.—This light-house is designated to take the place of the Wiloughby Spit light-ship, which is in need of extensive repairs. It is located on the shoalest point of Horseshoe Bar, at the entrance to Hampton Roads, called "*The Thimble*," which is the source of great danger to vessels navigating the bay, and others coming in from sea, this being particularly the case at night, when the buoy which has heretofore marked this shoal could not be seen.

After duly advertising for bids, a contract was made August 31, 1871, with the lowest bidder to furnish the iron-work to be used in the foundation at this new light-house, but the impracticability of having it ready in time to plant the piles during the working season of that year, necessitated a delay until May of the present, the exposed locality rendering it necessary to secure a season of calm weather in order to build the platform from which the work of screwing the piles into the shoal is carried on. While the iron-work was in process of construction, the frame of the superstructure was prepared at the depot at Lazarétto Point, Maryland. The material was shipped to its destination the latter part of May, and on the 10th of June the platform completed. As was anticipated, the shoal proved to be very hard, consisting of fine compact sand, which rendered the process of screwing in the piles very slow. Further delay was experienced by the breaking of a cast-iron column used as a follower on the pile, when the top of the latter reaches nearly the level of the platform and prevents the working of the levers; and also by the breaking of one of the screws, owing to a defective casting. The damage in each case was repaired with the least loss of time practicable, and the work resumed. The last pile was planted on the 1st of August, and it is expected that this structure will be finished by October 1, 1872. This will enable the light-ship to be withdrawn, and there will then be no light-ship in service in this district. The light will be of the fourth order.

241. *Lambert's Point*, on the shoal off Lambert's Point, River Elizabeth, Virginia.—The screw-pile light-house, for which an appropriation was made by act of Congress approved March 3, 1871, was finished in May last. The original plan of a light-house on six piles was modified, in order to make use of some iron piles that were on hand. It is now a square house on five piles, and shows a red light of the fifth order. The

station is provided with a fog-bell which strikes by machinery in foggy weather every ten seconds.

245. *Deep Water Shoals, River James, Virginia.*—This light-house was painted throughout, and had other repairs made to it. The piles of the old light-house, which was destroyed by ice in 1866, were taken out and sent to the depot at Lazaretto Point, where they will be available for other works in the district or for dumb-beacons.

— *Solomon's Lump, in Kedges Strait, between Tangier Sound and Chesapeake Bay.*—In compliance with a resolution of the House of Representatives, an examination and report to Congress was made, during the last session, upon the necessity and expediency of establishing a light to mark the shoal known as Solomon's Lump, in Kedges Strait, between Tangier Sound and Chesapeake Bay. Solomon's Lump is a point of land on the north end of Evans Island. There is a shoal that extends out a considerable distance from this point in a northerly direction, and is a source of danger to vessels navigating Kedges Strait at night. Near its extreme point is the regular channel. The shoal itself has not more than about 5 feet water on it to a point near the red buoy, which marks its extreme northerly end. At night this buoy cannot be seen a sufficient distance to be of any use. The only light in this vicinity is that on Fog Point, about one and one-fourth miles in a west-southwest direction, but, on account of its distance and location, it affords no security to vessels from going ashore on the reef off Solomon's Lump. The light at Fog Point was established in 1827, before the introduction of the screw-pile system of light-houses, and though it has served to mark the entrance to Kedges Strait for a long time, it is of little value as compared with other positions that could have been selected for a screw-pile structure, which would not only have marked the entrance to the strait, but would have been a guide all the way through. A light established on the shoal off Solomon's Lump, near its extreme point, and in 5 feet water, or on the shoal on the opposite side of the channel would accomplish both these objects, and render navigation through Kedges Strait safe at all times. As the sailing course in either direction would be a straight line passing just north of the light-house at Solomon's Lump, in case a light was established there, that at Fog Point would be no longer of use, and could be discontinued. It would, therefore, not increase the number of lights, nor add anything to the annual cost of maintenance. An appropriation of \$15,000 is, therefore, asked to establish a light-house off Solomon's Lump to take the place of that at Fog Point.

260. *Point Lookout, on the north side of the entrance to River Potomac, Maryland.*—Under instructions from the Light-House Board, the engineer of the district has commenced the work of establishing a large fog-bell on the north side of the mouth of the river Potomac, under the general appropriation for fog-signals. This is a very desirable aid to navigation, and will be equally valuable to vessels navigating the bay and river.

264. *River Choptank, opposite the entrance to the Rivers Choptank and Treadhaven, Maryland.*—A contract was made in March, 1871, for the construction of this light-house, which was not completed until the 23d of December, partly owing to the character of the foundation, which was very hard, and to the want of experience on the part of the contractor in this kind of work. The light-house stands on ten wooden piles encased in cast-iron. Six of the piles form the foundation for the light-house proper, the other four being fender-piles, serving as ice breakers. The superstructure is an hexagonal frame building, with a lantern on the top, and shows a light of the sixth order. The light-

house stands in 11 feet water, mean tide, on a shoal about one and one-half miles from Benonis Point. As soon as the light-house was completed, the light-vessel, which was formerly stationed in this vicinity, was permanently withdrawn. This station is provided with a fog-bell, struck by machinery, at intervals of ten seconds.

265. *Thomas's Point, north side of mouth of South River, Maryland.*—It will be observed by reference to the Coast Survey chart of the Chesapeake Bay that the light-house at Thomas's Point, on the north side of South River, from four miles south of entrance to Annapolis Harbor, Maryland, can serve but poorly its purpose as a warning of the dangerous shoal that makes out from it a distance of one and one-quarter miles into the bay. This light-house was built in 1825, before the introduction of the system of light-houses in the water on iron piles. Its present location is such that little use can be made of it at night, and in times of foggy or thick weather it is utterly useless. Under no circumstances can vessels drawing more than 8 feet water pass within one and a quarter miles of it, as the shoal is continuous, and has on it only that depth at the outer extremity, and less between this point and the shore. The outer extremity of the shoal is only marked by a buoy, and it is a matter of frequent occurrence to see vessels ashore here. The ineligibility of its present location is frequently a source of complaint by mariners. This is particularly the case when coming up the bay, as the course is changed twice after passing Sharp's Island, and approaching Thomas's Point.

A light-house on the point of the shoal, in 8 feet water, which will be distant from the shore about one and a quarter miles, is recommended for this place. The new light-house should be provided with a fog-bell, the want of which is another defect at the old station, as the distance from the track of vessels going up or down the bay is so great that it would be useless if put there, as it could not be heard. This station is also in a bad state of repair. The rain, in windy weather, beats through the old masonry of the tower, flooding the inside of the structure, and frequently damaging the material in charge of the keeper.

If a light-house were built at the place referred to, viz, near the outer extremity of the shoal, and provided with a fog-bell, it would supply a defect long felt by the commerce of Chesapeake Bay, and render the maintenance of an almost useless light unnecessary. It is recommended, therefore, that an appropriation be made to build a light-house on Thomas's Point Shoal, supplied with a fog-bell, to take the place of a light-house on Thomas's Point. The estimated cost is \$20,000.

268. *Love Point Shoal, mouth of River Chester, Maryland.*—An appropriation of \$15,000 was made last year by Congress for a light-house on the shoal at the mouth of river Chester, near the north end of Kent Island, the exact location of which was fixed at a point on the shoal in 10 feet water, mean tide, distant from the north end of Love Point about one and a quarter miles in a northeasterly direction. The light-house is a duplicate of that erected in the river Choptank. A contract was made for the construction of this work, (after public advertisement for bids,) and it was expected that the work would have been completed the fall of last year. Unforeseen delays, however, were experienced by the contractor, in consequence of which it was found necessary to defer work till the spring of the present year. The lateness of the season, and several severe gales, however, caused further delay, so that it was not finished till August 1. The light was exhibited August 15. A fog-bell, struck by machinery, at intervals of five seconds, is provided.

— *Craighill Channel Range Beacons, Chesapeake Bay, Maryland.*—

An appropriation was made by Congress at its last session for two beacon-lights to mark the range of the channel just below the mouth of the river Patapsco, which is being widened and deepened, under appropriations by Congress. The plans are now being prepared, after which the work of building will be commenced without unnecessary delay. The range will mark a channel which is perfectly straight, has deep water, and will shorten the distance to the port of Baltimore, for large vessels, by several miles.

— *Shipping Point, River Potomac, Virginia.*—Plans and specifications are being prepared for the small light, for which an appropriation was made, to mark the entrance to the anchorage of Shipping Point, river Potomac, Virginia. Some delay will doubtless be experienced, however, owing to the fact that an act of the State legislature will be required, ceding jurisdiction over this site before any work can be done. Steps will be taken at an early day to secure the necessary legislation in the case.

— *A first-order light-house at or near Poyner's Hill, a point about midway between Cape Henry and Body's Island light-house, sea-coast of North Carolina.*—The attention of Congress was drawn in the last annual report to the importance of speedily establishing a light-house to illumine the dark space of forty miles on the coast of Virginia and North Carolina between Body's Island and Cape Henry.

The recommendations contained in that report are again referred to, and the earnest attention of Congress called to the importance of establishing this needful light-house. The distance from Body's Island to Cape Henry is eighty miles, of which there is an unlighted space of forty miles. The land along the coast in this vicinity is low and in many places without trees, so that even in day-time there is danger of vessels getting into unsafe proximity to the coast before becoming aware of it. This danger is enhanced by the fact that vessels bound around Cape Hatteras from the northern and eastern ports keep well to the westward, in order to avoid the strong current of the Gulf Stream, and for the additional reason they have a favorable current of about a mile an hour, nearly as far as Hatteras, and a smoother sea in bad weather; but in the absence of powerful sea-coast lights sufficiently near each other to give warning of approach to danger, many vessels laden with valuable lives and cargoes are in danger of being lost between these points. It is now believed that the construction of this tower should be no longer delayed. A glance at the chart of the coast will show its importance. An appropriation therefor of \$50,000 is accordingly submitted to commence the work.

An appropriation was made about ten years ago for this light, but the money reverted to the Treasury. The light-house should be similar to that building at Body's Island, with a focal plane 150 feet above the sea, and visible at a distance of eighteen nautical miles. It is estimated that the total cost of a first-order light-house at this place will be \$95,000.

288. *Body's Island, sea-coast of North Carolina.*—After having contracted with the lowest bidders for furnishing material to be used in this structure, a working party was dispatched to build the necessary temporary quarters, store-house, roadway, &c., for landing and taking care of material. This having been done, work on the tower was commenced the latter part of November, 1871, and has steadily progressed since that time. The prevalence of storms in this vicinity has, however, retarded its progress to some extent, as was anticipated. The tower and keeper's dwelling are now well advanced toward completion. The

lantern was set in August, and the light will be exhibited for the benefit of commerce October 1, 1872.

The difficulty of landing material at this station necessitated the erection of a derrick in Roanoke Sound, in 6 feet water, at which vessels could lie and be discharged of the stone used in the foundation. This was successfully accomplished at little expense, though some delay was experienced owing to the want of promptness on the part of contractors for some of the material used in the structure. This work is built of the most substantial and durable material. It is 150 feet high, and will show a light of the first order, which can be seen about eighteen nautical miles. The base of the tower is a frustum of an octagonal pyramid, built of granite, surmounted by a brick shaft of the form of a frustum of a cone. The establishment of this light will supply a want long felt by the commerce of the country, as may be readily seen from the number of wrecks that have been strewn along the beach, from time to time, for twenty miles to the south, and the same distance north of the light-house. Efforts have been made to secure a correct list of the vessels that have gone ashore near this station, and the damage sustained by each, but up to the present time a full authentic list has not been obtained.

The following is a list of vessels that have gone ashore in this vicinity since the work of building the light-house was commenced, with such particulars as to tonnage, damage, &c., as could be ascertained:

List of vessels that have gone ashore at Body's Island, North Carolina, since the new light-house was commenced in July, 1871, as near as can be ascertained.

Name.	Class.	Tonnage.	Cargo.	Where bound.	When wrecked.
Muscovado	Brig	160	Sugar	Baltimore	July 23, 1871.
Marion	Schooner ..	350	Iron	Savannah, Ga. .	August 20, 1871.
Sarah Peters	Brig	180	Furniture, &c. .	Savannah, Ga. .	December 13, 1871.
Baltic	Bark	360	Ballast	Saint Mary's, Fla.	February 7, 1872.
Willie	Schooner ..	104	Sugar	Baltimore	February 14, 1872.
	Schooner ..		Coal	South	March —, 1872.

The Marion escaped with a loss of \$8,000; the rest were total wrecks. If \$15,000 is allowed as the average value of each vessel, and \$10,000 the average value of cargo, we have in less than one year, viz, from June, 1871, to March, 1872, a loss to the commerce of the country of \$133,000, without taking into consideration the probable loss of life. Here is a loss of more than enough to build the light-house. Further comments on the importance of this structure, and the one (for which an appropriation is asked) between it and Cape Henry, are deemed unnecessary.

A complete record of all vessels that have gone ashore near Body's Island since the old light-house was destroyed by the confederates has been sought, but there seems to have been no authentic record kept by any of the inhabitants in the vicinity, and the information to be obtained is only vague, and to an extent unreliable, but it is well known that many valuable vessels, cargoes, and lives have been lost there every year.

299. *Roanoke Marshes, North Carolina, on the east side, and about in the middle of the narrow channel connecting Pamlico and Croatan Sounds, North Carolina.*—It was built in 1860, on what was at that time a marsh, which was dry or nearly so at low water. The foundation consists of seven wood piles covered with cast iron, the latter, when the structure

was first built, being screwed into the ground several feet. Since then the marsh has been washed away so that there are now 10 feet water at the light-house. The piles being of wood, as soon as they were exposed, by the washing away of the shoal below the depth covered by the cast-iron sleeve, were attacked by worms. In order to save the light-house from falling, three coppered piles were driven at each angle, of the structure, capped by heavy squared timbers. A short time ago a raft drifted against the light-house and carried away three of the coppered piles above referred to. The house has settled some inches on the west side, and though the damage sustained by the striking of the raft has been repaired, it is not considered in a safe condition, nor can it be made so except at great expense, for which an appropriation would be necessary. It will be cheaper in the end to build a new structure, and an appropriation for this purpose is recommended. The estimated cost of a light-house near the present site, but in about 6 feet water, is \$15,000.

304. *Cape Lookout, near the extremity of the Cape, North Carolina.*—The repairs and renovations authorized by act of Congress will be taken in hand without delay. They are much needed, the keeper's dwelling being in a very dilapidated condition.

REPAIRS.

During the year repairs and renovations, more or less extensive, have been made at each of the following-named light-stations in the fifth district:

235. *Hog Island, Virginia, west point of Hog Island, Great Matchepungo Inlet.*

236. *Cape Charles, Virginia, entrance to Hampton Roads.*

237. *Cape Henry, Virginia, entrance to Hampton Roads.*

240. *Craney Island, screw-pile light-house, Virginia, mouth of river Elizabeth.*

242. *Naval Hospital light, Virginia, on wharf at Naval Hospital, river Elizabeth.*

246. *Jordan's Point, Virginia, river James.*

247. *Cherrystone, Virginia, mouth of Cherrystone Inlet, Chesapeake Bay.*

248. *Back River, Virginia, entrance to Back River.*

249. *York Spit, screw-pile light-house, Virginia, easterly end of York Spit, entrance to river York.*

250. *New Point Comfort, Virginia, entrance to Mobjack Bay, Chesapeake Bay.*

251. *Wolf Trap, screw-pile light-house, Virginia, Wolf Trap Shoal, Chesapeake Bay.*

252. *Stingray Point, Virginia, mouth of River Rappahannock, Chesapeake Bay.*

253. *Windmill Point, screw-pile light-house, Virginia, Windmill Point Shoals, Chesapeake Bay.*

254. *Watt's Island, Virginia, Tangier Sound, Chesapeake Bay.*

255. *Jane's Island, screw-pile light-house, Maryland, Tangier Sound, Chesapeake Bay.*

256. *Somer's Cove, screw-pile light-house, Maryland, Tangier Sound, Chesapeake Bay.*

257. *Smith's Point, screw-pile light-house, Virginia, mouth of River Potomac, Chesapeake Bay.*

258. *Fog Point, Maryland, Smith's Island, Chesapeake Bay.*

259. *Clay Island*, Maryland, Tangier Sound, Chesapeake Bay.
260. *Point Lookout*, Maryland, entrance to River Potomac, Chesapeake Bay.
261. *Hooper's Straits*, screw-pile light-house, Maryland, off mouth of River Hoga, Chesapeake Bay.
262. *Cove Point*, Maryland, mouth of River Patuxent, Chesapeake Bay.
263. *Sharp's Island*, screw-pile light-house, Maryland, mouth of River Choptank, Chesapeake Bay.
265. *Thomas's Point*, Maryland, north side of mouth of South River, Chesapeake Bay.
266. *Greenbury Point*, Maryland, mouth of River Severn, Chesapeake Bay.
267. *Sandy Point*, Maryland, Chesapeake Bay.
269. *Seven Foot Knoll*, screw-pile light-house, Maryland, mouth River Patapsco, Chesapeake Bay.
272. *Fort Carroll*, Maryland, River Patapsco.
273. *Hawkins's Point*, Maryland, River Patapsco.
275. *Leading Point*, screw-pile light-house, Maryland, River Patapsco.
276. *Lazaretto Point*, Maryland, River Patapsco.
277. *Pool's Island*, Maryland, off mouth of River Gunpowder, Chesapeake Bay.
278. *Turkey Point*, Maryland, mouth of the River Elk, head of Chesapeake Bay.
279. *Fishing Battery*, Maryland, mouth of River Susquehanna, Chesapeake Bay.
280. *Havre de Grace*, Maryland, Concord Point, mouth of River Susquehanna, Chesapeake Bay.
281. *Piney Point*, Maryland, River Potomac.
282. *Blackistone's Island*, Maryland, entrance Clement's Bay, River Potomac.
283. *Lower Cedar Point*, screw-pile light-house, Virginia, Yates's Shoal, River Potomac.
284. *Upper Cedar Point*, screw-pile light-house, Maryland, off mouth Tobacco River.
285. *Fort Washington*, Maryland, River Potomac.
286. *Jones Point*, Virginia, River Potomac, near Alexandria.
289. *Cape Hatteras*, North Carolina, Cape Hatteras.
296. *Neuse River*, North Carolina, west side of entrance to River Neuse.
297. *Pamlico Point*, North Carolina, south side of entrance to River Pamlico, Pamlico Sound.
299. *Roanoke Marshes*, screw-pile light-house, North Carolina, east side of channel connecting Pamlico and Croatan Sounds.
301. *North River*, screw-pile light-house, North Carolina, on bar at entrance to North River. A fog-bell has been placed at this station.
302. *Wade's Point*, screw-pile light-house, North Carolina, west side of River Pasquotank, Albemarle Sound.

The following are the names of the light-stations in the fifth district not mentioned elsewhere:

239. *Old Point Comfort*, Virginia, entrance to Hampton Roads.
243. *White Shoals*, Virginia, River James.
244. *Point of Shoals*, Virginia, River James.
270. *North Point*, (lower,) Maryland, entrance to River Patapsco, Chesapeake Bay.

271. *North Point*, (upper,) Maryland, River Patapsco, Chesapeake Bay.

287. *Bowler's Rock*, screw-pile light-house, Virginia, River Rappahan-nock.

290. *Cape Hatteras Beacon*, North Carolina, Cape Hatteras.

291. *Ocracoke*, North Carolina, entrance to Ocracoke Inlet.

292. *Southwest Point Royal Shoal*, screw-pile light-house, North Caro-lina, Pamlico Sound.

293. *Northwest Point Royal Shoal*, screw-pile light-house, North Caro-lina, Pamlico Sound.

294. *Harbor Island*, screw-pile light-house, North Carolina, between Pamlico and Core Sounds.

295. *Brant Island Shoal*, screw-pile light-house, North Carolina, Pam-lico Sound.

298. *Long Shoal*, screw-pile light-house, North Carolina, east end of Long Shoal, Pamlico Sound.

300. *Croatan*, screw-pile light-house, North Carolina, Pamlico Sound.

303. *River Roanoke*, screw-pile light-house, North Carolina, near mouth of River Roanoke.

LIGHT-SHIPS.

238. "*Willoughby Spit*," entrance to Hampton Roads, Virginia.

The completion of the screw-pile light-house on "*The Thimble*" shoal will enable the board to remove this light-ship on the 1st of October next. This is the only light-ship in the fifth district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the fifth district:

Smith's Point, port side of mouth of River Potomac, old tower.

Bodkin's Point, south side of mouth of River Patapsco, old tower.

Day's Point, half a mile from Day's Point, River James, iron shaft with cage on top.

Woodstock, entrance into Bell's Bay, &c., North Carolina.

Hunting Quarter, Core Sound, mid-channel, spar with barrel.

Wilson's Bay, Core Sound, mid-channel, spar with barrel.

Piney Point, Core Sound, mid-channel, two spars with barrels.

Yellow Shoal, Core Sound, mid-channel, spar with barrel.

There are, besides the above-named beacons, forty stake-beacons planted to mark channels in Core Sound and other places.

DEPOTS.

Lazaretto Point, River Patapsco, Maryland.—A large number of spar-buoys were manufactured to supply the places of those lost or rendered unserviceable in the northern part of the district. The stone sea-wall was repaired, and the place put in good condition. During the winter the frame-work of the screw-pile light-houses was prepared here.

Portsmouth, Virginia.—The buoy depot at Portsmouth, Virginia, was finished about seven months ago, and it is now in full working order.

It is in good condition, well kept, and admirably adapted to its purposes; a great saving to the Government not only in rents, but in protection to public property.

SIXTH DISTRICT.

The sixth district extends from New River Inlet, North Carolina, to and including Cape Canaveral light-house, Florida, and embraces part of the coast of North Carolina, the coasts of South Carolina and Georgia, and part of the coast of Florida.

Inspector.—Captain Richard T. Renshaw, United States Navy, until January 18, 1872; Commander Charles S. Norton, United States Navy, present inspector.

Engineer.—Major Peter C. Hains, United States Engineers, brevet lieutenant-colonel, United States Army.

In this district there are:

Light-houses and lighted beacons, (including those in process of construction,).....	36
Light-ships.....	4
Fog-signals operated by steam or hot-air engines.....	0
Day or unlighted beacons.....	43
Buoys actually in position.....	224
Spar-buoys, (for relief and to supply losses).....	22
Tenders (steam) <i>Alanthus</i> (buoy-tender) and <i>Dandelion</i> , (used in engineer's constructions and repairs).....	2
Tender (sail) <i>Mignonette</i> , (used in engineer's constructions and repairs).....	1

The numbers preceding the names of the stations correspond with those given in the "List of Light-Houses, Lighted Beacons, and Floating Lights of the Atlantic, Gulf, and Pacific Coasts of the United States," published January 1, 1872.

307. *Oak Island beacons, at the south entrance to River Cape Fear, North Carolina.*—These beacons mark the range over the bar at the Oak Island entrance to river Cape Fear. They are, however, badly located, being so near each other that considerable deviation from the true course is necessary to make them appear to separate. The front beacon is an open-frame frustum of a square pyramid resting on a rail tramway, which allows of its being moved to the right or left, to suit the changes in the channel. The rear light is placed on a wooden tower, immediately over the center of the keeper's dwelling. The shore-line at this place, as at many others on the southern coast, is not permanent, being washed away by the abrasive action of the sea. The latter has gradually encroached upon the land, till at present the high-water mark is only a few feet from the front beacon, which renders it in imminent danger of being destroyed in any southeasterly gale. The two beacons being already so close together as to have their usefulness seriously impaired, the front beacon cannot be moved back any farther. To move both would be an expensive undertaking at this place, and would necessitate the discontinuance, for a time, of the lights; besides, there is no appropriation available. It would be more satisfactory, and doubtless cheaper in the end, to build two new frame beacons detached from the keeper's dwelling. The present ones could then remain as they now are until the new ones are established. By this means the change would cause no inconvenience to commerce, and such locations and relative elevation could be given them as would make them much more useful than they now are.

It is very important that this range be well maintained, as the channel which it marks is the most reliable, permanent, and the deepest of

the several entrances to River Cape Fear. An appropriation of \$4,000 is therefore asked to re-establish the range.

314. *Morris Island range-beacon, (rear,) south end of Morris Island, South Carolina.*—There are two beacons on Morris Island, both of which are very low. They answer their purpose very well, however, so far as marking the line of range for crossing the bar of the main ship or "Pumpkin Hill Channel" into Charleston Harbor; but it is highly important, also, that one of these beacons should be made to answer the purpose, in addition, of a sea-coast light. This cannot be done by using either of the present towers. The front beacon has on it a light which can be seen from any direction at sea; the rear one has only a small angle of visibility, being intended only to mark a range-line. The former can only be seen at the level of the sea at a distance of five miles, or, estimated from the deck of a vessel 15 feet above the level of the sea, a distance of nine and a half miles; and the light being only of the fifth order, and red, is not visible at this distance, except on very clear nights.

Previous to the war, there was a sea-coast tower and light at this station, and the same reasons that existed for establishing it then, exist still. It will be observed, by reference to the chart, that along the coast, from Cape Romain to the River Saint John continuous shoals extend out from the main-land to a considerable distance, in many places reaching out as far as six and seven miles. Timely warning of their proximity is necessary for the safety of the lives and cargoes of the large number of vessels that pass them. This can only be given by the establishment of sea-coast lights, or by placing light-ships outside of them. The latter is by far the most expensive plan, besides being open to serious objections. The present light, owing to want of sufficient range, leaves a dark space on the South Carolina coast, between it and Hunting Island, which should be lighted. This can and should be done by making a new rear tower on Morris Island, 150 feet above the sea, and establishing on it a first-order sea-coast light. It is estimated that the cost of making this change would be \$85,000, for which an appropriation is asked.

316. *Sullivan's Island range-beacons, Charleston Harbor, South Carolina.*—An appropriation was made by act of Congress approved March 3, 1871, for range-beacons to guide into Charleston Harbor, after passing the bar of the main ship-channel. At the date of last report plans and specifications were prepared, but, owing to certain laws of the State of South Carolina, a satisfactory title to a site on Sullivan's Island could not be obtained without further legislation on the part of the State. As this would have caused considerable delay, and might not have been obtained after all, and as, under the act approved July 12, 1870, the appropriation would revert to the Treasury at the end of the fiscal year, application was made to the War Department for permission to establish the beacons on the land held by the Government at Fort Moultrie. This permission was given, but the location was hardly as good as might have been obtained elsewhere, under more favorable circumstances. So far, however, as its value to commerce is concerned, the range is a good one. The front beacon is a frame structure resting on the parapet of the fort. The rear one is an open-frame square pyramid. The keeper's dwelling is detached. The beacons and dwelling were finished in June, and the lights exhibited July 15. On the same night the light of the Weehawken light-ship was discontinued, and, a few days after, the vessel was withdrawn.

The "Weehawken," light-ship marked the wreck of the monitor of that

name; this obstruction has been partially removed, and the remainder, it is reported, has sunk deeply into the sand. The lights of the Sullivan's Island range are red. Besides marking the range from Pumpkin Hill Bar, they mark a good range over the Southwest Bar, so that vessels coming up from southerly ports can enter Charleston Harbor at night, without the necessity of going up to the main ship-channel, thereby saving a run of several miles.

317. *Fort Sumter Beacon, Charleston Harbor, South Carolina.*—This beacon formerly stood on the east face of Fort Sumter, but on account of the meliorations that are being made in the fort it became necessary to remove it to the center of the southwest face. The beacon was also in need of considerable repairs. The change of position and repairs were made from the general appropriation for repairs and incidental expenses of light-houses.

— *Light-house on or near Hunting Island, entrance to Saint Helena Sound, South Carolina.*—An appropriation was made by act of Congress for a second-order light-house at or near Hunting Island. Under the law governing this appropriation, the light-house site must be selected from lands now owned by the Government. A personal examination was recently made of the locality by the district engineer. There are only two positions that give suitable sites for this light-house, one on the north side of Saint Helena Sound, on Edisto Island, near the southern extremity, and the other at a point some distance south of the site of the former light-house on Hunting Island. It is understood, however, that the Government does not own any land on Edisto Island. In this case it will be necessary to place the light on Hunting Island, where it is known the Government does own land. The objection to this side of Saint Helena Sound lies in the fact that the island is being washed away by the abrasive action of the sea upon its low banks. A survey was made, under the direction of the district engineer, of the north end of the island, from which it appears that about one hundred and fifty acres of this portion of the island have been washed away, the present shoreline having receded about half a mile from its position as given by the Coast-Survey chart of 1869. There is deep water now where at that time there was dry land. The Government formerly owned a tract of fifty acres of that portion of the island which has been washed away. Owing to the danger to which a light-house site on the north end of Hunting Island will be subjected, and the provisions of the act which make it necessary to select a site on land owned by the Government, it will perhaps be necessary to erect such a structure as could be removed in case of necessity to some other place. An iron light-house would answer this purpose, but an additional appropriation will be necessary to complete the work. An appropriation of \$50,000 is accordingly asked, and the light should be of the first instead of the second order, as named in the last appropriation bill.

321. *Tybee light-station, Tybee Island, entrance to River Savannah, Georgia.*—The recommendation contained in the last annual report is again made. As then stated, the tower is not in a safe condition, owing to the damage it sustained in the cyclone of 1871. This tower is very old, having been built in 1793. It is a frustum of an octagonal pyramid, built of Savannah brick. Five of its faces show dangerous cracks. As stated in a previous report, its great age, and neglect during the war, render it impracticable to properly repair it. An appropriation of \$50,000 is therefore asked to commence the building of a new structure. This can be done without delay on Government land near the site of the present tower.

323. *Tybee Knoll, River Savannah, Georgia.*—A light-ship is now stationed off Tybee Knoll, in the River Savannah, which could readily be dispensed with in case a screw-pile light-house was built at this place. An appropriation was made by Congress for this purpose, but reverted to the Treasury under the operation of the act approved July 12, 1870.

A screw-pile light-house will serve the purposes of navigation quite as well as the light-ship, and the expense of maintenance will be considerably lessened. Borings were made more than a year ago, to determine the character of the foundation; it was found to be soft mud to a depth of 19 feet. A light-house on five or six hollow cast-iron piles, with large flanges to give bearing, could be built at very little more than the usual cost of such structures. Its erection would insure the permanent removal of the light-ship, which is now in need of extensive repairs. It is estimated that the cost of this light-house will be \$18,000, and an appropriation of this amount is recommended.

— *Daufuskie Island range-beacons, Calibogue Sound, South Carolina.*—As stated in the last annual report, plans and specifications were prepared, and the securing of proper sites was only necessary in order to commence the work. The sites were selected on the northeastern end of Daufuskie Island; in the aggregate, they amount to five acres. The investigation of the title was intrusted to the United States district attorney for the district in which the land lies, but, owing to the difficulty of procuring information bearing on this subject, and to the loss of records during the war, considerable delay was experienced. It was not until June 13 that the district attorney reported on its validity, which report was approved by the Attorney-General of the United States on the 3d of August. No further delay is now apprehended, and it is proposed to let out the work by contract without delay. The front beacon is to be an open-frame structure; the rear one, a small tower built on the keeper's dwelling. The lights will be of the fifth order, both white.

— *Day-beacons in the River Savannah, Georgia.*—The four day-beacons on Jones's and Long Islands, which were built entirely of wood, were destroyed by the burning of the high marsh-grass. They were rebuilt without delay, and the precaution was taken to have the grass cut in the vicinity. It would be more economical, however, to use iron beacons, which would not be subject to this danger. The estimated cost of four such beacons to replace the frame ones is \$2,500, and an appropriation for this purpose is asked.

— *Light on the obstructions in River Savannah, Georgia.*—It is proposed to extinguish this light as soon as the obstructions are removed by the Engineer Department of the Army. It is expected that this work will be accomplished during the present season.

326. *Fig Island, on the east end of Fig Island, River Savannah, Georgia.*—A new landing was built at this station, as the old one had rotted away. The house had other repairs made, and was painted throughout.

331. *Saint Simon's light-station, north side of the entrance to Saint Simon's Sound, Georgia.*—This light-house, which was contracted for in the fall of 1869, was delayed from various causes, the death of the contractor and one of his bondsmen (each while successively superintending the work) being the main cause. At date of last report the tower was 51 feet high. It was then taken in hand by the surviving bondsman, and by him the work has been completed. The tower is built of brick, of the form of a frustum of a cone, focal plane 108 feet above the sea-level, and will show a fixed light of the third order, varied by flashes alternately red and white, the interval between the

flashes being one minute. The light was exhibited for the first time on the night of September 1, 1872.

333, 334. *Amelia Island north range-beacons, at entrance to Fernandina Harbor, Florida.*—The work on this range was commenced in December, 1871, and finished in May, 1872. The rear light is mounted on the keeper's dwelling, and the front one on an open-frame square pyramid, which rests on a tramway, and can be moved to the right or left, to conform to the changes in the bar which are generally effected after a severe northeasterly or southeasterly gale. The lights at this station were exhibited June 1, 1872.

338. *Dame's Point screw-pile light-house, off Dame's Point, River Saint John, Florida.*—This structure was framed at the workshops at Lazaretto Point, Maryland, during the winter, and the iron-work prepared under contract. In March, 1872, a working party was dispatched to erect the structure, which was completed in June. The light-house stands on a shoal in 8 feet of water. It is built on six wood piles, with cast-iron sleeves, and has two fender-piles, one up and the other down stream. The light, which is fixed white, was exhibited July 15, 1872.

339. *Saint Augustine light-house, north end of Anastasia Island, Florida.*—A site for this light-house, for which an appropriation was made by Congress, was selected about half a mile from the old tower. The lot consists of five acres.

Considerable difficulty and delay were experienced in procuring a valid title and complying with the necessary legal forms incident to the purchase of land by the Government, in consequence of which, work on the tower was not commenced until late in the spring. Borings were made to test the character of the foundation, which was found to be fine sand with some loam, to a depth of about 15 feet, where loose coquina shell was encountered, underlying which is a stratum of compact coquina, called, in this section of the country, *coquina rock*, but of such character as to be totally unfit to enter into the construction of a light-house.

Previous to commencing work on the tower it was necessary to build a wharf and store-sheds, and temporary quarters for the men; also a tramway for moving with facility the material from the landing to the site. Contracts were made, after public advertisement, with the lowest bidders for furnishing the iron and brick. The latter have all been delivered, and there are now at the site sufficient brick to complete the work. All the iron-work is on the way. Unfortunately, the last appropriation was so small that operations may have to be suspended by December for want of funds. The foundation of the tower was finished July 29, 1872, and the tower is now several feet above the ground. The base is to be an octagonal pyramid, on which will rest a frustum of a cone. It will be 150 feet high, and show a light of the first order. There is no good building-sand in this locality, and it has to be procured at a distance and transported to the site. This is a source of additional expense, but one absolutely necessary to insure good work.

Observations show that the water has again commenced washing away the shore. At date of last report, high-water mark was 48 feet from the corner of the old tower; it is now about 35 feet distant. It is desirable, therefore, as the old tower may be destroyed at an early day, that this work be finished with as little delay as practicable, and an appropriation of \$25,000 is asked for this purpose. This amount is necessary to complete the work.

— *Mosquito Inlet, east coast of Florida.*—In common with all the inlets and harbors on the east coast of Florida, this bar shifts con-

stantly, so that no soundings can be relied on. The general effect of westerly winds is to reduce the depth of water, and that of northeasterly gales to increase it; thus the inlet may be opened or closed one or more times each year. The wrecks lying on or near the bar give a practical illustration of the uncertainty of the channel. For all practical purposes of construction of a light-house, it may, however, be safely assumed that the material can be delivered without any very serious difficulty or delay, although additional expense would be incurred by reason of the remoteness of the station, and the small-sized vessels that would be required for transportation. As regards the necessity of a light at this point, it is manifest that the commerce passing through the inlet would not justify an expenditure by the United States for a light for merely local purposes, or at least that there are other points that may justly take precedence of it. But a light-house between Saint Augustine and Cape Canaveral lights is necessary, as one of a system of coast lights, and Mosquito Inlet is undoubtedly the proper site, as, in the first place, the light there would answer the double purpose of a harbor and coast guide, and in the second, for a landing-place, both for the original construction and subsequent supply and inspection, which could be made with more safety and certainty there than at any other point along the open-sea beach. A tower 150 feet high, lighted by a first-order Fresnel lens, is recommended for this position, and for the commencement of its construction an estimate of \$60,000 is submitted.

REPAIRS.

At each of the following-named light-stations in the sixth district there have been repairs and renovations, more or less extensive, during the last year, viz:

- 310. *Cape Romain*.—Raccoon Key, South Carolina.
- 313; 314. *Morris Island range-lights*, entrance to Charleston Harbor, South Carolina.
- 317. *Fort Sumter*, Charleston Harbor, South Carolina.
- 318. *Castle Pinckney*, Charleston Harbor, South Carolina.
- 319. *Combahee Bank*, entrance to Saint Helena Sound, South Carolina.
- 321, 322. *Tybee light and beacon*, Tybee Island, Georgia.
- 324. *Cockspur*, River Savannah, Georgia.
- 325. *Oyster-Beds Beacons*, River Savannah, Georgia.
- 326. *Fig Island*, River Savannah, Georgia.
- 327, 328. *Sapelo light and beacon*, entrance to Doboy Sound, Georgia.
- 329, 330. *Wolf Island*, entrance to Doboy Sound, Georgia.
- 332. *Little Cumberland Island*, entrance to Saint Andrew's Sound, Georgia.
- 335, 336. *Amelia Island light and beacon*, Saint Mary's Bar, Fernandina, Florida.
- 337. *River Saint John*, south side of entrance to Jacksonville, Florida.

The following are the names of light-stations in the sixth district not mentioned elsewhere:

- 305. *Federal Point*, New Inlet, River Cape Fear, North Carolina.
- 309. *Georgetown*, entrance to Winyaw Bay, South Carolina.
- 311. *Bull's Bay*, Bull's Island, South Carolina.
- 340. *Cape Canaveral*, on northeast pitch of cape, east coast of Florida.

LIGHT-SHIPS.

"Frying-Pan Shoals," off Cape Fear, North Carolina.—This vessel was taken from her station on the 2d of June, 1872, and sent to Wilmington, North Carolina, where she is undergoing extensive repairs. Her place is supplied temporarily by Relief No. 32.

"Rattlesnake Shoal," off Charleston Harbor, South Carolina.—The present vessel on this station was placed on this station September 11, 1871. She has received no repairs and requires none; is a new vessel, and is in very good condition.

"Weehawken," entrance to Charleston Harbor, South Carolina.—The vessel lately on this station was placed in position over the wreck of the Monitor Weehawken June 23, 1865. Her general condition is good. The wreck having been removed by the Engineer Department of the Army, and range-lights having been established on Sullivan's Island to mark the main ship-channel, the light-ship was removed July 15, 1872.

"Martin's Industry," off Port Royal, South Carolina.—The vessel now on this station was placed on her present station September 1, 1871, having been thoroughly repaired at Charleston, South Carolina, in August, 1871. She is in good condition.

"Tybee," on Tybee Island Knoll, mouth of River Savannah, Georgia.—This vessel has been on the station for over three years, or since June, 1869. No repairs have been made since, except new standing rigging. Her general condition is very bad, and she is not worth repairs. A small screw-pile light-house should take the place of this light-ship, being more economical in maintenance, and to save the very considerable expense of her necessary repairs.

Relief No. 30.—This vessel was taken from Rattlesnake Shoal and condemned as unfit for service, in August, 1871. By authority of the Secretary of the Treasury, after removing everything from her of value to the light-house establishment, she was sold at public auction for \$916, and the amount was turned into the Treasury.

Relief No. 32.—This vessel was stationed at Charleston, South Carolina, as a relief light-ship, until June, 1872, when she was placed on Frying-Pan Shoals, till the proper light-ship for that station can be repaired. She will require a new gang of rigging before winter; otherwise, her condition is good.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines, in this district.

DAY OR UNLIGHTED BEACONS.

The following is a list of the unlighted beacons in the sixth district:
Bad Head, mouth of the river Cape Fear, old tower, discontinued on the establishment of Frying-Pan Shoal light-vessel.

Pice's Creek, River Cape Fear, discontinued during the rebellion, not relighted.

Campbell's Island, River Cape Fear, discontinued during the rebellion, brick house, with iron lantern.

Grton's Point, River Cape Fear, discontinued during the rebellion, open frame beacon.

Port Point, Georgetown, South Carolina, discontinued during the rebellion.

Battery Light, (White Point Garden,) iron spindle, light discontinued during the rebellion.

Cape Romain, old tower, near present light-house.

Savannah City Beacon, iron spindle, light discontinued during the rebellion.

River Saint John, Florida, old tower.

Dumb-Beacons at Oyster Rocks, River Savannah, near Cockspur Island, iron-pile beacons.

River Savannah day-marks.

River Saint John, Florida, wooden piles.

DEPOT.

Fort Johnston, Charleston Harbor, South Carolina.—The wharf at this depot is in a very dilapidated state. Many of the piles have been eaten away by the worms. Repairs of a temporary nature have been made, but it will be necessary to secure another site, as the present one is too much exposed to northerly winds, which render it frequently impossible, for days at a time, for vessels to lie there; and even in calm weather there is danger in getting to and from it, on account of the eddies in the current, and the proximity of the stone jetties thrown out to protect the shore from the abrasive action of the sea.

SEVENTH DISTRICT.

The seventh district extends from (but does not include) Cape Canaveral to, and including, Cedar Keys, Florida.

Inspector.—Commander C. A. Babcock, United States Navy, to April 13, 1872; Commander Albert Kautz, United States Navy, present inspector.

Engineer.—Lieutenant-Colonel C. E. Blunt, Corps of Engineers, brevet colonel, United States Army.

In this district there are:

Light-houses.....	11
Light-ships.....	0
Fog-signals, operated by steam or hot-air engines.....	0
Day or unlighted beacons.....	53
Buoys actually in position.....	99
Spare buoys for relief and to supply losses.....	60
Tender (steam) <i>Arbutus</i> , (employed by the engineer in construction and repairs)...	1
Tender (sailing-schooner, buoy-tender) <i>Florida</i>	1

The numbers preceding the names of stations correspond with those of the Light-House List of the Atlantic, Gulf and Pacific Coasts of the United States, issued January 1, 1872.

344. *Alligator Reef, Florida Reefs*.—The preparations for the erection of the new iron-pile light-house, of the first order, on this reef, have been continued and completed. These preparations consist in the construction at Indian Key, the selected depot, (being four miles from the reef and the nearest land,) of a building for quarters for mechanics and laborers, with a capacious cistern, and ample storage-room in the cellar, a smithery and a large shed for the iron-work and other material for the light-house, whence it can be transported as wanted to the reef. A fuel-wharf has also been built, adjoining which the coal for the tender and other purposes is stored. The temporary platform on the site of the light-house has also been finished.

The piles, foundation-disks, and first section of the light-house were

delivered at Indian Key by the contractor, in January, 1872, and the remainder of the work at the close of the year. The steam-engine for hoisting pile-driver hammers, and other purposes, the pile-driver shears, forges, &c., &c., were also received in January.

The site selected is at the northeast end of the reef, about 30 yards from the site of the day-beacon "C;" the position is an excellent one, and the foundation found, by boring and driving test-rods into the coral, to be very good. The work of erection of the light-house has now been fairly commenced, and will be prosecuted as rapidly as possible until the available funds are exhausted.

Three foundation-disks have been accurately placed, and the center and northwest piles have been driven. The average penetration of these piles into the coral, the 2,000-pound hammer falling 18 feet average, was 1 inch per blow.

The funds will not be sufficient to complete the structure, and an additional appropriation of \$25,000 is asked for.

347. *Key West*.—A new lantern has been made and shipped to this station, and will be erected at an early day.

REPAIRS.

At each of the following-named light-stations in the seventh district there have been repairs, more or less extensive, during the last year.

342. *Cape Florida*, coast of Florida.

243. *Cary's Fort Reef*, Florida Reefs.

351. *Edmont Key*, Tampa Bay, Florida.

352. *Seahorse Key*, Cedar Keys, Florida.

The following are the names of lights in the seventh district not otherwise mentioned:

341. *Jupiter Inlet*, between Jupiter Inlet and Gilbert's Bar, Florida.

344. *Alligator Reef*, Florida Reefs, Florida.

345. *Dry Bank*, off Dry Bank, near Coffin's Patches and Sombrero Key, Florida Reefs, Florida.

346. *Sand Key*, Florida Reefs, Florida.

347. *Key West Harbor-light*, on Key West Island, Florida.

348. *Northwest Passage*, Key West, Florida.

349. *Dry Tortugas*, on Loggerhead Key, Florida.

350. *Dry Tortugas Harbor*, on Fort Jefferson, on Garden Key, one of the Tortugas group, Florida.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

Florida Reef beacons.—Four new iron day-beacons, marking the line of the Florida Reefs, have been erected, viz: "E" on Coach Reef, "F" on Pickle's Reef, "C" on French Reef, and "P" on Fowey Rocks, the latter a very important one. During the next year the erection of these im-

portant aids to navigation will be continued as rapidly as the other necessary works in the district will permit.

DEPOT.

Egmont Key, Tampa Bay, Florida.—This depot is situated in the seventh district, was built by the engineer of the eighth district, having been commenced and finished during the year. The building is of wood, stands on thirty-three piles, and is 30 feet by 60 feet on the outside. A tramway provided with a car, on a platform 208 feet long and 6 feet wide, which is supported by palmetto piles, connects it with the wharf. The wharf, 20 by 60 feet, built on palmetto piles, was constructed in 16 feet of water on the outer edge. These piles were procured on the key. The depot stands on the east side of the key, a small island two and a half miles long by a quarter of a mile broad. It is provided with twenty-eight wooden rollers, each two feet long and one foot in diameter, which materially assist in the handling of the buoys. The building is of the most substantial character, and was put up entirely by hired labor.

EIGHTH DISTRICT.

The eighth light-house district extends from Cedar Keys, Florida, to the Rio Grande, Texas, and embraces a part of the Gulf coast of Florida, and the coasts of Alabama, Mississippi, Louisiana, and Texas.

Inspector.—Commander William P. McCann, United States Navy, until September 5, 1871; Commander Robert Boyd, United States Navy, present inspector.

Engineer.—J. H. Simpson, Colonel, Corps of Engineers, brevet brigadier-general, United States Army.

Assistant Engineer.—Captain A. N. Damrell, Corps of Engineers, brevet major, United States Army.

In this district there are:

Lights and lighted beacons.....	48
Light-ships, (in position).....	1
Light-ships, (for relief).....	0
Fog-signals operated by steam or hot-air engines.....	2
Day or unlighted beacons.....	15
Buoys actually in position.....	106
Spare buoys for relief and to supply losses.....	147
Tenders (steam) Geranium, (buoy-tender) Ivy, (used in engineer's constructions and repairs).....	2
Tender (sail) Magnolia, (used in engineer's constructions and repairs).....	1

The numbers preceding the names of stations correspond with those of the List of Light-Houses, Lighted Beacons, and Floating Lights of the Atlantic, Gulf, and Pacific Coasts of the United States, issued January, 1872.

353. *Saint Marks, Florida.*—The light-house is in very good condition generally, but the engineer reports the land in front of the house as washing away, and though the building is in no imminent danger, it is threatened with peril from very heavy storms.

354. *Dog Island, Saint George's Sound, Florida.*—The brick tower is in a very precarious situation from wearing of the beach. It has been expected for several years that the first heavy gale from the southeast would undermine and overturn it. Some time ago the precaution was taken of driving a triple row of piles about six feet long in a circle around the foundation, at a distance from its outside of about ten feet,

and filling in between the piling and the tower to the depth of about three feet with concrete, with a smooth cement surface on top. A storm about six months ago washed away the sand on the south side nearly to the bottom of the piles, tore some of them out, and broke up the concrete. The tower was undermined on this side and settled, so that now it leans toward the south, about one foot out of the perpendicular. It might be preserved for some time by correcting the fault of inclination, driving piles around the base and concreting as before, only carrying both piles and concrete to a greater depth. But as it would eventually be swept away by the encroachments of the sea, it is considered better to transfer the lantern and lens from the tower and place them on the keeper's dwelling, which is on screw-piles and farther from the beach than the tower. This will be done, and it will be necessary to strengthen the piles by the usual iron braces, of which this building is destitute. To effect the change will require \$2,500, and the arrangement ought to secure the light for a number of years, except in case of some extraordinary storm.

— *Saint Andrew's Bay, Florida.*—Between Cape San Blas and Pensacola there exists an extent of one hundred and twenty miles of unlighted coast, and it is therefore recommended that there be established a fourth-order light at the entrance of Saint Andrew's Bay, thirty miles northwest of Cape San Blas. It would not only be useful as a coast light, but as a guide to the entrance of Saint Andrew's Bay, a very fine harbor of refuge. The light-house would probably be of the ordinary screw-pile character, though a critical examination of the ground might warrant the erection of a small brick or iron tower as more preferable. But no matter what plan might finally be selected, the cost would be about the same, and an appropriation of \$22,000 is asked for.

— *Upper part of Pensacola Bay, Florida.*—Preparations are in progress looking to the establishment of six day beacons, consisting simply of bunches of palmetto piles, bound together by three iron bolts to each beacon, and capped with sheet-zinc on their tops, the center pile projecting above the others and surmounted by a barrel. They are to serve as aids to navigation in Santa Maria de Galvaez and Blackwater Bays, branches of Pensacola Bay, the Board having authorized their construction. The cost of these six beacons is estimated at \$606. The inspector of the district has recommended the establishment of two lights in these waters; one to be a fifth-order screw-pile structure, in five feet water, off White's Point, near the mouth of Santa Maria de Galvaez Bay; the second to be a fifth-order light placed on the keeper's dwelling, situated on the point of land opposite Pierce's Point, at the head of Blackwater Bay, and a little over eleven nautical miles from the first-named light.

359. *Sand Island, off Mobile Harbor, Alabama.*—A temporary frame tower, with fourth-order lens, erected to replace a brick tower destroyed during the war, exists at this station, but is in danger of destruction by the encroachments of the sea, making it highly desirable that the new tower in progress be speedily completed. Indeed, it is on this account that the old one has been twice removed back from the water. The island lies three miles south of the mouth of Mobile Bay and is merely a bank of sand, about four hundred acres in extent, constantly changing its outline. The new tower has been located in what is, apparently, the most stable part of the island. During the previous fiscal year the work was commenced by the construction of a wharf and pier over 1,000 feet long, and continued early in the present fiscal year by the erection of quarters for the workmen and store-rooms, but the work was checked

by illness of employes from malarial complaints. The foundation, consisting of a double course of sill timbers resting on one hundred and seventy-one piles and overlaid with a depth of 12 feet of concrete, was put down. At the close of the present year, the tower had reached a height of 9 feet 6 inches above the grade line, and is progressing rapidly. It is to be a conical brick shaft, the well containing the iron stairway being also of conical form, with a height of focal plane of 125 feet above the grade line, to be provided with a lens of the second order. The granite-work about the entrance and windows is taken from the ruins of the old tower. Plans and estimates have been made for a double frame dwelling of two stories. Sand Island beacons, Nos. 1 and 2, were entirely destroyed during the war. A previous report recommended their re-establishment as soon as the new light would be in operation. The object of the first, taken in connection with the main light, is to range vessels over the outer bar, and if the second, taken in connection with beacon No. 1, to form a range which shall prevent vessels from getting on the west bank to the northward of Sand Island. The shipping interests of Mobile strongly urge the re-establishment of these minor lights. Inasmuch as the present appropriation is inadequate to complete even the tower, not counting the cost of keeper's dwelling, and the two beacons, an appropriation of \$20,000 is asked for.

360. *Mobile Point, entrance to Mobile Harbor, Alabama.*—A temporary light-house, standing on the southwest bastion of Fort Morgan, now marks the entrance to Mobile Bay, but is about to be replaced by a fourth-order iron tower 30 feet in height from base to focal plane, and, like the temporary frame, will stand on the same bastion, giving the light an elevation of 45 feet above the sea level. During the past fiscal year a neat and substantial frame dwelling of four rooms was added to the old one-room house of the keeper. The wharf at the fort was extended and repaired in conjunction with the Engineer Department of the Army, nine iron screw-piles from abandoned light-houses of another district and masses of brick for riprapping from the ruins of the old Sand Island tower being used for the purpose. The extinguished beacons Nos. 3 and 4 are recommended to be re-established. The two together will range the east bank in the same manner that Sand Island beacons will range the west bank. In addition, No. 4, in connection with the main light, will range the channel northwest one-half north, and guide vessels to clear the Middle Ground. Both these beacons, like those at Sand Island, are highly important to the commercial interests of Mobile. It is believed that on the completion of the tower funds sufficient for the erection of the beacons will remain on hand.

— *Mobile Bay range-lights, Alabama.*—Six temporary beacons to mark the channel over Dog River and Choctaw Pass Bars were authorized and put up during the year. Two are on shore, being elevated on poles, and those in the water on wooden piles, and all lighted by ordinary lanterns. The General Government and the State are both now engaged in increasing the depth and extending the length of the channel, so that it will ultimately be about 45,000 feet long. On its completion a different arrangement of the beacons will be necessary, and when the change is required, it would be highly advisable to alter at the same time the present style of temporary beacons to a more durable form of structure when the time for making the alteration draws near. The lighting of the beacons is now cared for by a party under contract, but it is intended to place it in charge of the keeper of Battery Gladden light-house, using one of the launches belonging to the Light-House Estab-

lishment, and the additional assistance of two sailors. By this system a considerable sum can be saved yearly.

361. *Battery Gladden, Mobile Bay, Alabama.*—The light-house marking the entrance to Mobile Harbor was undertaken and finished during the year. The light replaces an extinguished one that stood on Choctaw Point, at the west side of the mouth of river Mobile, and is a frame dwelling on five wrought-iron screw-piles, surmounted by a fourth-order lantern, of the general design for screw-pile light-houses. The site is an artificial island made by the confederates during the civil war as a defensive work for the city of Mobile, and lies at the head of Mobile Bay, five-eighths of a mile east of Choctaw Point. The iron and wood work, prepared by contract at the North, and the building, was put up by hired labor; the work commencing in December, 1871, by erecting a temporary wharf and workmen's quarters, was furnished March 11, 1872, and lighted for the first time the 8th of April following.

— *Horn Island, Mississippi Sound, Mississippi.*—The establishment of a light at the eastern end of Horn Island is recommended as being necessary toward the completion of aids to navigation in Mississippi Sound. It is much needed both in the navigation of the sound and in the use of Horn Island Pass from the Gulf to the sound. The light-house should be of the ordinary screw-pile character, and would require an appropriation of \$22,000.

366. *Cat Island, Mississippi Sound, Mississippi.*—All material for the screw-pile light-house at this station was shipped from the North and delivered to Cat Island July, 1871. Malarial illness prostrated many of the laborers, and seriously retarded the work. The building is of the ordinary form of screw-pile light-houses, square in plan, and supported on five piles. It was lighted for the first time December 15, 1871. The illuminating apparatus is a fifth-order Fresnel lens, showing a fixed white light, varied by flashes, and has its focal plane 45 feet above the mean level of Mississippi Sound.

369. *Saint Joseph's Island, Mississippi Sound, Mississippi.*—The light-house, a substantial wooden structure, resting on five wooden piles, situated 300 feet north of the most southerly point of the island, a low, marshy plat of land, about half a mile long, and not 400 feet wide in the broadest part, about eight acres in extent, elevated only 3 feet above low water, is in danger of destruction from the abrasion of the eastern shore of the island by the action of the waves. It had been previously attempted to preserve the light-house by a riprapping of 120 tons of brick from the old Cat-Island tower, and spreading thereon 54 cubic yards of concrete, but this proving insufficient, it is now proposed to build a breakwater around from the north to the south sides, about 275 feet in length, as the only economical means of protecting it. The breakwater will be of palmetto piles, (the only kind of wood which resists the attack of the sea-worm in this latitude,) bound on its inner and outer faces with string-pieces, and securely braced at intervals of 12 feet with palmetto logs, abutting against piles of the same. A contract to build the breakwater at the rate of \$13 per foot has been submitted and approved by the board, and the work is to be completed not later than the 1st of February next.

373. *Point aux Herbes, Lake Pontchartrain, Louisiana.*—A fifth-order light has been authorized, but the site for the purpose has not yet been secured. Plans and estimates have been prepared, preparatory to commencing work as soon as the purchase of the site shall have been effected. The light-house will be a wooden building 28 feet square, surmounted by a lantern, with lens of fifth order, and in design the

same with all screw-pile light-houses built in this district. The sub-structure, however, instead of being of iron, will be five brick pyramidal piers, 4 feet square at the base, and a little over 8 feet in height, resting on a bed of concrete 18 inches in depth at the center, which will overlay a grillage of two courses of timber, each 6 inches in thickness, the sub-soil of the site being considered too soft and yielding to permit the use of screw-piles. An appropriation of \$15,000 is available.

378. *Pass Manchac, Lake Pontchartrain, Louisiana.*—A breakwater 200 feet long was built at a cost of \$7.50 per linear foot at the east side of the light-house, to protect it from the destructive action of the waves. The work has two faces, meeting at an angle of 120°, is built of sawed 12-inch by 12-inch yellow pine piles, connected by two courses of 10-inch by 10-inch stringers, faced with sheet-piling of 3-inch plank, and capped with the same. All the piling has a penetration of 8 feet, and the breakwater projects above the surface of the land, on which it is principally located, 7 feet.

— *Errol Island, Gulf of Mexico, Louisiana.*—A light-house has been recommended to be established at this locality as necessary, to fill the gap of fifty-two miles in sea-coast lights existing between Chandeleur Island and Pass à l'outre, but no exact survey has yet been made on which to base an estimate for an appropriation.

380. *Pass à l'outre, river Mississippi, Louisiana.*—A 12-inch steam fog-whistle has been put up, and is now in operation at this light-house.

382. *Head of the Passes, river Mississippi, Louisiana.*—The light-house being in danger of destruction from the washing of the river bank, it has been removed 200 feet farther inland to a place of greater security, and the building is now being repaired and strengthened. A breakwater formerly protected the site, but a large portion of it was carried away in a gale, last October.

383. *Southwest Pass, River Mississippi, Louisiana.*—It has already been reported that the foundation for a new light-house at the station was completed. A first-order iron tower is under contract in the North, and will be erected on its site during the coming year. The old light-house and dwelling are not in very good condition, but will answer all purposes until the completion of the new tower. By the act of Congress approved June 10, 1872, an appropriation of \$25,000 has been granted for completing the erection of this tower. A 12-inch steam fog-whistle has been set up, and is now in operation at this light-house.

385. *Timbalier, Timbalier Bay, Louisiana.*—A first-order iron tower, to be elevated on screw-piles, is under contract in the North. Its design is a skeleton frame-work with a spiral stairway inclosed by sheet-iron, giving access to the lantern, and provided with keeper's dwelling in the lower part of the tower. It will be placed in the water, under the lee of West Timbalier Island. As the available funds are insufficient to finish the erection of the building, it is deemed advisable to store the iron until an additional appropriation of \$44,000 can be granted by Congress for its completion.

387. *Southwest Reef, Atchafalaya Bay, Louisiana.*—The iron screw-pile tower has already once been seriously damaged in a storm by the waves breaking the cast-iron floor of the lower story, and is in danger of being carried away altogether by any hurricane which may visit this vicinity. The lower story, now used as a part of the keeper's quarters, will be replaced by an open iron frame-work. An appropriation of \$5,000 is asked to make the change.

— *Grand Lake, Louisiana.*—Application has been made by parties interested for the establishment of a light or lights in Grand Lake to

accommodate the commerce seeking an outlet to the Gulf by way of the river Atchafalaya. The subject has not yet been fully examined, but there seems to be little doubt that a light-house at the northern end of the lake near Chicot Pass, would be of great benefit. The land in most places is high, with soil suitable for foundation, and could be purchased at from \$5 to \$10 per acre, and a light-house can be constructed, without doubt, at a small expense, but the board are not prepared to recommend an appropriation therefor.

388. *Trinity Shoal, Gulf of Mexico.*—This is an extent of fifteen miles of hard sand, on over 6 miles of which there is less than 12 feet of water, lying 20 miles south of the Louisiana coast. A skeleton iron tower, exactly similar to that for Timbalier, is in course of preparation, under contract in the North. It will probably be located in 14 feet water, and the light, which will be of the first order, will have an elevation of about 131 feet above the sea. A survey of the shoal has just been completed by the Coast Survey. The iron-work will be ready for delivery at an early date, but, for lack of funds adequate to complete the erection, will have to be stored until an additional appropriation is granted, and \$44,000 is asked for it.

389. *Calcasieu, mouth of River Calcasieu, Louisiana.*—A site for a new light-house has been surveyed and steps have been taken toward the purchase of the land, the matter having been placed in the hands of the United States district attorney, who has not yet been heard from. The structure is to be a fourth-order iron tower, similar to that at Southwest Reef, with focal plane of about 50 feet, supported on hollow cast-iron screw-piles, four in number, and strengthened by braces abutting against four exterior piles. The tower will be sheathed with plate-iron. It is already contracted for in the North, and will be erected on its site during the coming year.

392. *Bolivar Point, entrance to Galveston Bay, Texas.*—The foundation of this light-house was completed previous to the last annual report. It is to be a conical sheet-iron tower inclosing a wall of brick; the focal plane of the light (third order) to be 110 feet above the base. When the tower had reached a height of 40 feet the past April, work was suspended by order of the board for want of funds. A new appropriation of \$10,000 having been granted, the construction party will very shortly recommence and the tower be completed at an early date. The lens and all the iron-work are on the ground.

396. *Matagorda, entrance to Matagorda Bay, Texas.*—An appropriation of \$20,000 having been made, a new site for an iron tower similar to that at Bolivar Point, to be provided with a third-order light, has been selected nearly two miles from the old destroyed tower, from which nearly all the iron will be serviceable for the new one. At the close of the year the foundation was under way, and it is proposed to continue the work until the present appropriation is exhausted, when it must be suspended until an additional appropriation of \$12,000 is granted to complete it, which is included in the estimates.

397 and 398. *West Shoal and East Shoal, entrance to Matagorda Bay, Texas.*—The screw-pile light-houses were prepared, and a party organized at Baltimore, in the fifth district, for their erection. They were built simultaneously, and finished in the month of March last. Both lights are on screw-piles. The West Shoal light-house being nearest the Gulf, exhibits a *white* light, and the East Shoal, about one-half mile distant, shows a *red* light.

401. *Brazos Island Beacon, Texas.*—This is the last light but one that exists on the Texas coast before reaching the Mexican boundary. The

present wooden tower is decayed, and is subject to destruction in heavy gales. The vibration of the building in storms causes the breaking of the glass in the lantern, and it is highly important that something be done at this station at an early day. A new light-house of the ordinary screw-pile character of iron foundation is recommended. The distance of the station and the high prices ruling there would enhance the cost of the building above the ordinary rates for such structures even in this district, and an appropriation of \$25,000 is asked.

REPAIRS.

At each of the following-named stations in the eighth district there have been repairs, more or less extensive, during the past year:

— *Buoy and coal depot, Fort Pickens, Florida.*

369. *Saint Joseph's Island, Mississippi Sound, Mississippi.*

380. *Pass à l'Ouvre, River Mississippi, Louisiana.*

386. *Ship Shoal, Gulf of Mexico, Louisiana.* The entire building had the rust scraped off, cleansed with acid and coal-tarred, and a new iron cistern furnished. The fog-bell, which had been only temporarily hung, was permanently fitted in an iron frame.

It is proposed to make repairs at the following-named stations in the eighth district during the coming year:

353. *Saint Mark's, Florida.*

355. *Cape Saint George, Florida.*

356. *Cape San Blas, Florida.*

363. *East Pascagoula River, Mississippi.*

364. *Ship Island, Mississippi Sound, Mississippi.*

368. *Morrill's Shell Bank, Mississippi Sound, Mississippi.*

369. *Saint Joseph's Island, Mississippi Sound, Mississippi.*

372. *West Rigolets, entrance to Lake Pontchartrain, Louisiana.*

374. *Port Pontchartrain, Lake Pontchartrain, Louisiana.*

377. *Tchefuncti River, Lake Pontchartrain, Louisiana.*

379. *Chandeleau, Gulf of Mexico, Louisiana.*

381. *South Pass, River Mississippi, Louisiana.*

384. *Barrataria Bay, Louisiana.*

386. *Ship Shoal, Gulf of Mexico, Louisiana.*

399. *Half-Moon Reef, Matagorda Bay, Texas.*

The following are the names of the light-stations in the eighth district not mentioned elsewhere:

357. *Pensacola, south side Pensacola Bay, near Barrancas, Florida.*

362. *Round Island, off Pascagoula, Mississippi.*

365. *Biloxi, entrance Biloxi Bay, Mississippi.*

367. *Pass Christian, six and one-half miles northwest of Cat Island.*

370. *Rigolets, (Pleasanton's Island,) mouth River Pearl.*

371. *Proctorville Beacon, near fort at Proctorville, Lake Borgne.*

375. *Bayou Saint John, five miles north of New Orleans.*

376. *New Canal, entrance New Canal, Louisiana.*

390. *Sabine Pass, on Brant Point, east side entrance river Sabine.*

391. *Galveston light-vessel, inside Galveston Bar, Texas.*

393. *Half-Moon Shoal, in Galveston Bay, between Pellican Island and Dollar Point, Texas.*

394. *Red-Fish Bar, to mark channel across Red-Fish Bar, Galveston Bay, Texas.*

395. *Clopper's Bar*, to mark channel across Clopper's Bar, Galveston Bay, Texas.

400. *Aransas Pass*, on Low Island, inside Aransas Pass, Texas.

402. *Point Isabel*, at Point Isabel, Brazos Santiago, Texas.

LIGHT-SHIPS.

"*Galveston*," inside of *Galveston Bar*, Texas.—This vessel is very much in want of repair, and she leaks so much that she cannot be kept afloat. She will be removed at once, and a chartered vessel will be procured as a temporary substitute and until the *Galveston* can be repaired.

There are no other light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

Pass à L'outre.—A 12-inch steam-whistle, in good condition.

Southwest Pass.—A 12-inch steam-whistle, in good condition.

DAY OR UNLIGHTED BEACONS.

The day-beacons of the eighth district are all in good condition as far as known, except the one at Stake Island, Southwest Pass, which requires a very trifling strengthening of the bracing to make it more secure.

Day-beacons in Mississippi Sound have been authorized by the board to be established at Horn Island, Round Island, Biloxi, and Pass Christian, and it is proposed to erect them during the coming year. There are five old wrought-iron screw-piles in store, which will answer the purpose, and will be used.

An iron day-beacon about 20 feet in height, and of the form of a tripod surmounted by a hoop-iron globe, has been erected to take the place of the wooden one destroyed in the heavy gales of last fall at Pass à L'outre. It rests on three hollow cast-iron piles filled with concrete.

A day-beacon of the same design as that at Pass à L'outre, but of a height of 50 feet, has been put up in place of a wooden one that was damaged at Stake Island, mouth of river Mississippi, in the same storms that destroyed the Pass à L'outre Beacon.

DEPOTS.

Depot at Head of the Passes, River Mississippi.—This building is in fair condition, but threatened by the wearing away of the river-bank. The cost of protective works to insure the safety of the building, makes it a question as to whether it would not be advisable to remove the depot back from the river, as in the case of the light-house, or to abandon the site for some other eligible location in the western portion of the district.

The cost of everything that enters into light-house construction on the Mexican Gulf coast is exceedingly high compared with other parts of the Union; the small number of cities where supplies necessary can be obtained at any price, in a district extending over one thousand miles of coast, measured on the shortest line, not taking into consideration the bays, sounds, and estuaries; the delays experienced from illness among working-parties from malarial fevers; the soft and yielding nature of the land and shoals in the greater part of the district, making the operation of putting down foundations difficult and ex-

pensive; the unreliable means of communication with distant field-parties, by reason of the deficiency of railroads and packet-lines, have prevented the board from completing many of the works in the eighth district.

TENTH DISTRICT.

The tenth district extends from the mouth of River Saint Regis, New York, to include Grassy Island light-house, River Detroit, Michigan, and embraces all the aids to navigation on the American shores of Lake Erie, Lake Ontario, and River Saint Lawrence.

Inspector.—Commodore Gustavus H. Scott, United States Navy, until 18th September, 1871; Commodore Napoleon Collins, United States Navy, present inspector.

Engineer.—Major George L. Gillespie, Corps of Engineers, brevet lieutenant-colonel, United States Army.

In this district there are:

Light-houses and lighted beacons.....	56
Light-ships.....	0
Fog-signals operated by steam or hot-air engines.....	0
Day or unlighted beacons.....	1
Buoys actually in position.....	76
Spare buoys for relief to supply losses.....	84
Tenders.....	0

The numbers preceding the names of stations correspond with those of "Light-House List of the Northern Lakes and River Coasts of the United States," issued January 1, 1872.

461. *Cross-Over Island, River Saint Lawrence, New York.*—The tower and dwelling are both in very bad condition, and are not worth repair. The tower is of wood, and rises from the roof of the brick dwelling; the timber is so decayed, and the interior framing so badly arranged, that water finds its way into the interior at all points of the connection with the roof. The brick of which the old dwelling is built were originally very inferior, and have been so injured by frosts that the walls are now unserviceable, and cannot be used for supporting any new work. They were sheathed on the outside with boards, in 1869, but this was a temporary expedient, serving only to relieve the cold and dampness of the dwelling, until the whole could be renewed. An appropriation of \$11,000 is required for a new tower and dwelling.

470. *Oswego, Lake Ontario, New York.*—A small frame beacon, with a focal plane 23 feet above the lake-level, was established at the end of the pier, and a communication with the main light formed by a strong elevated wall. The apparatus used is a lens of the sixth order, showing a fixed white light.

471. *Fair Haven, Little Sodus Bay, Lake Ontario, New York.*—An appropriation was made, March 3, 1871, for the erection of a pier, light-house, and dwelling at this station. In May, 1871, a lot of four acres, the smallest which could be obtained, was purchased on the west bank, as the site for the keeper's dwelling. No work was done during the working season on account of the delay of the seller in presenting warrantee deed for the light-house lot for examination. Finally, in May, 1872, the title-papers were presented, but not proving acceptable to the United States district attorney they were returned. Having determined early in the spring to build the frame beacon, irrespective of the dwelling, sealed proposals were publicly invited for the necessary materials. No bids were offered. The materials were accordingly purchased in open

market at Oswego, New York, and framing done there by days' labor. The beacon was shipped from Oswego in May, 1872, erected on the west pier, and the light exhibited June 10, 1872. The apparatus is a Fresnel lens of the fourth order, arc 270°, showing a fixed white light. The height of focal-plane above the lake-level is 34 feet. Should the Board not be able to obtain title to the lot selected, another will be purchased on the opposite side of the bay upon which to erect the keeper's dwelling.

— *Thirty-mile Point, Lake Ontario.*—It is recommended that a lake-coast light be established near the point where the boundary line between Niagara and Orleans Counties intersects the south shore of Lake Ontario. The point is designated on some maps as Thirty-mile Point, being just thirty miles from the mouth of Niagara River. The necessity for this light will be apparent when it is considered that the first light to the eastward of the mouth of the Niagara River is at Oak Orchard, New York, a fourth-order light on a pier, and which, from its re-entrant position, can be of but little service to shipping making the Welland Canal. The light proposed is of the third order. An appropriation therefor is required of \$30,000.

478. *Fort Niagara, mouth of Niagara River, New York.*—An appropriation was made, March 3, 1871, for rebuilding the light-house at this station. Immediately after the passage of the act plans were prepared for the new buildings, sealed proposals were publicly invited for the delivery of the necessary building-materials, and contracts made. The former light was placed on one of the old military buildings of the fort, and unsuccessful efforts were made to locate the new tower within the walls, being near the point which the light is intended to mark, the main object, however, being to serve as a lake-coast light, but it was found that the only place practicable was the lot on which stands the light-keeper's dwelling; this, although further from the point than is desirable, serves very well for both of the above purposes. Work was commenced in July, 1871, and pushed rapidly, but cold weather coming on unusually early, masonry was suspended November 30, 1871. Work was resumed April 15, 1872, and the light exhibited June 10, 1872. The tower and oil-room were completely finished June 27, 1872. When it was decided to place the tower upon the light-house lot, a careful inspection of the bank of the river showed that some protection should be made to arrest the abrasion constantly in operation by the currents and the ice of the river. A thick, low, rubble-stone wall was run along the greater part of the shore, near the water edge, and behind this the bank was terraced and sodded. Six heavy timber jettées, 14 feet to 30 feet in length, filled with stones, were run out from the wall perpendicular to the shore. These have caused the water to shoal, and, it is believed, now perfectly protect the lot. The station is now in fine order.

480. *Buffalo breakwater, (north end,) Lake Erie, New York.*—The work in progress at the date of last report was suspended again September 9, 1871, on account of the continued and irregular setting of the pier of protection, and was not resumed during the working season further than to throw in some heavy stone around northwest corner, to prevent the undermining of the crib, and to protect the angles of the crib with a sheathing of boiler-iron against injury from ice. Work was resumed as early in the spring as the ice would permit, and has been continued, with a few interruptions, to date. The interior finish of the house was completed on the 10th July. The fog-bell is suspended on the exterior, and the striking-apparatus, occupying one of the rooms of the dwelling, has been properly adjusted to strike three times in quick succession, at

intervals of thirty seconds, during foggy weather. The lens is of the fourth order, arc 360° , and the light shown is a fixed red.

485. *Erie Harbor, Pennsylvania*.—An appropriation was made, March 3, 1871, for renovating this station. It was expended in raising the roof, renewing the brick-work around windows, renewing floors, replastering the house, renewing the barn, and building a fence partially around the buildings. The station is in good order.

488. *Presqu'île beacon-range No. 3, Erie Harbor, Lake Erie*.—A small octagonal frame tower has been erected upon the east end of the north pier, to mark the extremity of the new extension. The height of focal plane above lake-level is 12 feet. The apparatus is a sixth-order lens, showing a fixed white light.

— *Presqu'île, Lake Erie, Erie, Pennsylvania*.—An appropriation was made, June 10, 1872, for building a light-house on the north shore of peninsula covering the harbor of Erie. Plans have been prepared, and proposals will be publicly invited at an early day for the delivery of the necessary building-materials. The buildings will consist of a tower and keeper's dwelling attached, and will be built of limestone. The apparatus will be a Fresnel lens of the fourth order, revolving, showing a white light. The height of focal-plane above lake level will be 45 feet.

491. *Conneaut, Lake Erie, Ohio*.—An appropriation was made; March 3, 1871, for building a light-keeper's dwelling at this station. Proposals were publicly invited for its construction, and a contract was made. The contract has been satisfactorily executed excepting a part of the interior finish. The dwelling is a one-story and attic frame structure, with an oil-room, and is situated on the left bank of the stream, a short distance from the piers.

492. *Ashtabula, Lake Erie, Ohio*.—An appropriation was made, March 3, 1871, for building a light-keeper's dwelling at this station. Proposals were publicly invited for its construction, and a contract was made. The contract has been satisfactorily executed, and the building has been accepted. It is a building of the same character as that at Conneaut, Ohio, and is situated on the left bank of the stream, within the township of Ashtabula. The beacon on the east pier is very old and dilapidated, and by the irregular setting of its crib has been much thrown out of verticality. It should be removed, and a pier-head beacon should be established in its stead. The appropriation required is \$3,400.

493. *Grand River, Lake Erie, Fairport, Ohio*.—Work in progress at date of last report was so far completed as to exhibit the light from the new tower on the 11th of August, 1871. The new building and oil-room were completed 20th of October, 1871. The order of the original light was not changed. The east pier of entrance to the harbor at this station is being extended 400 feet, and as the frame beacon is very old and needs renewing, it should be taken down and a new frame beacon should be erected at the pier-head of the new extension. An appropriation is required of \$3,400.

495. *Cleveland, Lake Erie, Ohio*.—The work of building the stone wall in closing the lot, in progress at date of last report, was completed in July. Proposals were publicly invited for the necessary building-materials for the new tower and dwelling, and a contract was made for the stone. One bid was offered for the brick, but as the sample presented was of a very inferior kind, it was rejected. No bid was offered for lumber. The stone were delivered in November, and the winter was consumed in dressing them, and in preparing all the necessary carpentry. On account of the great fire in Chicago, it was found impossible to buy in

Cleveland, at anything like a reasonable price, brick at all suitable for exterior work. The engineer, therefore, was compelled to make a contract with a firm at La Salle, New York, for the supply of the brick needed. This season has been most unfavorable for their manufacture, and the contractors have not supplied them at the time nor in the quantities expected. A small lot has been delivered, and the work of construction has advanced to 5 feet above the water-table. On the 15th of July it was expected that the full amount ordered would have been delivered, and that after that date the construction would advance without interruption.

498. *Black River, Lake Erie, Ohio.*—This station has no keeper's dwelling. An appropriation of \$4,000 is required for the construction of a frame dwelling similar to the one at Ashtabula, Ohio.

499. *Vermillion, Lake Erie, Ohio.*—The house and lot purchased in this village for the use of the light-keeper were transferred to the United States in April. A few alterations have been made to the house to furnish accommodations for oil, and a cellar, a neat inclosure, and a stone sidewalk have been added. The station is in fine order.

500. *Huron, Lake Erie, Ohio.*—An appropriation was made March 3, 1871, for building a light-keeper's dwelling at this station, and a lot has been purchased for it. There was great delay in making the title-papers satisfactory to the district attorney, but they have been perfected at last, and have been forwarded to the Attorney-General of the United States for examination and approval. The construction of the dwelling is under contract, and work will commence immediately after the acceptance of the title-papers by the Attorney-General.

508. *Maumee outer range, (rear,) Toledo, Ohio.*—Work in progress at date of last report was satisfactorily completed in October. The dwelling was accepted, and the keeper immediately installed. There are two points in the southwest channel through Maumee Bay, Ohio, which require to be marked by day-beacons. The one is in the position now occupied by red can-buoy No. 2, and the other is that occupied by black can-buoy No. 1. Vessels making the harbor frequently strike these buoys and either break their moorings or drag them out of the place, to the great embarrassment of shipping. Vessels are continually grounding in the bay from this cause. The foundation and superstructure of the beacons should be made of 12-inch pine timber, framed and bolted like ordinary crib-work for harbor-piers, and filled with heavy stone; the foundation to be 30 feet square, sunk in 10 feet water, and its exposed angles protected by piling. The superstructure will be sheathed on the outside with heavy oak timber. The whole will be surmounted by an iron cage. One beacon will be painted red and the other black. An appropriation of \$12,000 is required for these beacons.

511. *Maumee inner range, (front,) Toledo, Ohio.*—A frame buoy-house has been built on the water-front of the light-house property. It is established about 200 feet from shore upon a crib of protection 25 feet square, sunk in 6 feet of water.

514. *Gibraltar, mouth of River Detroit, Lake Erie, Michigan.*—An appropriation was made June 10, 1872, for rebuilding tower and keeper's dwelling at this station. It is proposed to remove the old tower, relinquish the site, and to erect the new buildings upon the light-house lot. Sealed proposals will be publicly invited at an early day for the supply of the necessary building-materials. The plans contemplate a tower, and dwelling attached, constructed of brick. It is expected to complete the work before the close of the working season.

REPAIRS.

At each of the following-named stations in the tenth district there have been repairs and renovations more or less during the year:

461. *Cross-Over Island*, New York, River Saint Lawrence.
462. *Sister Islands*, New York, River Saint Lawrence.
464. *Rock Island*, New York, River Saint Lawrence.
469. *Oswego*, New York, Lake Ontario.
470. *Oswego pier-head light*, New York, Lake Ontario.
473. *Big Sodus beacon*, (rear,) New York, Lake Ontario.
474. *Big Sodus*, New York, Lake Ontario.
475. *Genesee*, New York, Lake Ontario.
476. *Genesee beacon*, Lake Ontario, moved to end of pier.
477. *Oak Orchard beacon*, Lake Ontario, moved to end of pier.
479. *Horseshoe Reef*, Buffalo, New York, lantern changed.
482. *Buffalo*, New York.
483. *Dunkirk*, New York, Lake Erie.
489. *Peninsula range No. 1*, Lake Erie.
490. *Peninsula range No. 2*, Lake Erie.
494. *Grand River*, Fairport, Ohio, Lake Erie.
504. *Green Island*, Lake Erie, Ohio.
505. *West Sister*, Lake Erie, Ohio.
506. *Turtle Island*, Maumee Bay, Ohio.
- 508, 510, 511, 512. *Maumee ranges*, Toledo, Ohio.
513. *Monroe*, Lake Erie, Michigan.
515. *Mamajuda*, River Detroit, Michigan.
516. *Grassy Island*, Detroit River, Michigan.

Stations at which repairs in the tenth district will be made during the next year:

462. *Sister Islands*, River Saint Lawrence, New York.
464. *Rock Island*, River Saint Lawrence, New York.
465. *Tibbets's Point*, Lake Ontario, New York.
479. *Horseshoe Reef*, Buffalo, New York.
483. *Dunkirk*, Lake Erie, New York.
491. *Conneaut*, Lake Erie, Ohio.
500. *Huron*, Lake Erie, Ohio.

The following are the names of the light-stations in the tenth district not mentioned elsewhere:

460. *Ogdensburg*, River Saint Lawrence, New York.
463. *Sunken Rock*, River Saint Lawrence, New York.
466. *Galloo Island*, Lake Ontario, New York.
467. *Sackett's Harbor*, Lake Ontario, New York.
468. *Stony Point*, Lake Ontario, New York.
472. *Big Sodus*, Lake Ontario, New York.
481. *Buffalo breakwater*, (south end,) Buffalo, New York.
482. *Buffalo*, Lake Erie, New York.
484. *Dunkirk beacon*, Lake Erie, New York.
486. *Presqu'isle range, No. 1*, Pennsylvania.
487. *Presqu'isle range, No. 2*, Pennsylvania.
496. *Cleveland, No. 1*, Ohio.
497. *Cleveland, No. 2*, Ohio.

- 501. *Cedar Point*, Sandusky Bay, Ohio.
- 502. *Cedar Point Beacon range*, Sandusky Bay, Ohio.
- 503. *Marblehead*, Sandusky Bay, Ohio.
- 507. *Maumee outer range*, (front,) Ohio.
- 509. *Maumee middle range*, Ohio.

LIGHT SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot air in this district.

DAY OR UNLIGHTED BEACONS.

There are no day-beacons in this district.

DEPOT.

The construction of a wharf for the use of the light-house depot at Buffalo, New York, in progress at the date of last report, was prosecuted satisfactorily during the summer, and completed September 30, 1871. This wharf is 264 feet long, by 12½ feet wide, and is sunk 6 feet below low-water mark. At a distance of 3 feet in front of the wharf a row of protecting piles has been driven, 4 feet from center to center, and confined at top with walling pieces bolted through and through to each pile with seven bolts. During the winter it was found that snow penetrated the roof of the store-house and damaged articles in store there. The slate were removed in June, new boards and felting put on, and the slating renewed. The foundation of the exterior stairs being cracked and sunken, was removed and rebuilt; the decayed sleepers of the second floor were replaced by sound ones, and additional supporting-timbers placed underneath. All the buildings of the station have been painted, a new fence built in front, with spikes on top to exclude trespassers, and the grounds planted with shade-trees and grass. A commodious boat-house for two boats has been built at the east end of the wharf. The station is now in fine condition.

TENDER.

There is now no tender in the tenth district; and the Haze, belonging to the eleventh district, is used for supplying the lights in the tenth district, and for buoy service. The great distances between the extremes of the tenth and eleventh districts make it necessary to have another tender, to be used in the former for inspector's and engineer's purposes, and an estimate is submitted therefor.

ELEVENTH DISTRICT.

The eleventh district embraces all aids to navigation on the northern and northwestern lakes above Grassy Island light-house, River Detroit, and includes Lakes Saint Clair, Huron, Michigan, and Superior.

Inspector.—Commodore Alexander Murray, United States Navy.

Engineer.—Major O. M. Poe, Corps of Engineers, brevet brigadier-general, United States Army.

There are in this district :

Light-houses and lighted beacons.....	91
Light-ships.....	none
Fog-signals operated by steam or hot-air engines.....	7
Day or unlighted beacons.....	1
Buoys actually in position.....	138
Spare buoys for relief and to supply losses.....	99
Tender (steam) Haze, buoy-tender and supply-vessel, (common to tenth and eleventh districts).....	1
Tender (steam) Warrington, (used in engineer's constructions and repairs)....	1
Tender (sail) Belle, (used in engineer's constructions and repairs).....	1

The numbers preceding the names of stations correspond with the "Light-House List of the Northern and Northwestern Lakes of the United States," issued January 1, 1872.

520, 521. *Saint Clair Flats Canal*.—These two light-houses were completed as proposed in the last annual report, and were lighted for the first time on the night of November 15, 1871. Simultaneously the temporary lights were discontinued. It was found that the foundations were liable to injury from the impact of rafts in tow of steam-tugs, as well as from other causes not connected with the construction. They were protected by special constructions, which thus far have proven perfectly satisfactory.

522. *Fort Gratiot, Lake Huron, Michigan*.—The steam fog-whistle under construction was completed in good time last season, and was in operation during all the thick and smoky weather consequent upon the great fires in the Northwest of last fall. Its use was most opportune, and the signal gives great satisfaction.

—A light-house between *Fort Gratiot and Point aux Barques, Lake Huron, Michigan*.—The recommendation contained in the last annual report is renewed, together with the estimate of the cost of a suitable structure. This light-house is one of the coast-lights of the general system, and is not intended to serve any local interest. Its value to the general commerce will be great, as it will divide the long distance of seventy-five miles between Point aux Barques and Fort Gratiot.

528. *Thunder Bay Island, Lake Huron, Michigan*.—The steam fog-whistle under construction at this station at the date of the last annual report was duly completed, and has rendered excellent service.

532. *Spectacle Reef, Lake Huron, Michigan*.—At the date of the last annual report (July 1, 1871,) the crib, 92 feet square, with a central opening of 48 feet square to receive the coffer-dam which was to form the pier of protection, as well as a landing-place for materials during the building of the light-house, was in course of construction at Scammon's Harbor. The original intention was to put the crib in position in four sections, but upon further consideration it was decided to attempt placing it as a whole upon the reef, which was successfully accomplished, as is detailed hereafter.

In order to get accurate soundings to guide in shaping the bottom of the crib, and to fix with a degree of certainty the position of these soundings and that to be occupied by the crib, the following method was pursued: Four temporary cribs, each 15 feet by 25 feet, of round timber, were placed in from 8 to 10 feet of water, in a line corresponding with the proposed eastern face of the pier of protection, and filled to the level of the water with ballast-stone. These four cribs were then decked over and connected together. Upon the pier thus formed about seventy cords of ballast-stone were placed, ready at the proper time to be thrown into the crib forming the pier of protection. The lower two complete courses of the pier of protection, having been fastened together by screw-bolts, forming a raft, constituting a ground-plan of the pier of

protection, were then towed from the harbor where framed to the reef, and moored directly over the position to be occupied by the finished pier. Its position was marked upon the temporary pier referred to above, and soundings taken at intervals of two feet along each timber in the raft, thus obtaining accurate contours of the surface of the reef within the limits of these timbers. The raft was then towed back to the harbor, hauled out upon ways, and by means of wedges of timber the bottom was made to conform to the surface of the reef. The raft, now become the bottom of the pier of protection, was then launched, and additional courses of timber built upon it, until its draught of water was just sufficient to permit its being floated into position on the reef, at which time it was estimated that the top of the pier would be one foot out of water.

The depth of water on the reef at the points to be occupied by the four corners of the pier of protection was found to be as follows: At northeast corner, 10 feet 6 inches; at northwest corner, 13 feet; at southwest corner, 14 feet 6 inches; and at southeast corner, 9 feet 6 inches; the position to be occupied by the pier of protection having been so chosen that the sides would correspond to the cardinal points of the compass. Meanwhile five barges at the harbor had been loaded with ballast-stone, making, together with those on the temporary pier at the reef, 290 cords (about 1,800 tons) at command, with which to load the pier of protection and secure it to the reef as soon as it should be placed in position.

On the evening of the 18th of July, 1871, everything being in readiness, and the wind, which had been blowing freshly from the northwest for three days previously, having somewhat moderated, at 8 p. m. the tugs Champion (screw-propeller) and Magnet (side-wheel) took hold of the immense crib and started to tow it to the reef, fifteen miles distant, followed by the Warrington (screw-propeller) having in tow the schooner Belle, (the two having on board a working force of 140 men,) the tug Stranger (screw-propeller) with barges Ritchie and Emerald, and the tug Hand with two scows of the Light-House Establishment. The barge Table Rock, with fifty cords of stone on board, was left in reserve at the harbor. The construction-scow, with tools, &c., on board, was towed with the crib. At 2 a. m. next morning, six hours after starting, the fleet hove to off the reef awaiting daylight and the abatement of the wind, which had again freshened up. At 6½ a. m., it having moderated, the pier, with considerable difficulty, was placed in position, and after being secured to the temporary pier and the moorings previously set for the purpose, all hands went to work throwing the ballast-stone into the compartments, and by 4 p. m. succeeded in getting into it about 200 cords (1,200 tons.) By this time the wind was blowing freshly and the sea running so high as to make it necessary to stop work for the time, but early next morning all the reserve stone were put into the compartments.

The tugs Magnet and Stranger were discharged as soon as the pier was in position, but for fear of accident the Champion (a steamer of great power) was retained until all the stone were in place, when she was discharged, and started for Detroit with the barges Ritchie and Emerald in tow. The Table Rock was retained in service until the 30th July, when she was dispensed with. After the pier was in position the schooner Belle was moored on the reef to serve as quarters for the working force, which proceeded to build up the pier to the required height above water, (12 feet.) The Warrington having gone to Detroit to receive a new boiler, the tug Hand was retained to tow the scows carry-

ing the ballast-stone used in completing the filling of the compartments, until the return of the Warrington on the 12th of September, when she, too, was discharged. By this time the pier had been built up to its full height, and by the 20th of September quarters for the workmen had been completed upon it, which were at once occupied, and the Belle returned to the harbor. By means of a submarine diver the bed-rock within the opening of the pier was then cleared off, and the work of constructing the coffer-dam was taken in hand. The coffer-dam itself consisted of a hollow cylinder, 41 feet in diameter, composed of wooden staves, each 4 inches by 6, and 15 feet long. The cylinder was braced and trussed internally, and hooped with iron externally, so as to give it the requisite strength. It was put together at the surface of the water, and when complete was lowered into position on the bed-rock by means of iron screws. As soon as it rested on the rock, (which was quite irregular in contour,) each stave was driven down so as to fit as closely as it would admit and a diver filled all openings between its lower end and the rock with Portland cement. A loosely-twisted rope of oakum was then pressed close down into the exterior angle between the coffer-dam and rock, and outside of this a larger rope made of hay. The pumping-machinery having meanwhile been placed in readiness, the coffer-dam was pumped dry, and on the same day (14th October) a force of stone-cutters descended to the bottom and commenced the work of leveling off the bed-rock, and preparing it to receive the first course of masonry. The bed-rock was found to consist of dolomitic limestone, (confirming the previous examinations,) highest on the western side, (toward the deepest water,) and sloping gradually toward the eastern. In order to make a level bed for the first course of masonry, it was necessary to cut down about two feet on the highest side, involving a large amount of hard labor, rendered more difficult by the water forcing its way up through seams in the rock. But the work was finally accomplished, the bed being as carefully cut and leveled as any of the courses of masonry. The first course of masonry was then set, completing it on the 27th of October. While setting this course much trouble was caused by the water, already referred to as forcing its way up through seams in the rock, which attacked the mortar bed. For this reason water was let into the dam every evening (and pumped out next morning) to give the mortar time to harden during the night. This mortar was composed of equal parts of Portland cement and screened siliceous sand. Specimens of it obtained the following spring, after being in place under water for seven months, were quite as hard or harder than either the bed-rock or the stone used in building the tower.

The weather having now become very boisterous, with frequent snow-squalls, often interrupting the work, and the setting of any additional stone requiring the removal of a portion of the most important of the interior braces of the coffer-dam, it was deemed prudent to close the work for the season. This, too, would give ample time for the hardening of the mortar used in bedding the stone, and in the concrete used for filling cavities in the bed-rock, as well as the space between the outside of the first course and the coffer-dam, (which was solidly filled with concrete to the top of the first course.) Therefore the coffer-dam was allowed to fill with water, the process being hastened by boring holes through it to admit the water, and it was secured to prevent its being lifted by the ice during the winter. The machinery was laid up, and on the last of October all the working force, except two men, were removed. These two men were left to attend to the fourth-order light, which had been established on top of the men's quarters, and the fog-

signal, consisting of a whistle attached to one of the steam-boilers. At the close of navigation they were taken off the pier by the light-house tender Haze.

The degree of success of this novel coffer-dam may be inferred from the fact that although prepared with pumps of an aggregate capacity of five thousand gallons per minute, not more than a capacity of seven hundred gallons was used, except when emptying the coffer-dam, and then only to expedite the work. Once emptied, a small proportion of this capacity was ample to keep the coffer-dam free from water; and this at a depth of 12 feet of water, on rock, at a distance of nearly eleven miles from the nearest land. Every person connected with the work may well feel a just pride in its success. All the stone which had been delivered at the harbor, consisting of the first five courses, (each course 2 feet thick,) having been cut by this time, the work there was also closed.

The season opened a month later in 1872 than in 1871, consequently work was not resumed at the harbor until the 3d of May, and upon the reef on the 20th of the same month. On the 13th of May the ice in the coffer-dam was still a compact mass, of some feet in thickness. Masses of ice still lay on top of the pier itself. As soon as anything could be done, the ice still remaining was cleared out of the coffer-dam, the machinery put in order, the braces removed from the interior of the coffer-dam, and the work of setting additional courses begun. This has continued without interruption to the present time; when the masonry is well above the water, and going on at such a rate that one entire course is set, drilled, and bolted complete every three days. If this continues, the tower will have reached a height of at least 40 feet above the lake-level before the close of the season.

It is greatly to be regretted that in a work of such difficulty and importance it was not found practicable to use granite. The first contractor to furnish stone agreed to supply granite from a quarry at Duluth, Minnesota. After a trifling effort to quarry the stone, he utterly failed, and he abandoned the contract. It was then so late in the season that the engineer was compelled either to stop operations or to go into the open market and purchase such stone as he could get. The best available was the Marblehead limestone from the vicinity of Sandusky, Ohio, and this was used. In February, 1872, proposals for the remaining stone were received, and of these the granite offered was at such a price as to exclude it, and no other suitable stone except the Marblehead limestone being offered, he was again driven to use it.

It is hoped that the work will be entirely completed by the close of the season of 1873. It seems now as though the appropriations available would be sufficient to complete the work, but for fear they may not, it is deemed advisable that \$20,000 be appropriated for the important work, in addition to the balance of appropriations on account of this work, which have heretofore reverted to the Treasury, or which may do so under existing laws, previous to the time at which it is possible to complete it.

536. *Detour, Lake Huron, Michigan.*—A steam fog-whistle has been established at this station, greatly to the benefit of navigation.

— *Saint Helena Island, Straits of Mackinac.*—An appropriation for this work is available, and it will be taken in hand as soon as practicable.

— *Little Traverse, Lake Michigan, Michigan.*—Attention was directed to the necessity of a light-house to make this fine harbor of refuge available at all times, by an inquiry from the Senate Committee on

Commerce, which inquiry was referred to the engineer officer of the district, and he reported under date of April 11, 1871, in a communication of which the following is a copy :

Referring to a letter from the Light-House Board, dated March 28, 1871, inclosing a copy of a communication from the chairman of the Senate Committee on Commerce, covering a resolution of the legislature of Michigan, relative to establishing a light-house, &c., at the mouth of Little Traverse Bay, Michigan, and directing me to report as to the utility and cost of the constructions asked for, I have the honor to submit the following :

By reference to the tracing of the lake-survey detail chart of Little Traverse, inclosed herewith, and the engraved lake-survey chart of the northeast end of Lake Michigan, including Big and Little Traverse Bays and the Fox and Manitou Islands, a copy of which is supposed to be in the office of the board, or can be readily obtained at the office of the Chief of Engineers, the relation of the harbor of Little Traverse to the navigation of Lake Michigan can be readily seen and appreciated. The harbor itself is excellent in every respect, easy of access, affording good anchorage, and a complete shelter from all winds.

A light-house of the fifth order, together with a fog-bell of 600 pounds, with Stevens's striking-apparatus will make the harbor available.

In addition to its relation to the general commerce of Lake Michigan, the harbor has some local importance. This is increasing and doubtless will continue to do so.

The proposed aids to navigation should be placed at the extreme end of the point, on the south side of the harbor, as indicated on the accompanying tracing, and would cost about \$12,000, which sum, for the purpose indicated, I respectfully recommend be included in the next annual estimates.

544. *South Manitou Island, Lake Michigan.*—The work of improving this station, which was in progress at the date of the last annual report, was duly completed.

546. *Manistee, Lake Michigan, Michigan.*—This light-station was destroyed during the great fire of the night of the 8th of October, 1871. The keeper, with commendable energy, established a temporary light within a few days afterward, and under the act of Congress approved May 18, 1872, making an appropriation for rebuilding the station, a working party was dispatched some time since from Detroit for the work.

548. *Pere Marquette, Lake Michigan, Michigan.*—This station is as yet without a keeper's dwelling, and an appropriation of \$4,000 is required for the purpose in question.

— *Little Point au Sable, Lake Michigan, Michigan.*—The site required for the proposed coast-light at this point has been reserved, and as soon as practicable the erection of the station, under the act of Congress approved June 10, 1872, will be undertaken.

— *White River, Lake Michigan, Michigan.*—A pier-head light has been established at this point, but a dwelling for the keeper is much needed, there being none at the station, and an appropriation of \$4,000 is required for the purpose.

550. *Muskegon pier-light, east shore of Lake Michigan, Michigan.*—This light, in course of construction at the date of the last annual report, was duly completed, and has been in operation since.

552. *Grand Haven pier-light, Lake Michigan, Michigan.*—This light has also been established since the date of the last annual report. It is one of the general system of pier-head lights.

553. *Holland, Michigan, at the mouth of Black Lake, east side Lake Michigan, Michigan.*—The construction of a dwelling for the keeper at this station will be undertaken as soon as a title to the requisite site can be obtained. The necessary funds were appropriated by act of Congress approved June 10, 1872.

555. *South Haven, Lake Michigan, Michigan.*—The necessary buildings have been erected at this station and the light established.

559. *Michigan City pier-light, Lake Michigan, Indiana.*—As proposed at the date of the last annual report, this light was erected and in full operation before the close of last season.

— *Calumet, Lake Michigan, Illinois.*—The re-establishment of this light has been delayed by the failure of the present owners to make to the United States the requisite title to the proposed site. Efforts to obtain title are still being made.

562. *Grosse Point, Lake Michigan, Illinois.*—The plans and specifications for the proposed buildings at this station have been made, and proposals for their construction will be invited within a few days.

— *Racine Point, Lake Michigan, Wisconsin.*—The following are the remarks concerning the establishment of a coast-light at this point, contained in the last two annual reports :

This is a prominent point on the west coast of Lake Michigan, about three and a half miles north of Racine, and eighteen miles south of the North Cut beacon, at Milwaukee. The point shuts out to the northward the Racine light, which lies in a bay, and is not seen by vessels coming from the north, and keeping the shore well aboard, as they mostly do, until nearly abreast of it.

Frequent shipwrecks have occurred at this point for the want of a light. For vessels coming from the south it would also be a good guide for steering clear of Racine Reef.

A fog-signal should also be provided. For these two objects there is required an appropriation of \$40,000.

— *Racine pier-light, Lake Michigan, Wisconsin.*—A working party is now engaged in erecting a pier-head light and elevated walk at this place. It will be completed about the 1st of September of this year.

— *Milwaukee pier-head light, Lake Michigan, Wisconsin.*—Upon completion of the pier-head light at Racine, the working party will be transferred to Milwaukee for the purpose of erecting a pier-head light at the outer end of the north pier, which has been extended during the present season. An elevated walk will be built to connect the light with the shore.

— *Twin River Point, Lake Michigan, Wisconsin.*—This point is seven miles north of Manitowoc, and occupies a position on the west coast of Lake Michigan, similar to Grand Point au Sable on the east. It is the prominent landmark for vessels navigating Lake Michigan, and should be marked by a tower 100 feet high, with an apparatus of the third order. There is an old discontinued station at the village of Twin River, but the site is too far south of the point to answer the purpose of a coast-light. There is required for a proper light at this station an appropriation of \$40,000.

— *North Bay, Lake Michigan, Wisconsin.*—By act of Congress approved July 15, 1870, an appropriation of \$7,500 was made for the purpose of establishing a light or lights to enable vessels to enter this harbor, and a price for the land required was agreed upon. But the owner found it impracticable to clear the title before the 30th June, when the appropriation reverted to the Treasury. It is recommended that the amount be re-appropriated and another attempt be made to obtain title.

— *Poverty Island, Lake Michigan.*—The remarks contained in the last annual report, and those for the two preceding years, respecting the necessity for a light at this point, with estimate of cost of same, are repeated, as follows :

The already large and rapidly increasing commerce to and from the northern end of Green Bay, and the lower lake ports, now takes, in daylight, the northern passage from Lake Michigan into Green Bay, because of its being much shorter and more direct. To enable vessels to use the same passage in the night, a light-house on Poverty Island is necessary.

There is recommended an appropriation of \$18,000 for the object stated.

— *Big Sable, Lake Superior, Michigan.*—An appropriation for a light-house at this point was made at the last session of Congress, under the title of "*a light between White Fish Point and Grand Island Harbor.*" Steps have been taken to select the exact site; when this is done, the title will be secured as soon as possible, and the erection of the necessary buildings undertaken.

— *Stannard's Rock, Lake Superior.*—The remarks and estimate contained in the last annual report, relating to a light-house at this point, are renewed as follows:

The rapid increase of the commerce between Du Luth, the eastern terminus of the Northern Pacific Railroad, and the lower lakes, will demand at no distant day the erection of a light-house on this danger so much dreaded by all vessels bound to or from ports above Keweenaw Point, and ports below. The case will be similar to that of Spectacle Reef, and all the costly apparatus and machinery purchased for the latter can be made available for the former, thereby greatly reducing the cost of construction. It is not proposed, however, to do anything further at this time than to make the preliminary examinations, and mature plans for the work, for which purpose it is recommended that the sum of \$10,000 be appropriated.

— *L'Anse, Lake Superior, Michigan.*—The last annual report contained the following remarks and estimate relating to the necessity of establishing a light at this place, which are repeated:

The railroad from Escanaba and Marquette, to Ontonagon, passes the head of L'Anse Bay, and will for the present terminate there. Efforts which will probably prove successful are now being made to complete the road to L'Anse before the close of this season, when the place will at once become an important point for the shipment of iron-ore. A good harbor is found at the head of the bay, and it should be lighted. A joint report upon this subject was made by the inspector and engineer. To establish such a light as is needed will require an appropriation of \$12,000, which amount, for the purpose indicated, is recommended.

— *Outer Island, Lake Superior.*—Concerning the necessity for a light at this point the following, contained in the report for the last year, is repeated:

The through commerce to and from the western end of Lake Superior increasing so rapidly, as the railroads having their terminus at Du Luth are extended to the westward, all passes outside of the Apostle Islands, and is greatly in need of a light-house on the northern end of Outer Island. This should be a light of the third order, and will cost \$40,000, which sum is recommended for appropriation.

— *Sand Island, Lake Superior.*—The remarks and estimate of last year are renewed as follows:

For reasons given in the preceding case, (Outer Island,) a light (of a lower order, however) is demanded on the northern end of Sand Island, the most westerly of the group, for which purpose an appropriation of \$18,000 is recommended.

608. *Duluth, Lake Superior, Minnesota.*—A contract for the erection of this station has been made, and the work is now in progress.

— *Passage Islands, Lake Superior.*—Respecting the importance of establishing a light at this place, the remarks contained in the last annual report are repeated with the estimate of cost, as follows:

The discovery of the silver mines on Lake Superior, and consequent sudden and remarkable increase of travel and traffic to that region, render it desirable that a light house should be built on Passage Island, to mark the channel between it and Isle Royale. The island is difficult of access, and therefore any structure put there will cost more than if erected at some more accessible point. There is recommended an appropriation of \$18,000 for the purpose indicated.

PIER-HEAD LIGHTS.

These are being erected as rapidly as piers are reported by the Engineer Department of the Army ready to receive them, and apparatus

can be supplied. The extension of this system of pier-lights must depend upon that of harbor improvements, which renders it somewhat difficult to estimate in detail until it is known just where these improvements are to be made.

REPAIRS.

Repairs, more or less extensive, were made or are in progress at the following stations in the eleventh district, viz:

518. *Saint Clair Flats*, Lake Saint Clair.
520. *Saint Clair Flats Canal*, (lower light.)
521. *Saint Clair Flats Canal*, (upper light.)
523. *Point aux Barques*, Michigan, Lake Huron.
524. *Tawas*, (Ottawa,) Michigan, Lake Huron.
526. *Saginaw Bay*, Michigan, Lake Huron.
534. *Cheboygan*, Michigan, Lake Huron.
538. *Skulligallee*, Michigan, Lake Michigan.
549. *Muskegon*, Michigan, Lake Michigan.
556. *Saint Joseph*, Michigan, Lake Michigan.
567. *Milwaukee*, Wisconsin, Lake Michigan.
568. *Milwaukee pier-light*, Wisconsin, Lake Michigan.
569. *Port Washington*, Wisconsin, Lake Michigan.
570. *Sheboygan*, Wisconsin, Lake Michigan.
575. *Port du Mort*, Wisconsin, Lake Michigan.
576. *Pottawatomic*, Wisconsin, Lake Michigan.
577. *Point Peninsula*, Michigan, Green Bay.
580. *Chambers Island*, Wisconsin, Green Bay.
582. *Tail Point*, Wisconsin, Green Bay.
585. *White Fish Point*, Wisconsin, Green Bay.
587. *Grand Island Harbor*, Wisconsin, Green Bay.
588. *Grand Island Harbor range*, (front light,) Wisconsin, Green Bay.
589. *Grand Island Harbor range*, (rear light,) Wisconsin, Green Bay.
592. *Huron Island*, Michigan, Lake Superior.
594. *Portage range*, (front light,) Michigan, Lake Superior.
595. *Portage range*, (rear light,) Michigan, Lake Superior.
596. *Manitou*, Michigan, Lake Superior.
597. *Gull Rock*, Michigan, Lake Superior.
598. *Copper Harbor*, Michigan, Lake Superior.
599. *Copper Harbor range*, (front light,) Michigan, Lake Superior.
600. *Copper Harbor range*, (rear light,) Michigan, Lake Superior.
605. *La Poinet*, Wisconsin, Lake Superior.
607. *Minnesota Point*, Wisconsin, Lake Superior.

The following are the names of the light-stations in the eleventh district, not mentioned elsewhere:

517. *Windmill Point*, River Detroit, entrance to Lake Saint Clair, Michigan.
525. *Charity Island*, mouth of Saginaw Bay, Michigan.
527. *Sturgeon Point*, Lake Huron, Michigan.
- 529, 530. *Presque Isle Harbor*, Lake Huron, Michigan.
531. *Presque Isle range-light*, Lake Huron, Michigan.
533. *Bois Blanc*, Bois Blanc Island, entrance to Straits of Mackinac, Lake Huron.
535. *McGulpin's Point*, Straits of Mackinac, Michigan.
537. *Waugoshance*, entrance to Straits of Mackinac, Lake Michigan.

- 539. *Beaver Island*, south end, Lake Michigan.
- 540. *Beaver Island*, north end, Lake Michigan.
- 541. *South Fox Island*, Lake Michigan.
- 542. *Grand Traverse*, entrance to Grand Traverse Bay, Michigan.
- 543. *Mission Point*, Grand Traverse Bay, Michigan.
- 545. *Point Betsey*, (Aux Becs Scies,) Lake Michigan, Michigan.
- 547. *Grand Point au Sable*, Lake Michigan, Michigan.
- 551. *Grand Haven*, Lake Michigan, mouth of Grand River, Michigan.
- 554. *Kalamazoo*, Lake Michigan, mouth of Kalamazoo River, Michigan.
- 558. *Michigan City*, Lake Michigan, Indiana.
- 560. *Chicago*, Lake Michigan, Illinois.
- 563. *Waukegan*, Lake Michigan, Illinois.
- 564. *Kenosha*, Lake Michigan, Wisconsin.
- 566. *Racine*, Lake Michigan, Wisconsin.
- 571. *Manitowoc*, Lake Michigan, Wisconsin.
- 572, 573. *Bailey's Harbor*, Lake Michigan, Wisconsin.
- 574. *Canu Island*, Lake Michigan, Wisconsin.
- 578. *Escanaba*, Green Bay, Wisconsin.
- 579. *Eagle Bluff*, Green Bay, Wisconsin.
- 581. *Green Island*, Green Bay, Wisconsin.
- 583. *Round Island*, White Fish Bay, Lake Superior, Michigan.
- 584. *Point Iroquois*, White Fish Bay, Lake Superior, Michigan.
- 586. *Grand Island*, Lake Superior, Michigan.
- 590. *Marquette*, Lake Superior, Michigan.
- 591. *Granite Island*, Lake Superior, Michigan.
- 593. *Portage River*, Keewenaw Bay, Lake Superior, Michigan.
- 602. *Eagle River*, Lake Superior, Michigan.
- 603. *Ontonagon*, Lake Superior, Michigan.
- 604. *Michigan Island*, Lake Superior, Wisconsin.
- 606. *Raspberry Island*, Lake Superior, Wisconsin.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- White Fish Point, Lake Superior*.—A steam fog-whistle.
- Port du Mort, (Pilot Island,) Lake Michigan*.—An air-trumpet.
- Grand Haven, Lake Michigan*.—A fog-bell, rung by hot-air engine.
- Detroit, Lake Huron*.—A steam fog-whistle.
- Spectacle Reef, Lake Huron*.—A steam fog-whistle.
- Thunder Bay Island, Lake Huron*.—A steam fog-whistle.
- Port Gratiot, Lake Huron*.—A steam fog-whistle.

DEPOT.

The fire-proof store-house of the light-house depot at Detroit was carried up two stories above the basement, and then covered with a temporary roof during last season. A line of sheet-piling was driven along the western line of the lot between the basin and the adjoining glue-factory. By act of Congress approved June 10, 1872, the sum of \$25,000 was appropriated for this work, and will, it is thought, be sufficient to complete it.

The first work undertaken under this appropriation will be the erec-

tion of a suitable dwelling for the store-keeper and a close board fence along the top of the sheet-piling referred to. As soon as practicable it is also proposed to finish the store-house. This depot is already of great value, and its advantages will increase from year to year.

SURVEYS OF LIGHT-HOUSE SITES.

These surveys have been carried on as rapidly as possible. Those completed are Windmill Point and River Clinton, Lake Saint Clair; Fort Gratiot and Point aux Barques, on Lake Huron; Saginaw Bay and Tawas, on Saginaw Bay; Grand Haven, South Haven, Grosse Point, Beaver Island, and Beaver Island Harbor, on Lake Michigan; and Eagle River, on Lake Superior. The work will be continued in accordance with the plans of the board.

TENDERS.

The steam-barge Warrington has been almost exclusively used as a tender upon the work at-Spectacle Reef. Last fall she was supplied with a new boiler and heater, both of the very best class, and her machinery for handling freight put into the best possible condition, and she has contributed greatly to the success of the work on Spectacle Reef.

The schooner Belle was used as quarters for the workmen on Spectacle Reef until the completion of the barracks on the pier of protection, when she was withdrawn from that duty and used for the general purposes of the work. During the latter part of the winter repairs of considerable extent were put upon her, which will enable her to perform good service for at least four years. Since the opening of this season she has been used principally in carrying coal and other heavy supplies to Spectacle Reef and the several steam fog-signals.

TWELFTH DISTRICT.

This district embraces all aids to navigation on the Pacific coast of the United States between the Mexican frontier and the southern boundary of Oregon, and includes the coast of California.

Inspector.—Commodore Alfred Taylor, United States Navy, until February 27, 1872; Commander Charles J. McDougal, United States Navy, present inspector.

Engineer.—Lieutenant-Colonel Robert S. Williamson, Corps of Engineers, United States Army, until May 1, 1872; Major N. Michler, Corps of Engineers, brevet brigadier-general, United States Army, present engineer.

There are in this district :

Light-houses	16
Light-ships	none.
Fog-signals, operated by steam or hot-air engines	6
Day or unlighted beacons	1
Buoys actually in position	35
Spare buoys for relief and to supply losses	26
Tenders Fern (ordered to the East to serve as supply-vessel for Atlantic and Gulf coast) and Shubrick, (common to twelfth and thirteenth districts,) used for inspector's and engineer's purposes	2

The following numbers, which precede the names of stations, correspond to those of the "Light-House List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1872.

— *Point Fermin, entrance to San Pedro Harbor, California.*—An appropriation of \$20,000 was made June 10, 1872, for establishment of a light and fog-signal at this point. The site has been selected and a survey of the locality made. As there are several proprietors to the land, resort must be had to the California law of condemnation, in order to acquire title to the site, so that the construction will very probably be delayed beyond the fiscal year. A report, accompanied by a map of the site, has already been forwarded to the board. The structure can be rapidly built, as the material can be hauled over a very good road from New San Pedro, a distance of about five miles. The landing is safe and the anchorage-ground secure and well protected. A large well has been sunk near the settlement. It can furnish water during the construction, and, if necessary, can be purchased for the subsequent use of the keepers and for supplying the fog-signal.

— *Point Hueneme, Santa Barbara Channel, California.*—An appropriation of \$10,000, approved June 10, 1872, has been made for the establishment of a first-class fog-signal at this point. By direction of the board the site was selected in the month of June and surveys were made of the locality. Negotiations are in progress for its purchase.

405. *Point Conception, sea-coast of California.*—An appropriation was made March 3, 1871, for the establishment of a first-class steam fog-signal. A thorough examination and survey of the point were made with a view to ascertain the best location for the signal, and the supply of water. The structure has been completed, and the machinery placed in position. Owing to ignorance on the part of the light-house keeper, the latter soon needed repairs. The pipes connecting the hydraulic ram with the cistern were not laid according to directions from the district engineer, and will have to be relaid. The cistern and water-shed, said to have been damaged by the recent earthquakes, will require an additional coat of cement. An abundant supply of water from an adjoining spring furnishes all that is required for the light-house and fog-signal. Many minor repairs to the light-house are needed.

— *Piedras Blancas, sea-coast of California.*— This point is about midway between Point Conception and Point Pinos light-houses, distant one hundred and fifty miles from each. An appropriation of \$75,000 was approved June 10, 1872, for a first-order light and fog-signal at this point. By direction of the Board, an examination of the locality was made, a site selected for the light, and necessary surveys made to connect it with previous ones, by the county surveyor, for the purpose of defining the limits of the reservation set aside by direction of the President for light-house purposes. A report, accompanied by a sketch of the locality, has been submitted for the information of the board. The site belongs to the United States, and as soon as certain details in regard to it can be obtained, the plans will be made and the work commenced.

406. *Point Pinos, sea-coast of California, entrance to Monterey Bay.*—The suit for condemnation of land for right of way to this light-house has not yet been decided, the owners having appealed the case from the district court to the supreme court of California.

408. *Año Nuevo Island, sea-coast of California.*—A steam fog-whistle and keeper's dwelling have been constructed on this island, and it has been in operation since the 29th of May of this year.

409. *Pigeon Point, sea-coast of California.*—An appropriation was approved March 3, 1871, for continuing and completing the light-house and fog-signal at this point. The work was commenced June 9, 1871, and the tower and keeper's dwelling are already completed. The para-

pet, lantern, and lens are still to be placed in position. It is expected to have the light in full operation by the end of August of this year. A steam fog-whistle has been erected on this point, and has been in operation since September 10, 1871.

— *Pillar Point, sea-coast of California.*—Two and a half nautical miles north of this point a light-house and steam-fog signal are required, and an appropriation of \$50,000 is recommended for their establishment. This point is approximately midway between Pigeon Point and Point Bonita, and within a few miles of Point San Pedro, from which extends a dangerous reef of rocks.

411. *Point Bonita, entrance to San Francisco Harbor, California.*—An appropriation for the establishment of a first-class steam fog-signal at this point was made March 3, 1871. The structure was completed, the machinery placed in position, and the signal, a syren, was put in operation May 29, 1872.

— *Point San Pablo, between San Francisco and San Pablo Bays, California.*—An appropriation of \$20,000, approved March 3, 1871, was made for a light-house and steam fog-signal on this point. On the 13th of July, 1871, a special proceeding was instituted in the district court of the fifteenth judicial district of the State of California to obtain condemnation of the necessary land for light-house purposes on this point. An award of \$4,000 was given by the jury to the owners of the land, from which they appealed, and the case comes before the court for final hearing in October next.

— *Entrance to the Straits of Karguines, California.*—An appropriation of \$20,000, approved June 10, 1872, was made for the erection of a light-house and fog-signal to mark the entrance to the Straits of Karguines. A site on the southern shore, opposite Mare Island, having been recommended by the local officers and others, surveys were made there, but none suitable was found, and the engineer of the district has been ordered to locate the light on the southern end of Mare Island.

414. *Point Reyes, sea-coast of California.*—An appropriation of \$10,000 was made by Congress, approved June 10, 1872, for rebuilding and re-establishing the steam fog-signal station at this point, which was destroyed by fire April 28, 1872, and the district engineer has received orders from the board for its reconstruction.

415. *Point Arena, sea-coast of California.*—Since the last annual report a steam fog-whistle has been constructed, and was put in operation November 25, 1871.

416. *Cape Mendocino, sea-coast of California.*—During the month of November, 1871, the keeper's dwelling and cistern, referred to in the last annual report, were completed.

418. *Trinidad Head, sea-coast of California.*—On the night of December 1, 1871, a fourth-order light of the system of Fresnel was exhibited for the first time from the tower built on the southern slope of Trinidad Head. The structures built consist of a pyramidal tower on a square base, 18 feet high from the ground-line to focal plane; a dwelling for the keeper, and a cistern.

REPAIRS.

At each of the following-named stations in the twelfth district there have been repairs, more or less extensive, during the last year:

406. *Point Pinos, sea-coast of California, south side of entrance to Monterey Harbor.*

412. *Fort Point, entrance to San Francisco Harbor, California.*

- 415. *Point Arena*, sea-coast of California.
- 417. *Humboldt*, entrance to Humboldt Bay, California.

The following are the names of light-stations in the twelfth district not mentioned elsewhere:

- 403. *Point Loma*, sea-coast of California, entrance to San Diego Bay.
- 404. *Santa Barbara*, sea-coast of California.
- 407. *Santa Cruz*, entrance to Santa Cruz Harbor.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- Point Conception*.—A 12-inch steam-whistle.
- Año Nuevo Island*.—A 12-inch steam-whistle.
- Pigeon Point*.—A 12-inch steam-whistle.
- Point Bonita*.—A first-order steam-syren.
- Point Reyes*.—A 12-inch steam-whistle.
- Point Arena*.—A 12-inch steam-whistle.

DAY OR UNLIGHTED BEACONS.

Fauntleroy Rock, Crescent City Harbor, California.—An appropriation for erecting a day-beacon on this rock was made March 3, 1871. It is now in course of construction under contract, and is expected to be completed at an early day.

BELL-BOAT OFF HUMBOLDT BAR, CALIFORNIA.

A bell-boat has been moored off this dangerous bar, in 16 fathoms of water, to aid in crossing it in foggy weather.

DEPOTS.

San Diego, California.

Yerba Buena Island, Harbor of San Francisco, California.—A selection of a site for a buoy depot, to serve instead of the present inconvenient depot at Mare Island, has been made on the eastern side of the island of Yerba Buena. A sketch showing the site selected, the depth of water, and proposed plan of building, is being prepared, and will be forwarded to the board at an early day.

Eureka, Humboldt Bay, California.—This depot is on rented ground, and it is proposed to remove it to the Humboldt light-house, and place it under charge of the keeper.

THIRTEENTH DISTRICT.

This district embraces all aids to navigation on the Pacific coast of the United States north of the southern boundary of Oregon. It extends from the forty-first parallel of latitude to British Columbia, and includes the coasts of Oregon and the Territory of Washington.

Inspector.—Commodore Alfred Taylor, United States Navy, until Feb-

ruary 27, 1872; Commander Charles J. McDougal, United States Navy, present inspector.

Engineers.—H. M. Robert, major of engineers, United States Army.

There are in this district:

Light-houses and lighted beacons.....	11
Light-ships	0
Fog-signals, operated by steam or hot-air engines	1
Unlighted or day beacons	0
Buoys actually in position	46
Spare buoys for relief and to supply losses	26
Tender (steam) Shubrick common to the twelfth and thirteenth districts.....	1

The following numbers which precede the names of stations correspond with those of the "Light-House List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1872.

422. *Yaquina Bay, Oregon.*—The light-house at this point was commenced May 1, 1871. It was completed the following October, and lighted November 3, 1871.

— *Cape Foulweather, sea-coast of Oregon.*—Work has been seriously hindered by the difficulties connected with the transportation of materials. Since the commencement of work in the autumn of 1871 the lighters have been destroyed twice, and the schooner engaged in bringing materials from San Francisco has been obliged to discharge most of her freight at Newport, to be reshipped in milder weather, besides twice getting on the bar at the mouth of Yaquina Bay, and being once partially wrecked. Part of the materials have been hauled from Newport, six miles over an almost impassable road to the light-house site. The metal-work was completed at Portland, Oregon, June 1, 1872. After the failure of persistent efforts to charter a vessel for carrying iron and brick from Portland to the cape, the metal-work was shipped via San Francisco. About one-half the time since the work began has been lost on account of the difficulties of transportation. The foundation of the tower has been laid, and work commenced on the keeper's dwelling, a double frame house. Both will probably be completed this season.

— *Sand Island, mouth of river Columbia.*—The daily growing home and foreign commerce of the Columbia and Willamette Valleys demands that additional aids to navigation be judiciously disposed about this important outlet to the commerce of the Northwest. The chief difficulty in navigating the Columbia is the prevalence of fogs, and the fog-bell at Cape Disappointment cannot be heard in the south channel, through which the major part of the commerce of the Columbia is carried on.

A small light, to serve as a beacon leading into the south channel, and a powerful steam fog-signal, should be erected on Sand Island. As this island is shifting, a small dwelling, (surmounted by the light,) which can be moved from time to time, is designed for this place. The drift-wood on the island will furnish an inexhaustible supply of fuel for the fog-signal, and it, like the light-house, will be so erected that it can be moved from time to time as the position of the island is changed by the currents. An appropriation of \$30,000 is recommended.

423. *Cape Disappointment, mouth of river Columbia, Territory of Washington.*—There was commenced in August and completed in December, 1871, a new double frame dwelling for the keepers. The old fog-bell frame having been shattered by a blast from a gun of a neighboring battery, in July, a new fog-bell house was built in August, 1871. A new oil-house is needed at this station, and will be built during the present fiscal year.

425. *Cape Flattery, Tatoosh Island, entrance to the Straits of Fuca, Terri-*

tory of Washington.—A first-class steam fog-whistle, with large fuel-house, a cistern holding 33,000 gallons, and a water-shed of 3,000 square feet, were completed June 6, 1872. The machinery and materials for this work were ready for shipment from Portland six weeks before transportation could be secured to any point in the Straits of Fuca or Puget Sound, and as, in the end, delivery at Tatoosh Island could not be obtained, they were shipped to Port Townsend, Territory of Washington. Although efforts were made to secure transportation in Puget Sound, the only vessel that could be had was one with mail and other contracts which could not be interfered with. One cargo was delivered safely on the island early in October, 1871, but the time consumed by the steamer in other work made the second trip so late that only part of the cargo could with great risk be discharged at Tatoosh Island, and the balance was landed at Neah Bay, on the main-land, November 1. This necessitated suspension of work on the island, then well under way, until the next season. In order, if possible, to complete the cistern in time to make sure of a sufficient supply of water for the summer of 1872, work was carried on at intervals during February, March, and April, but great difficulties were experienced in carrying freight by Indian canoes from Neah Bay. A party was sent May 1 from Portland which completed the work June 6. As no supply of water can be had until the next rainy season, the fog-whistle cannot be operated before that time, (about November.) Much as this delay of twelve months is to be regretted, it could not have been avoided, in the dearth of vessels in the North Pacific and Straits of Fuca.

— *New Dungeness, Straits of Fuca, Territory of Washington.*—This station is exposed to heavy surfs, and the fact that in the North Pacific and Straits of Fuca fogs prevail to a considerable extent during storms, makes the fog-bell now at this station almost if not quite useless. An appropriation of \$8,000 is required for a steam fog-whistle to replace the fog-bell at this point.

— *Point No Point, Puget Sound, Territory of Washington.*—This point is about twenty miles from Port Townsend on the route to Seattle, Territory of Washington. The rapidly increasing importance of the commerce of Puget Sound, which will be still more augmented by the Northern Pacific Railroad, requires the construction of such aids to navigation as will more effectually open these waters to foreign as well as to home trade. An appropriation of \$25,000 is required for a light-house.

— *West Point, Puget Sound, Territory of Washington.*—This point marks the entrance to Dwamish Bay, the harbor of Seattle. The reasons given for the preceding apply with equal force to this case and also the following, (Point Defiance.) An appropriation of \$25,000 is required for a light.

— *Point Defiance, entrance to the Narrows, Puget Sound, Territory of Washington, nine miles north of Steilacoom.*—This is a most difficult point to avoid in fogs and cloudy nights. A light at this important point would greatly aid in navigating the upper sound, for which an appropriation of \$25,000 is required.

REPAIRS.

Repairs have been made at the following stations in the thirteenth district during the year:

423. *Cape Disappointment, Territory of Washington.*

Repairs and renovations are needed at each of the following-named stations during the next year :

- 422. *Yaquina Bay*, Oregon.
- 423. *Cape Disappointment*, mouth of river Columbia, Washington Territory.
- 425. *Cape Flattery*, entrance Straits of Fuca, Territory of Washington.
- 426. *Ediz Hook*, Straits of Fuca, Territory of Washington.
- 427. *New Dungenness*, Straits of Fuca, Territory of Washington.
- 429. *Admiralty Head*, Admiralty Inlet, Territory of Washington.

The following are the names of light-stations in the thirteenth district not mentioned elsewhere :

- 420. *Cape Blanco*, sea-coast of Oregon.
- 421. *Cape Arago*, sea-coast of Oregon.
- 424. *Shoalwater Bay*, Territory of Washington.
- 428. *Smith's (or Blunt's) Island*, Washington Sound.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

Cape Flattery.—A 12-inch steam-whistle.

DEPOT.

The depot for the buoys of the thirteenth district is now at Astoria, at the mouth of the river Columbia, but it is proposed to remove it to Cape Disappointment, and place it under charge of the light-house keeper.

Respectfully submitted.

JOSEPH HENRY,
Chairman.

CHAS. S. BOGGS,
Rear-Admiral, U. S. N., Naval Secretary.

GEORGE H. ELLIOT,
Major of Engineers, U. S. A., Engineer Secretary.

REPORT OF THE LIGHT-HOUSE BOARD.

38 F

REPORT

OF

THE UNITED STATES LIGHT-HOUSE BOARD.

TREASURY DEPARTMENT,
OFFICE OF THE LIGHT-HOUSE BOARD,
Washington, November 24, 1873.

SIR: I have the honor to transmit herewith the annual report of the Light-House Board for the fiscal year ending June 30, 1873.

Very respectfully,

JOSEPH HENRY, *Chairman.*

Hon. W. A. RICHARDSON, *Secretary of the Treasury.*

[1.]

TREASURY DEPARTMENT,
OFFICE OF THE LIGHT-HOUSE BOARD,
Washington, D. C., October 14, 1873.

Hon. W. A. RICHARDSON, *Secretary of the Treasury :*

SIR: The following report of the operations of this Board during the last year is respectfully submitted:

No part of the executive branch of the Government includes more diversified duties or involves greater responsibilities than the Light-House Establishment.

The character of the aids which any nation furnishes the mariner in approaching and leaving its shores marks, in a conspicuous degree, its advancement in civilization. Whatever tends to facilitate navigation, or to lessen its dangers, serves to increase commerce, and hence is of importance not only to the dwellers on the seaboard, but to the inhabitants of every part of the country. Whoever has surplus products of industry to dispose of has a pecuniary interest in the improvement of commerce.

Every shipwreck which occurs enhances the cost of transportation, and, therefore, affects the interests of the producer. But it is not alone in view of its economical effects that the light-house system is to be regarded. It is a life-preserving establishment, founded on the principles of Christian benevolence. None can appreciate so well the value of a proper system of this kind as he who has been exposed for weeks and perhaps months to the perils of the ocean, and is approaching in the darkness of night perhaps a lee shore. He looks then, with anxious gaze, for the friendly light which is to point the way amid treacherous rocks and sunken shoals to a haven of safety. Or it may be in mid-day,

when observations cannot be had, the sun and coast being hid by dense fogs, such as imperil navigation on our northern and western coasts. He then listens with breathless silence for the sound of the fog-trumpet which shall insure his position and give him the desired direction of his course.

With that entire confidence which is inspired by a perfect light-house system the alternatives of life and death, of riches and poverty, are daily hazarded; and therefore it is of the first importance that the signals, whether of light or sound which indicate the direction of the course, and the beacons which mark the channel, shall be of the most improved character, and that they be under the charge of intelligent, efficient, and trustworthy attendants. But, above all, one maxim should ever be observed, namely, perfect regularity of exhibition of every signal from night to night and from year to year. A light, for example, which has been regularly visible from a tower, it may be for years, cannot be suffered to fail for a single night, or even for a single hour, without danger of casualties of the most serious character. A failure of such a light to send forth its expected ray, is, as it were, a breach of a solemn promise, which may allure the confiding mariner to an untimely death or a disastrous shipwreck.

In view of these facts our Government early established a light-house system, which, though simple and inexpensive at first, has since been extended and improved to meet the wants of an increasing commerce and the unrivaled resources of the country. It has been maintained with an enlightened liberality which indicates a just appreciation of its importance.

The magnitude of the light-house system of the United States may be inferred from the following facts: First, the immense extent of the coast which, from the St. Croix River, on the boundary of Maine, to the mouth of the Rio Grande, in the Gulf of Mexico, includes a distance of over 5,000 miles; on the Pacific coast a length of about 1,500 miles; on the great northern lakes about 3,000 miles, and on inland rivers about 700 miles, making a total of more than 10,000 miles. Secondly, the magnitude of the system is exhibited by the fact that nearly every square foot of the margin of the sea throughout the whole extent of 5,000 miles along the Atlantic and Gulf coast is more or less illuminated by light-house rays, the mariner rarely losing sight of one light until he has gained another. Thirdly, the same fact is illustrated by the number of signals now in actual existence as exhibited in the following table:

TOTAL SIGNALS FOR THE ENTIRE ESTABLISHMENT.

Light-houses and lighted beacons.....	591
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1873.....	29
Light-ships.....	21
Fog-signals, operated by steam or hot-air engines.....	35
Day or unlighted beacons.....	363
Boys in position.....	2,838

To carry on so extended a system necessarily requires a carefully-devised organization, based upon the history of all that has been recorded in regard to the subject, and a series of efficient officers and trained assistants.

The duties which belong to the light-house system involve the most varied knowledge and practical skill, a thorough acquaintance with the wants of commerce, engineering abilities of high order, with scientific acquirements, which shall appreciate the value of every new discovery

that may find an application in the improvement of signals, and the ability to make or direct such investigations as may from time to time be found desirable. To insure these requisites the organization of the light-house system includes, first, a Light-House Board, consisting of two officers of the Navy, two engineer officers of the Army, and two scientific civilians, with the addition of an officer of the Navy and an engineer officer of the Army as secretaries, who are also members of the Board. Secondly. It also includes twelve inspectors from the Army or Navy, and as many engineer officers from the Army, who have united charge of the twelve districts into which the coast is divided. The Light-House Board, having charge of the supervision of the whole system, is divided into five committees, to each of which special duties are assigned. These committees are on finance, engineering, floating aids, lighting, and experiments. It is the duty of each member of the Board to render himself intimately acquainted with the details of the business intrusted to his care, as well as to keep himself informed, as far as possible, of the condition of the general system. For this purpose, as well as that of insuring the proper working of the establishment in the several districts, it is advisable that he should make, from time to time, inspection of light-houses at various points on the coast. The inspector of each district is required to visit, at stated intervals, each light-house within his jurisdiction after completion by the engineers, to correct any delinquencies on the part of the keepers, and to supply oil and other materials necessary to the efficient maintenance of the signals, and finally to inform the engineer as to any repairs which may be required. The district engineers, as well as the engineer officers of the board, find full employment for all the theoretical knowledge and practical skill they possess in the surveys of new sites, making studies for the construction of new permanent aids to navigation, many of them on submarine sites in exposed positions, in planning and rearing the towers, and in fitting up the lenticular apparatus.

The scientific portion of the Board is at present composed of the Superintendent of the Coast Survey and the director of the Smithsonian Institution; to the first of whom is referred the duty of fixing the precise latitude and longitude of the various positions on the coast, in furnishing exact surveys of harbors, channels, &c., as well as the data for determining the position of light-houses, and, in the case of the present incumbent, of solving any mathematical problem of unusual complexity which may arise in the course of the varied discussions of the Board. The duty of the second civilian mentioned has been to examine and report upon the improvements in the lighting apparatus, the different materials for illumination, and on the efficiency of fog-signals.

The naval and engineer secretaries are the principal executive officers, who carry on the routine duties of the establishment during the intervals of the meetings of the Board.

In order that the members of the Board from different departments of the Government may co-operate harmoniously with each other, the whole system is placed under the Secretary of the Treasury. This organization of the light-house system was adopted after much deliberation, founded upon a very able report made by Lieutenant (now Admiral) Jenkins, who had been appointed to investigate the light-house systems of Europe. It has now been in operation upward of twenty years, and has in that time been prosecuted with the most satisfactory results in the way of increasing the number of stations, in the economy of materials, and improvement in signals.

It is true that it is sometimes suggested that the light-house system

might be better managed by a single department of the Government, but this we think it not difficult to disprove were this the place to enter into a discussion of the subject. It may be sufficient to observe that the old system, for which this was substituted, was managed by a single individual and his assistants as a bureau of the Treasury Department, with results which were far from being satisfactory.

The system requires the co-operation of officers of the Army and Navy, who by their special training are well fitted for the work to which they are respectively assigned, and of whom the Government has their commission and their official reputation as a guarantee against pecuniary loss and delinquency in a faithful discharge of duties. It has also been said that the light-house system is of a practical character, and, therefore, does not require the aid of high science. But in regard to this, it may be observed that the present system of light-house apparatus, now in use in every part of the civilized world, was invented and introduced into practice in its minutest details by a man of abstract science, the celebrated Fresnel, who shared with Young, of England, the invention of the undulatory theory of light, and its application to all the phenomena of optics.

The light apparatus introduced by the Board as a substitute for that previously in use is principally that of the French system. But the Board have been from the first alive to the introduction of improvements, and have carefully considered every suggestion and tested every invention which gave promise of greater economy or efficiency. Instead of sperm-oil, which was first employed, they have introduced, at one-third of the cost, lard-oil, and with this a required modification of the lamps, particularly those of the larger kind, in order that the oil may be burned at a higher temperature, especially in the northern portions of the United States. But the greatest improvement which has been introduced is that relative to fog-signals, indispensable aids to navigation, especially on the northeastern and western portions of our coast. At first these signals were principally confined to bells, weighing in some cases from 2,000 to 2,500 pounds. These were rung by winding up a weight which in its descent gave motion to a hammer striking the bell. In regard to this signal, an improvement has been introduced, by which an expenditure of about one-tenth of the power produces an equal effect. Bells are still used in cases where the signal is required to be heard only at a comparatively small distance, but in most cases much more powerful instruments are required, such as are founded on what is called 'resonance, in which the air itself is the resounding body as well as the conductor of sound. These instruments are of three kinds: first, the ordinary locomotive whistle, much enlarged in size and somewhat modified in form, and blown by steam from a high-pressure tubular boiler; second, the reed-trumpet actuated by air condensed in a reservoir by the power of a caloric engine; third, the syren-trumpet, operated by steam from a boiler sustaining a pressure of from 50 to 70 pounds per square inch. The sound from these instruments is many times more powerful than that from the largest bells.

A difficulty in carrying out the present system is the frequent change in the officers of districts, and the still more frequent change in the keepers of the stations.

The duties of the inspector and engineer are so special that it requires a considerable time to become perfectly familiar with them, and the experience which is gained by an individual is lost to the Government by his recall to the Army or Navy, and the substitution in his place of another officer, who has to pass through a similar training before he can

render the best service. In regard to light-keepers, the most efficient and faithful men, who from years of practice have acquired the skill necessary to a proper discharge of their duties, have been in many cases changed by collectors of customs for new men, for no other reason than to give place to some political favorite. It is hoped that the application of the civil-service reform to the employment of light-keepers will be of material benefit to the general service.

The Light-House Board, during the past year, desirous of acquainting itself minutely with any improvements which of late years may have been introduced into the light-house service in Europe, obtained the sanction of the honorable the Secretary of the Treasury to commission Major Elliot, of the Corps of Engineers of the Army and engineer-secretary of the Board, to visit Europe and report upon everything which he might observe relative to light-house apparatus and the management of light-house systems. He has lately returned, after having gathered information which will prove of importance in its application in our country, as will be evident from his preliminary report.

Major Elliot was everywhere received with marked cordiality, and every facility was given him to inspect the various coasts and systems of administration, of which full information was furnished him, together with the drawings and models necessary for a perfect acquaintance with the latest improvements which have been adopted in Great Britain and on the continent. The special thanks of the Board are due to His Royal Highness the Duke of Edinburgh, the master; to Sir Frederick Arrow, the deputy master; and the elder brethren of Trinity House, for the warmth of their reception and the marked distinction they conferred upon him as the representative of the Board; and to M. Leonce Reynaud, inspector-general of ponts et chaussées and director of the French light-house service, for his efforts to make the visit of Major Elliot profitable to his country and agreeable to himself.

[2.]

TREASURY DEPARTMENT,
Office of the Light-House Board, Washington, September 17, 1873.

Professor JOSEPH HENRY, *Chairman* :

I have the honor to make a preliminary report of my journey of inspection of the light-house establishments of Europe, which I have made by direction of the Board and with the approval of the honorable the Secretary of the Treasury, and from which I returned a few days since.

I sailed on the 30th of April, and, after a pleasant voyage, reached Liverpool on the 10th of May, observing *en route* the light-houses on the Irish coasts and the light-ships and buoys on the approaches to Liverpool.

On the 30th of May I arrived at London, and was cordially received by Sir Frederick Arrow, the deputy master, and the elder brethren of Trinity House, under the charge of which are the lights of England, and which also has a supervising control of the Irish and Scotch lights.

I remained in London some weeks, in order to take advantage of the opportunities which were kindly offered me of inspecting the light-houses, &c., on the coasts of England, in the steamers which were about to take the annual supplies to the light-houses, and in which I was to be accompanied by a delegation of the elder brethren, which was appointed for the purpose by Trinity House at its next session after my arrival. My time was occupied before our departure in inspecting the depots, lamp-shops, photometric test-rooms, &c., belonging to Trinity House; also plans of light-houses, lenses, and other optical apparatus used on the coasts of Great Britain.

I also visited Dover with Professor Tyndall, the scientific adviser, some of the elder brethren, and the engineer of Trinity House, to attend the inauguration of fog-signal experiments, which, under the direction of the former, are now being carried on at an experimental station on the cliffs near the great electric light of South Foreland.

The Board will remember that Sir Frederick Arrow and Captain Webb, of the elder brethren, visited the United States during the summer of last year, to be present at some experiments with the steam-whistle, the horn, and the siren at Portland Harbor.

And I will here mention that the light-house authorities of Great Britain are fully alive to the necessity of powerful fog-signals, and are anxiously seeking to find the best machine to carry intelligence to the mariner, when he is enveloped in fog, not only of his approach to the coast, but, by means of distinguishing characteristics of sound, to indicate to him on what part of the coast he is.

I think we have been impressed that on our foggy coasts of New England, California, and some of the great lakes, our fog-signals are fully as important as our lights, and the English are following us in this regard.

Professor Tyndall told me of his intention to make an exhaustive series of experiments with all the fog-signals at present in use, and to determine the best; and he and the elder brethren of Trinity House are especially pleased at the action of our Board in sending one of our American syrens for use at the Dover experiments.

The experiments are made by several observers on vessels cruising in the Straits of Dover, at different distances from the signal-station, and under varying circumstances of wind and weather.

The signals in use when I was at Dover were a steam-whistle, an air-whistle, and a trumpet of Professor Holmes's patent, but very much like the American invention of Daboll, and of which the English have several in use. Since the time mentioned the experiments have included a cannon and our own syren, and they are still in progress. I have a printed list of the questions to be answered by the experimenters when they have completed their labors, which I inclose herewith. Sir Frederick kindly promised to inform me of the results arrived at.

The delay in London gave me a good opportunity of seeing the great improvements in lamps made by Mr. Douglass, the distinguished engineer of Trinity House, and which are of the greatest importance in the improvement of the British lights, as they will be in regard to other countries. Not only is the brilliancy of the illumination very much increased by ingenious methods of promoting combustion, but the consumption of oil is actually decreased. Colza oil is principally used in British light-houses, though mineral oil is rapidly being substituted for it for the sake of economy, and, while the latter is also true in regard to the greater part of the continent, the French government has made an order for a general change to mineral oil in all the light-houses of the republic.

When the Trinity House tender had been made ready, I embarked with two of the elder brethren, Admiral Collinson, C. B., and Captain Weller, for an inspection of the British lights on the shores of the North Sea, and visited nearly every one on the coasts of Essex, Suffolk, Norfolk, Lincolnshire, Yorkshire, Durham, and Northumberland, or from the mouth of the Thames to the Tweed, (the boundary of Scotland,) including the gas-light at Haisborough and a new electric light at Souter Point, below the river Tyne, and which have been established, the former for experimental comparison with a light-house illuminated with oil, (and which stands a few hundred yards from it; the Haisborough lights being double, as at Cape Ann, on the coast of Massachusetts,) and the latter on account of the dense volume of smoke which envelops the coast near the Tyne, and which is produced by the immense number of manufactories on the river between Shields and Newcastle.

I had excellent opportunities for testing the different varieties of lights in all kinds of weather, and especially the gas and electric lights in fog.

I was especially shown the system of marking the positions of rocks and shoals by means of what Trinity House calls "red cuts," i. e., by means of covering proper sectors of the dioptric apparatus with red glass screens; and I made at different places on the northeast coast of England several boat excursions at night to test the utility of the system.

After my return from the inspection of the northeast coast, I embarked with Captain Webb, of the elder brethren, at Portsmouth, and inspected the light-houses on the Isle of Wight, on the coasts of Hampshire, Dorsetshire, Devonshire, and Cornwall, and passed around Land's End and as far as Saint Ives, on the west coast of Cornwall, visiting the celebrated light-house on "The Wolf" Rock, off Land's End, and which is a recent and the most difficult of all the English examples of light-house engineering.

I regretted that I could not land at the Eddystone light-house, but the sea, although usually not so dangerous as at The Wolf, was too heavy when I passed it to make a landing practicable. In addition to the light-houses on the coasts, I particularly observed the light-ships and the system of buoyage; and I will here mention that the British use the flashing-lens apparatus in their light-ships in many cases, and that they are found much more useful than fixed lights. I would recommend to the immediate attention of the Board the consideration of the propriety of distinguishing some of our numerous light-ships off the coasts of Massachusetts and on Long Island Sound in this way. The British find no difficulty, also, in the use of fog-signals operated by hot-air engines in their light-ships, and I saw several instances of this, in one case hearing the signal distinctly at a distance of eight miles.

From England I went to France and had conference with Monsieur Reynaud, *l'inspecteur-général des ponts et chaussées*, and director of the French light-house establishment, and Monsieur Allard, his assistant; also with the three lens-manufacturers of Paris.

I had much interest in seeing our own optical apparatus in all stages of its manufacture; of seeing the modes of testing the lenses, burners, and mineral-oil adopted by the French engineers, and of examining the most complete *dépôt des phares* in the world, which contains examples of all the stages of the progress of the science of light-house illumination, from the first efforts of Fresnel, a predecessor of Monsieur Reynaud, and the inventor of the system which bears his name, to the present time.

I visited the lights at the mouth of the Seine, and the double electric lights of "La Hève," at Saint Adresse, near Havre.

I afterwards proceeded to Vienna and examined the light-house apparatus at the Industrial Exhibition, consisting of models, drawings, and photographs of light-houses from different countries, including our own, and a package of which I made up a short time before I went to Europe, and which I was gratified to learn, on my return, obtained a diploma of honor.

After returning from Vienna I visited some light-houses on the coast of Wales, including two very interesting ones at Holyhead and at "The South Stack."

The former, a new one, was not lighted until some days after my inspection, but it was quite ready, and combined all the latest improvements of the English in regard to lens, lamp, and lantern. At South Stack is a light which is lowered down the cliff in foggy weather, when the upper light is obscured in fog and it is clear below—a plan which I had before thought of as applicable to our lights on the elevated cliffs of the Pacific coast. I also visited Ireland and Scotland, the former by special invitation from the board of commissioners of the Irish lights, and I had an excellent opportunity of seeing two of the gas-light houses, (Howth Head and Wicklow Head,) of which Professor Tyndall, when in the United States, expressed so favorable an opinion, and which have been applied only by the Irish board except in the case I have mentioned, viz, the experimental light at Haisborough, on the east coast of England.

These gas-lamps can be increased in an instant, when the weather becomes thick or foggy, from twenty-eight to forty-eight, sixty-eight, or eighty-eight, and to one hundred and eight jets in dense fog, and Mr. Wigham, of Dublin, the inventor, exhibited to me his apparatus for producing a light from three hundred and twenty-four jets in the same lens-apparatus.

At Edinburgh I visited the board of Scottish light-commissioners, and had an interesting, and instructive interview with Mr. Thomas Stevenson, the engineer of the board, and a son of the builder of the celebrated Bell Rock and Skerriyvore light-houses.

I also visited the very extensive manufactory of lenses for light-houses of Chance Brothers & Company, near Birmingham, and who are the furnishers of light-house apparatus to Trinity House, and they also supply, in a large degree, the Irish and Scottish boards, as well as India, China, and South America. Chance Brothers claim that their optical apparatus is superior to the French, and they certainly have a great advantage in having for the constant supervision of their work a gentleman of high scientific attainments.

I carried with me a special letter from the honorable the Secretary of State, to the ministers and consuls of the United States in Europe, and I received every facility and courtesy from them and from the officials of the countries which I visited.

I have full notes of my inspection, and at an early day I shall have the honor to present to you a detailed report of what I saw differing from our own system.

In closing this preliminary report I will say that the great questions which are occupying the attention of the light-house authorities of Europe, and in which the different establishments are in competition with each other, are: *What is the best illuminant?* and, *What is the best means for producing the most perfect combustion?*

I will only add that while the British and French systems are necessarily very much like our own, I saw many details of construction and administration which we can adopt to advantage, (and which I shall exhibit in my detailed report,) and there are many others in which we excel. Our shore fog-signals, particularly, are vastly superior both in number and power. They are in advance of us in using the gas and the electric lights in positions which are of special importance; in the use of azimuthal condensing prisms for certain localities; in their lamps; in the fog-signals of light-ships; in their light-ships with flashing lights; and, more than all, in the character of the keepers, who are in service, during good behavior, until death or superannuation, who are promoted for merit, and whose lives are insured by the Government for the benefit of their families.

I am much indebted to Mr. Paul J. Pelz, chief draughtsman to the Board, who accompanied me by its permission, and with the approval of the honorable the Secretary of the Treasury, as my secretary, and who has made many sketches for the illustration of my report, and who, in other ways, has been of much assistance to me in the execution of the duty assigned me.

Very respectfully,

GEORGE H. ELLIOT,
Maj. of Engineers, U. S. A., Engineer-Secretary.

[3.]

CONDITION AND OPERATIONS OF THE LIGHT-HOUSE SYSTEM DURING
THE FISCAL YEAR 1872-'73.*Light-houses, light-ships, fog-signals, day-beacons, and buoys belonging to the United States
Light-House Establishment on the 1st of July, 1873.*

ATLANTIC COAST AND STRAIT OF FLORIDA.

Light-houses and lighted beacons	332
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1873	18
Light-ships	20
Fog-signals, operated by steam or hot-air engines	20
Day or unlighted beacons	344
Buoys in position	2,368

COAST OF THE GULF OF MEXICO.

Light-houses and lighted beacons	52
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1873	2
Light-ships	1
Fog-signals, operated by steam or hot-air engines	2
Day or unlighted beacons	16
Buoys in position	135

PACIFIC COAST.

Light-houses and lighted beacons	26
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1873	1
Light-ships	0
Fog-signals, operated by steam or hot-air engines	6
Day or unlighted beacons	1
Buoys in position	89

NORTHERN AND NORTHWESTERN LAKES.

Light-houses and lighted beacons	181
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1873	8
Light-ships	0
Fog-signals, operated by steam or hot-air engines	7
Day or unlighted beacons	2
Buoys in position	246

It has ever been the endeavor of the Light-House Board to conduct the system under its charge with a strict regard to economy, with a view to obtaining the greatest amount of efficiency with a given expenditure of means. For this purpose frequent visits have been made to different parts of the coast, and a rigid enforcement of rules and regulations has been insisted on, holding officers and light-keepers personally responsible for the strict performance of duty.

Under the several names of the twelve geographical divisions or districts into which the coast of the United States is divided, will be found a detailed statement of the condition, changes, and work which has been done during the year. From these statements it will be seen that although the various signals at different stations are generally in such a condition of efficiency as to meet the wants of navigation, still there are many new lights called for by commerce, and many stations at which repairs and reconstructions are imperiously demanded. Indeed, in these respects the wants of the service are constantly recurring, since buildings, however well made at the time

of their construction, are subject to the deteriorating influence of the weather, as well as the more immediate destructive effects of equinoctial storms and the occasional recurring commotions of the sea of almost irresistible violence.

In regard to the general estimates for repairs of light-houses, for supplies (including oil, &c.,) for light-ships, and for buoys, the Board has to say that it has always been the custom of this Office, in preparing the annual estimates for supporting the existing and authorized aids to navigation, and the construction of new ones, to make as close a calculation of items, quantities, and prices as the information at hand would allow, and to endeavor to so manage the disbursements as at all times to have ample funds available to supply any losses and repair any damage, however serious, to which this service is so peculiarly liable during the winter months.

For repairs and incidental expenses of light-houses we have estimated \$250,000, an increase of \$25,000 over the amount estimated last year, which experience during the last year has shown to be necessary.

For expenses of fog-signals we have estimated an increase of \$10,000, on account of the extension of this branch of the service.

For the salaries of light-keepers the estimate is \$599,400, and the increase is owing to the increase in the number of light-keepers authorized by the appropriations for new lights. There are in actual employment and required for new lights appropriated for, 999 light-keepers, and the average pay authorized by law is \$600 per annum.

For supplies of light-houses the estimate is \$395,350, and the increase is due, as above, to the increased number of lights authorized by law.

For the expenses of light-ships the estimate is \$234,087.50, and an increase of \$16,355 over the appropriation of last year, which experience has shown to be insufficient.

For expenses of buoyage our estimate is \$350,000, and the increase is due to the increased demand for these aids to navigation, decay of those in use, and losses by ice and storm.

During the last fiscal year the following changes have occurred in the board: Rear-Admirals Bailey and Walke, having retired, were succeeded by Commodore Foxhall A. Parker and Capt. John Lee Davis. Commodore Parker was, in turn, succeeded by Rear-Admiral Charles H. Davis.

Rear-Admiral Boggs, the naval secretary, retired and was succeeded by Commander John G. Walker. The other members of the board, viz, Professor Henry, Generals Humphreys and Barnard, Professor Peirce, and Major Elliot, remain as at the date of the last annual report.

[4.]

List of light-houses finished and lighted between July 1, 1872, and July 1, 1873,

Name of station.	Locality.	When lighted.
Burnt-Coat Harbor, range or leading lights, (two).	Swan Island, off coast of Maine	August 15, 1872.
Newburyport, inner range or leading lights, (two).	Harbor of Newburyport, Merrimac River, Massachusetts.	June 1, 1873.
Wood End	Entrance to harbor of Provincetown, Cape Cod, Massachusetts. Harbor of refuge.	November 20, 1872.
Bullock's Point	On a shoal in Providence River, Rhode Island, off Bullock's Point.	November 1, 1872.
Sabin's Point	On a shoal in Providence River, off Sabine's Point, Rhode Island.	November 1, 1872.
Blackwell's Island *	North end of Blackwell's Island, near Hell Gate, East River, New York.	September 15, 1872.
West Point†	On Gee's Point, (West Point,) Hudson River, New York.	October 1, 1872.
Esopus Meadows‡	On a shoal in Hudson River, between Poughkeepsie and Rondout, New York.	August 26, 1872.
Barber's Point	On Barber's Point, west side of Lake Champlain, New York.	Opening of navigation in the spring of 1873.
Mispillion	On Delaware Bay, near mouth of Mispillion River.	June 15, 1873.
"The Thimble"	On "The Thimble" shoal, entrance to Hampton Roads, Virginia.	October 10, 1872.
Love Point	On a shoal off Love Point, Chesapeake Bay, mouth of Chester River, Maryland.	August 15, 1872.
Body's Island†	On Body's Island, sea-coast of North Carolina.	October 1, 1872.
Sullivan's Island range or leading lights, (two).†	On Sullivan's Island, north side of entrance to harbor of Charleston, South Carolina.	July 15, 1872.
Saint Simon's	On Saint Simon's Island, entrance to Saint Simon's Sound, sea-coast of Georgia.	September 1, 1872.
Dame's Point	On a shoal in Saint John River, Florida	July 15, 1872.
Mobile Point‡	On Mobile Point, east side of entrance to harbor of Mobile, Alabama.	February 15, 1873.
Bolivar Point‡	On Bolivar Point, north side of entrance to Galveston Bay, Texas.	November 15, 1872.
Cleveland†	Cleveland, Ohio, Lake Erie	Opening of navigation in the spring of 1873.
Gibraltar†	Mouth of Detroit River, Michigan, Lake Erie.	Do.
Pentwater	On pier at harbor of Pentwater, Lake Michigan, Michigan.	June 20, 1873.
Racine	On pier at entrance to harbor of Racine, Lake Michigan, Wisconsin.	September 5, 1872.
Milwaukee	On pier at entrance to harbor of Milwaukee, Lake Michigan, Wisconsin.	October 30, 1872.
Grassy Island, (two)	At each end of canal into mouth of Fox River, Green Bay, Wisconsin.	
Pigeon Point	On Pigeon Point, sea-coast of California.	November 15, 1872.

* Erected and maintained by city of New York.

† Reconstructed.

‡ Reconstructed. Destroyed during the rebellion.

[5.]

FIRST DISTRICT.

The first district extends from the northeastern boundary of the United States (Maine) to and including Hampton Harbor, N. H., and includes all aids to navigation on the coasts of Maine and New Hampshire.

Inspector.—Commander Thomas O. Selfridge, United States Navy, to September 13, 1872; Commander W. K. Mayo, United States Navy, from September 13, 1872, to June 30, 1873; Commander W. N. Allen, United States Navy, present inspector.

Engineer.—Lieut. Col. James C. Duane, Corps of Engineers, Bvt. Brig Gen., United States Army.

In this district there are :

Light-houses and lighted beacons	51
Light-houses finished and lighted during the year ended July 1, 1873	2
Light-houses, for which appropriations were available, but which were not finished on July 1, 1873	2

Light-ships.....	0
Fog-signals operated by steam or hot-air engines.....	8
Day or unlighted beacons.....	46
Buoys actually in position.....	361
Spare-buoys for relief.....	221
Tender (steamer) Myrtle for construction and repair; also used in second district, and tender Iris, (inspector's tender).....	2
Tender (sail) schooner Wave (for repairs) also used in second district.....	1

The following numbers, which precede the names of stations, correspond with those of the light-house list of the Atlantic, Gulf, and Pacific coasts of the United States, issued January 1, 1873.

LIGHT-HOUSES AND LIGHTED BEACONS.

6. *Nash's Island, off the mouth of Pleasant River, Maine.*—A new lantern, parapet, and deck have been made.

15-16. *Burnt-Coat Harbor, (range lights).*—This new station was completed and lighted for the first time on the 15th of August, 1872. Both of the lights are white, the rear, fourth order, dioptric, 75 feet above sea-level; the front, fifth order, dioptric, 42 feet above sea-level, and are 100 feet apart, on a course NE $\frac{3}{4}$ N. The towers are of brick, square in plan; the keeper's dwelling is of wood, and all of the buildings are white. The station is located on the north side of the entrance to the harbor.

34. *Monhegan, Monhegan Island.*—An appropriation for new house for the keeper is recommended at this station.

40. *Seguin, off mouth of Kennebec River, Maine.*—A 10-inch steam-whistle fog-signal has been established at this station, and is arranged to give blasts of 8 seconds at intervals of 52 seconds. The work on the new parapet and decks for the lantern is in progress. The exterior wood-work of the keeper's dwelling has been repainted.

42-43. *Cape Elizabeth, west side of entrance to Casco Bay, &c., Portland Harbor, Maine.*—An appropriation was made last year for rebuilding the western tower; the foundation and basement have been constructed, and the iron-work for the tower is nearly ready.

45. *Portland Breakwater, in Portland Harbor, Maine.*—This structure will be completed this year; during the course of its construction a light has been exhibited from a temporary wooden tower, located at the outer extremity of the pier. As soon as the breakwater is completed it will be necessary to occupy the pier-head by a permanent tower, and an appropriation is asked for this purpose.

46. *Wood Island, west side of entrance to Saco River, Maine.*—A fog-bell tower, with Stevens's striking-apparatus, and a cast-steel bell, weighing 1,315 pounds, has been established, and considerable repairs to the station have been made.

REPAIRS.

At each of the following-named light-stations there have been made repairs and renovations more or less extensive during the year.

1. *Saint Croix river*, on Dochet's Island, in Saint Croix river, Maine.
2. *West Quoddy Head*, southwest side of entrance to Passamaquoddy Bay, Maine.
3. *Little River*, west side of entrance to Little River Harbor, Maine.
4. *Libby Island*, entrance to Machias Bay, Maine.
5. *Moose-Point*, west side of entrance to Bay of Fundy, Maine.
6. *Narraguagus*, west side of Narraguagus Bay, Maine.
7. *Petit Menan*, south end of Petit Menan Island, Maine.
9. *Prospect Harbor*, east side of entrance to the harbor.

10. *Winter Harbor*, west side of entrance to the harbor.
 11. *Mount Desert Rock*, off Mount Desert, Maine.
 12. *Baker's Island*, off Mount Desert, Maine.
 13. *Bear Island*, off Cranberry Islands, Maine.
 14. *Bass Harbor Head*, east side of entrance to Bass Harbor, Maine.
 17. *Eggemoggin*, north side of east entrance to Eggemoggin Reach, Maine.
 18. *Saddleback Ledge*, in Isle au Haute Bay, Maine.
 19. *Heron Neck*, west side of entrance to Carver's Harbor, Maine.
 20. *Deer Island Thoroughfare*, south side of west entrance to the thoroughfare.
 21. *Eagle Island Point*, west side of Isle au Haute Bay, near the head.
 22. *Pumpkin Island*, south side of west entrance to Eggemoggin Reach, Maine.
 23. *Matinicus Rock*, entrance to Penobscot Bay, Maine.
 25. *White Head*, west side of entrance to Muscle Ridge Channel, Penobscot Bay, Maine.
 26. *Owl's Head*, south side of entrance to Rockland Harbor, Maine.
 27. *Brown's Head*, east side of west entrance to Fox Island Thoroughfare, Maine.
 28. *Negro Island*, entrance to Camden Harbor, Maine.
 29. *Grindell's Point*, north side of entrance to Gilkey's Harbor, Maine.
 30. *Dice's Head*, north side of entrance to Castine Harbor, Maine.
 31. *Fort Point*, west side of entrance to Penobscot River, Maine.
 32. *Tenant's Harbor*, south side of the entrance to the harbor.
 33. *Marshall's Point*, east side of entrance to Herring Gut Harbor, Maine.
 35. *Franklin Island*, west side of entrance to George's River, Maine.
 36. *Pemaquid Point*, east entrance to John's Bay, Maine.
 37. *Burnt Island*, west side of entrance to Townsend Harbor, Maine.
 38. *Hendrick's Head*, east side of mouth of river Sheepscot, Maine.
 39. *Pond Island*, west side of entrance to river Kennebec, Maine.
 41. *Halfway Rock*, in Casco Bay, Maine.
 44. *Portland Head*, west side of entrance to Portland Harbor, Maine.
 45. *Portland Breakwater*, on the outer end of the breakwater in Portland Harbor, Maine.
 47. *Goat Island*, north side of entrance to Cape Porpoise Harbor, Maine.
 48. *Boone Island*, off York Harbor, Maine.
 49. *Whale's Back*, east side of entrance to Portsmouth Harbor, New Hampshire.
 50. *Portsmouth Harbor*, west side of entrance to the harbor.
 51. *Isle of Shoals*, off Portsmouth, New Hampshire.
- The following named light-stations require repairs to be made during the current and ensuing year :
3. *Little River*, west side of entrance to harbor of Little River, Maine.
 4. *Libby Island*, entrance to Machias Bay, Maine.
 5. *Moose Peak*, on Moosepeak Head, Maine.
 6. *Nash's Island*, west end of Moose Peak Reach, Maine.
 18. *Saddleback*, in Isle au Haut Bay, Maine.
 23. *Matinicus Rock*, off Penobscot Bay, Maine.
 26. *Owl's Head*, west side of Muscleridge channel, Penobscot Bay, Maine.
 34. *Monheigan Island*, off George's Islands, Maine.
 40. *Sequin*, off mouth of river Kennebec, Maine.

LIGHT-SHIPS.

There are no light-ships in the first district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

West Quoddy Head.—Ten-inch steam-whistle.
Petit Menan.—Ten-inch steam-whistle.
Matinicus Rock.—Twelve-inch steam-whistle.
White Head.—Ten-inch steam-whistle.
Monhegan.—Six-inch steam-whistle.
Seguin.—Ten-inch steam-whistle.
Cape Elizabeth.—Ten-inch steam-whistle.
Portland Head.—Second-class Daboll air-trumpet.
 All of the above are in good condition.

At the *House Island Depot*, Portland Harbor, Maine, experiments with and tests of steam and air fog-signals, boilers, air-tanks, and engines have been made during the last year.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons:

Jerry's Point, Portsmouth Harbor, New Hampshire.—Iron.
South Beacon, Portsmouth Harbor, New Hampshire.—Stone.
North Beacon, Portsmouth Harbor, New Hampshire.—Wooden mast.
Wiley's Ledge, Portsmouth Harbor, New Hampshire.—Iron spindle.
York Ledge off River York, Maine.—Iron spindle.
Fishing Rocks, Kennebunkport, Maine.—Iron spindle broken off, spar buoy substituted.
Stage Island Monument, entrance to Saco River, Maine.—Stone tower 40 feet high.
Sharp's Rocks, entrance to Saco River, Maine.—Iron socket and wooden shaft; socket broken off, spar-buoy substituted.
Ram Island Ledge, (new,) east side of main entrance to Portland Harbor, Maine.—Wooden tripod 50 feet high.
Back Cove Beacon, Portland Harbor, Maine.—Pile beacon.
White Head Ledge, in White Head passage to Portland Harbor, Maine.—Iron spindle, slightly bent.
Trott's Rock, in White Head passage to Portland Harbor, Maine.—Iron spindle broken off, will be replaced with a new one.
Mark Island Monument, Casco Bay, Maine.—Stone tower 50 feet high, in good condition.
Black Jack Rock, entrance Kennebec River, Maine.—A new hole has been drilled in the rock, and a wrought-iron spindle will be set.
Seal Rock, Kennebec River, Maine.—Iron spindle, copper cylinder.
Lee's Rock, Kennebec River, Maine.—Iron socket, wooden shaft, socket broken, spar-buoy substituted.
Ram Island Ledge, Kennebec River, Maine.—Iron socket, wooden shaft.
Winslow's Rocks, Kennebec River, Maine.—Iron socket, wooden shaft, socket broken off, spar-buoy substituted.
Ames' Ledge, Kennebec River, Maine.—Iron socket, wooden shaft.
Beef Rock, Kennebec River, Maine.—Iron socket, wooden shaft.
Lime Rock, Back River, Maine.—Iron socket, wooden shaft.
Carleton's Ledge, Back River, Maine.—Iron socket, wooden shaft.
Clough's Rock, Sheepscot River, Maine.—Iron socket, wooden shaft.
Merrill's Ledge, Sheepscot River, Maine.—Iron socket, wooden shaft.
Yellow Ledges, Penobscot Bay, Maine.—Iron shaft, copper cylinder.

Garden Island Ledge, Penobscot Bay, Maine.—Iron shaft, copper cylinder and one ball, shaft good, lower part of cylinder partially broken away and ball gone.

Otter Island Ledge, Penobscot Bay, Maine.—Iron shaft, copper cylinder and two balls, shaft bent, lower part of cylinder partially broken away, and one ball gone.

Ash Island Point, Penobscot Bay, Maine.—Holes have been drilled in the ledge, and a tripod will be erected.

Dodge's Point Ledge, Penobscot Bay, Maine.—Wooden shaft attached to stump of iron spindle.

Potterfield Ledge, Penobscot Bay, Maine.—Stone beacon.

Lowell's Rock, Penobscot Bay, Maine.—Iron spindle and cage.

Seal's Ledge, Penobscot Bay, Maine.—Iron spindle and cage.

Harbor Ledge, Penobscot Bay, Maine.—Stone beacon.

Shipyards Ledge, Penobscot Bay, Maine.—Iron spindle broken off, not necessary.

Fiddler's Ledge, Penobscot Bay, Maine.—Stone beacon.

Northeast Ledge, Camden Harbor, Maine.—Iron spindle.

Morse's Point Ledge, Camden Harbor, Maine.—Iron spindle.

Hosmer's Ledge, Castine Harbor, Maine.—Stone monument.

Steel's Ledge, Belfast Harbor, Maine.—Stone beacon.

Fort Point Ledge, Penobscot River, Maine.—Stone beacon.

Odum's Ledge, Penobscot River, Maine.—Stone beacon.

Buck's Ledge, Penobscot River, Maine.—Iron beacon.

Center Harbor Ledge, Eggemoggin Reach, Maine.—Iron socket, wooden shaft.

Ship and barges, Blur Hill Bay, Maine.—Iron socket, wooden shaft.

Bunker's Ledge, Mount Desert, Maine.—Stone beacon.

Half-Tide Ledge, Narraguagus Harbor, Maine.—Iron socket, wooden shaft.

Norton's Reef, Pleasant River, Maine.—Iron tripod, shaft, and ball.

Snow's Rock, Moosepeak Reach, Maine.—Iron socket, wooden shaft.

Gilchrist's Rock, Moosepeak Reach, Maine.—Iron shaft and ball.

Western Bar, Lubec Narrows, Maine.—Wooden crib filled with stone.

The Ledge, Saint Croix River, Maine.—Wooden crib filled with stone.

All of these beacons are in good condition except where it is otherwise specified.

Steps have been taken to substitute spindles for buoys in the following places, viz :

Stone's Rock, Old York River.

Cow Island Ledge, Casco Bay.

Lower Basket Island Ledge, Casco Bay.

Gooly Ledge, Casco Bay.

Hodsdon's Ledge, Sheepscot River.

Basket Island Ledge, Casco Bay.

Hypocrite Ledge, near Damiscove Island.

Egg Rock, George's River.

Goose Rock, Fox Island.

Iron Point Ledge, Fox Island.

Inner Ledge, Isle au Haute.

Colby's Ledge, Merchant's Row.

Scrag Island Ledge, Merchant's Row.

Drunkard's Ledge, Penobscot Bay.

Trafton's Island Ledge, Millbridge.

Jordan's Delight Ledge, Narraguagus.

Bunker's Ledge, Mount Desert.

LIGHT-HOUSE BOARD.

601

BUOYS.

New buoys have been placed to mark the following dangers, viz:

Burnt Coat Harbor, Maine.

John's Island Ledge.
Heron Island Ledge.
Gooseberry Island Ledge.
Hat Island Reef.

Lubec Narrows, Maine.

Lower Buoy.
Upper Buoy.

Machias Bay, Maine.

Cross Island Ledge.
Thornton Point Ledge.
Seal Cove Ledge.
Sea-shore Ledge.
Foster's Island Ledge.

Rockland Harbor, Maine.

North end of Southern Ledge.
South end of South Ledge.
Railway Ledge.
Ninety-eight new buoys have been used to supply losses during the year.

DEPOT.

A buoy-depot is at present located upon House Island, near Fort Scammel, Portland Harbor, upon land belonging to the War Department, which is now needed by the engineer in charge of the construction of fortifications at that point.

Notice has been given that the depot must be removed, and an appropriation of \$15,000 is recommended for the purchase of a site and the erection of a wharf and the necessary buildings.

[6.]

SECOND DISTRICT.

Extends from Hampton Harbor, New Hampshire, to include Gooseberry Point, entrance to Buzzard's Bay, and embraces all the aids to navigation on the coast of Massachusetts.

Inspector.—Commander George H. Perkins, United States Navy.

Engineer.—Lieut. Col. James C. Duane, Corps of Engineers, brevet brigadier-general United States Army.

In this district there are:

Light-houses and lighted beacons	61
Light-houses finished and lighted during the year ending July 1, 1873.....	3
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873.....	0

Light-ships, (in position)	8
Light-ships, (for relief)	2
Fog-signals, operated by steam or hot-air engines	4
Day or unlighted beacons	51
Buoys actually in position	508
Spare buoys, for relief and to repair losses	414
Tender-steamers Verbeena, inspector's tender	1

The following numbers, which precede the names of stations, correspond with those of the light-house list of the Atlantic, Gulf, and Pacific coasts of the United States, issued January 1, 1873:

LIGHT-HOUSES AND LIGHTED BEACONS.

54, 55. *Newburyport, upper harbor.*—Two range-lights to guide up the river Merrimack to the city of Newburyport have been established in the same position as the private lights heretofore maintained by subscription, and were lighted June 1, 1873. The front light is on an iron tower, conical in form, 14 feet 6 inches high, located on Bayley's new wharf, and the focal plane is 25 feet above the sea. The rear light is about 350 feet W. $\frac{1}{2}$ S. from the front light, on a brick tower, pyramidal in form, 32 feet high, and the focal plane is 47 feet above the sea.

64, 65. *Baker's Island, south side of northerly entrance to Salem Harbor, Massachusetts.*—A frame dwelling for the assistant keeper has been erected and the light-house land partially refenced with posts and pickets.

78. *Race Point, Cape Cod, Massachusetts.*—A 12-inch steam-whistle has been established, and is arranged to give two blasts of 4 seconds' duration each, with an interval of 8 seconds between them, followed by an interval of 44 seconds. A frame engine-house 12 feet by 24 feet, and fuel, water-sheds and tanks have been erected.

79. *Wood End, Cape Cod, Massachusetts.*—This new light-station was completed and lighted for the first time on the night of the 20th of November, 1872. The tower is of brick, pyramidal in form, and is painted brown. The focal plane is 34 feet above the ground and 45 feet above the sea. The lens is of the fifth order of the system of Fresnel, illuminating the entire horizon, and will show a red light flashing every 15 seconds, which can be seen in clear weather from the deck of a vessel 10 feet above the sea at a distance of eleven nautical miles. The exterior of the lantern, railing, and deck, and all of the iron-work at the top of the tower, are painted black. The keeper's dwelling is of wood; one and a half stories high; painted cream-color, and is placed north-eastward of the tower.

80. *Long Point, Cape Cod, Massachusetts.*—A new keeper's dwelling and tower has become indispensable at this station, the beach having changed to such an extent as to leave the foundation of the present building exposed. The piles on which the present building is supported are decayed, and the entire structure in danger of being carried off by a heavy storm.

84. *Cape Cod Highlands, Truro, Massachusetts.*—A first-class Daboll trumpet has been established at this station, and is arranged to give blasts of 8 seconds' duration, with intervals between them of 30 seconds. A frame engine-house, 12 feet by 24 feet, and fuel-shed, have been erected. Some repairs have been made.

85, 86, 87. *Nauset Beach, at Eastham, Cape Cod, Massachusetts.*—Fourth-order lenses have been substituted in the places of the 6th at this station. The dwelling-house should be enlarged, or a small cottage built for the accommodation of the assistant keeper, as the building now occupied is entirely too small.

91. *Monomoy, southern extremity of Cape Cod, Massachusetts.*—The importance of establishing a powerful light at this point was urged in the last annual report. The present light is insufficient, and the necessity of furnishing a more efficient aid to the navigation of this great thoroughfare, cannot be exaggerated. The last annual report of the Light-House Board contains the following statement in relation to increasing the efficiency of this light:

Monomoy Point.—The light at this station, which is of the fourth order, on a tower about 40 feet high, was originally intended as a guide to Old Stage Harbor. The harbor has been filled with sand and cannot now be entered, and the light is therefore of no further use for that purpose. But, inasmuch as nearly all vessels (both steamers and sailing) plying between New York and the eastern ports pass this point, and have now no other guide than the light-ships, which cannot be seen a sufficient distance, it is considered a matter of the greatest importance that this light should be replaced by one of sufficient power to guide vessels safely through this intricate passage. For this purpose, there is recommended a second-order fixed light, varied by red flashes, for which an estimate is submitted.

95. *Sankaty Head, on southeast side of Nantucket, Mass.*—The tower and buildings require extensive repairs, and a new lantern is necessary, and a special estimate therefor is submitted.

108. *Edgartown, north side of the harbor.*—Extensive repairs have been made at this station.

— *East Chop, Martha's Vineyard, east entrance to Holmes's Hole Harbor, Massachusetts.*—A light has been maintained for several years at this point by the subscription of the owners of steamships and by other private individuals. As there is no doubt as to the utility of the light, it is recommended that an appropriation for erecting a fourth-order light be made.

112. *Sow and Pigs, entrance to Vineyard Sound and Buzzard's Bay.*—The western entrance to Vineyard Sound is now marked by a light-ship anchored off the Sow and Pigs Ledge. A second-order light placed on this point would not only furnish a better guide to vessels entering the sound, but would be a saving of expense by enabling both the light-ship and the Cuttyhunk light to be dispensed with.

REPAIRS.

At each of the following-named light-stations there have been made repairs and renovations more or less extensive during the year:

- 56 and 57. *Ipswich, entrance to Ipswich Harbor, Massachusetts.*
- 58. *Annisquam, entrance to Annisquam Harbor, Massachusetts.*
- 59. *Straitsmouth, north side of Cape Ann, Massachusetts.*
- 62. *Eastern Point, east side of entrance to Gloucester Harbor, Massachusetts.*
- 63. *Ten-Pound Island, Gloucester Harbor, Massachusetts.*
- 66. *Hospital Point, Beverly, Massachusetts.*
- 67. *Fort Pickering, Salem, Massachusetts.*
- 68. *Derby Wharf, Salem, Massachusetts.*
- 69. *Marblehead, south side of entrance to Marblehead Harbor, Massachusetts.*
- 70. *Egg Rock, off Nahant, Massachusetts.*
- 71. *Minot's Ledge, entrance to Boston Bay, Massachusetts.*
- 72. *Boston, north side of main entrance to Boston Harbor, Massachusetts.*
- 73. *Narrows, entrance to Boston Harbor, Massachusetts.*
- 74. *Long Island Head, Boston Harbor, Massachusetts.*

- 75, 76. *Plymouth*, entrance to Plymouth Harbor, Massachusetts.
 77. *Duxbury Pier*, entrance to Plymouth Harbor, Massachusetts.
 81. *Mayo's Beach*, head of Wellfleet Bay, Massachusetts.
 82. *Billingsgate Island*, near Wellfleet, Massachusetts.
 83. *Sandy Neck*, entrance to Barnstable Harbor, Massachusetts.
 - 88, 89. *Chatham*, west side of Chatham Harbor, Massachusetts.
 90. *Pollock Rip*, light-ship, off Chatham, Massachusetts.
 92. *Shovelful Shoals*, light-ship, off Chatham, Massachusetts.
 93. *Handkerchief*, light-ship, Vineyard Sound, Massachusetts.
 94. *Nantucket*, (Great Point,) northeast point of Nantucket, Massachusetts.
 96. *South Shoal*, light-ship, off Nantucket, Massachusetts.
 97. *Gay Head*, west point of Martha's Vineyard Island, Massachusetts.
 98. *Brant Point*, entrance Nantucket Harbor, Massachusetts.
 99. *Nantucket Range Beacon*, Nantucket Harbor, Massachusetts.
 - 100, 101. *Nantucket Cliff Range Beacons*, near Nantucket Harbor, Massachusetts.
 102. *Bass River*, entrance to Bass River, Massachusetts.
 103. *Bishop & Clerk's*, Vineyard Sound, Massachusetts.
 104. *Hyannis*, entrance Hyannis Harbor, Massachusetts.
 105. *Cross Rip*, light-ship, off Nantucket, Massachusetts.
 106. *Cape Poqe*, near Edgartown, Massachusetts.
 107. *Succonnessett*, light-ship, Vineyard Sound, Massachusetts.
 109. *Holmes' Hole*, (west chop,) entrance to Holmes' Hole Harbor, Massachusetts.
 110. *Nobsque Point*, entrance to Wood's Hole Harbor, Massachusetts.
 111. *Tarpaulin Cove*, on Naushon Island, Vineyard Sound, Massachusetts.
 113. *Hen and Chickens*, light-ship, entrance to Buzzard's Bay, Massachusetts.
 114. *Cuttyhunk*, entrance to Buzzard's Bay, Massachusetts.
 115. *Dumpling Rock*, Buzzard's Bay, Massachusetts.
 116. *Clark's Point*, entrance to New Bedford Harbor, Massachusetts.
 117. *Palmer's Island*, New Bedford Harbor, Massachusetts.
 118. *Ned's Point*, entrance to Mattapoissett Harbor, Massachusetts.
 119. *Bird Island*, Buzzard's Bay, Massachusetts.
 120. *Wing's Neck*, entrance to Sandwich Harbor, Massachusetts.
- The following named light-stations require repairs to be made during the current and ensuing years:
60. *Cape Ann*, Massachusetts.
 80. *Long Point*, (Cape Cod,) entrance to Provincetown Harbor, Massachusetts.
 91. *Monomoy*, southern point of Cape Cod, Massachusetts.
 95. *Sankaty Head*, island of Nantucket, Massachusetts.
 97. *Gay Head*, western end of Martha's Vineyard, Massachusetts.
 114. *Cuttyhunk*, entrance to Buzzard's Bay, Massachusetts.

LIGHT-SHIPS.

Although none of the light-ships in this district have parted their moorings, or met with any serious accidents during the past year, yet more extensive repairs have been required than perhaps ever before in a single year, eight out of the whole number (ten) having been taken into port for that purpose. With the exception of Vineyard Sound they are all now in excellent order.

90. *Pollock Rip*, off Chatham, Massachusetts. This vessel has been put in complete order during the year at a total expense of \$1,258.66.

92. Shovelful, on Shovelful Shoal, off Chatham, Massachusetts. This vessel has been thoroughly repaired at an expense of \$5,287.26.

93. "Handkerchief," on Handkerchief Shoal, in Vineyard Sound, Massachusetts. This vessel has been extensively repaired and refitted at an expense of \$6,800, and is now in perfect order.

96. Nantucket, New South Shoals, twenty-one miles S. S. E. from the island of Nantucket. Has had no repairs during the year, and is in good condition.

105. "Cross Rip," off Cross Rip Shoal, in Nantucket Sound, Massachusetts. Early in December last the windlass of this vessel was started, in a severe gale, and it was found necessary to take her to New Bedford. Upon examination the vessel was found to be very rotten in her timbers and planking, and to require very extensive repairs, which were made at an expense of \$12,393.79.

107. Succunnessett, between Succunnessett and Eldridge Shoals, Nantucket Sound. The repairs of this vessel, which were in progress at the date of the last annual report, were completed within the estimate, and the vessel returned to her station, for which she is well adapted, though much smaller than the other light-vessels in the district. The expense of the repairs was \$4,707.63.

112. Vineyard Sound, off Sow and Pigs Rocks, western entrance to Vineyard Sound, Massachusetts. This vessel requires considerable repairs, at an estimated expense of \$3,000.

113. Hen and Chickens, western side of entrance to Buzzard's Bay, Massachusetts. This vessel was taken to New Bedford last autumn, and some necessary repairs made, at an expense of \$775.15.

Reliefs No. 9 and 24. Necessary repairs were made to these vessels during the year, at an expense of \$1,527.00.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

Cape Ann.—Twelve-inch steam-whistle.

Boston.—First-class Daboll air-trumpet.

Race Point.—Twelve-inch steam-whistle.

Cape Cod.—First-class Daboll air-trumpet.

All of the above are in good condition.

FOG-SIGNALS ON LIGHT-SHIPS IN VINEYARD SOUND.

The entire commerce by sea between the East and New York and the South passes through Vineyard Sound, and depends on the light-ships at "Pollock Rip," on the eastern, and the "Sow and Pigs Reef," at the western entrance, to guide them in entering and leaving the sound. In foggy weather these lights are not available and many disasters occur in consequence.

The Board therefore earnestly recommend that an appropriation of \$10,000 be granted for the purpose of putting fog-signals in these vessels, which may be operated by steam or hot air.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the second district:

Old Cock, Buzzard's Bay, Massachusetts.—Iron spindle 36 feet high; cage at top.

Egg Island, Buzzard's Bay, Massachusetts.—Granite cone with iron spindle and vane.

Range Beacon, Fairhaven, Massachusetts.—Iron triangular pyramid 40 feet high.

Cormorant Rocks, entrance Mattapoisett Harbor, Buzzard's Bay, Massachusetts.—Iron spindle; cage at top.

Lone Rocks, entrance Wood's Hole, Massachusetts.—Iron spindle; cage at top.

Collier's Ledge, Centreville Harbor, Vineyard Sound, Massachusetts.—Granite base, iron spindle, ball, and vane.

Great Rock, west of Point Gammon, Vineyard Sound, Massachusetts.—Iron spindle; cage at top.

Hyannis Breakwater, Massachusetts.—Wooden spindle, four arms; cask at top.

Sunken Pier, Bass River, Bar, Massachusetts.—Wooden spindle; cask at top.

Spindle Rock, entrance to Edgartown Harbor, Massachusetts.—A new iron spindle 12 feet high, with cask at top; surmounted by a spindle and vane, has been erected in place of the one which was carried away by the ice.

Billingsgate Shoal, Massachusetts.—Old site; timber beacon, with masts and slats.

Egg Island Rock, entrance to Wellfleet Harbor, Massachusetts.—Wooden spindle; cask at top.

Duxbury Beacon, Massachusetts.—Square granite, and granite post at top.

Breakwater Beacon, Massachusetts.—Square granite, with wooden spindle and cage.

Hogshead Beacon, Massachusetts.—Iron spindle, with arm, cask, and cage at top.

North Beacon, entrance to Scituate Harbor, Massachusetts.—Iron spindle, with two rounds.

South Beacon, entrance to Scituate Harbor, Massachusetts.—Iron spindle, with two lozenges.

Londoner, off Thatcher's Island, Cape Ann, Massachusetts.—Iron spindle with cage at top.

Point Alderton, Boston Bay, Massachusetts.—Square granite pyramid with cone at top.

False Spit, Boston Bay, Massachusetts.—Granite base, with iron spindle and cage at top.

Spit Beacon, Boston Bay, Massachusetts.—Square granite pyramid.

Nix's Mate, Boston Harbor, Massachusetts.—Square granite base, with octagonal wooden pyramid.

Great Farm Bar, Boston Bay, Massachusetts.—Square granite base and granite cone, with iron spindle and cage at top.

Deer Isle Point, Boston Bay, Massachusetts.—Square granite pyramid.

Bird Island, Boston Bay, Massachusetts.—Iron spindle, cage at top.

Sunken Island, Boston Bay, Massachusetts.—Granite base, with wooden spindle and cage at top.

Pig Rocks, Boston Bay, Massachusetts.—Granite pyramid, with wooden spindle and cage at top.

Half-tide Rock, entrance to Swampscot Harbor, Massachusetts.—A wrought-iron spindle 23 feet high, with cask at top, painted red, has been set in place of the wooden shaft.

Cat Island, entrance to Salem Harbor, Massachusetts.—Wooden spindle, with cask at top.

Marblehead Rock, entrance to Marblehead Harbor, Massachusetts.—Granite, conical, with wooden spindle.

Little Aqua-Vitæ, entrance to Salem Harbor, Massachusetts.—Granite, with wooden spindle and cage at top.

Great Aqua-Vitæ, entrance to Salem Harbor, Massachusetts.—Granite, with wooden spindle and cage at top.

Hardy's Rock, entrance to Salem Harbor, Massachusetts.—Wooden spindle, with two triangles at top.

Bowditch Beacon, entrance to Salem Harbor, Massachusetts.—This beacon has been rebuilt of granite on the old site; it is a triangular pyramidal structure, surmounted by a mast and cage; the sides at the base are 16 feet; at top 7 feet; height of masonry, 30 feet, to top of cage, 45 feet. The wooden mast and cage are painted black.

Halfway Rock, off Marblehead, Massachusetts.—Granite beacon. It has been nearly destroyed.

Little Haste Beacon, entrance to Salem Harbor, Massachusetts.—Wooden mast, with cask at top.

Abbott's Monument, entrance to Salem Harbor, Massachusetts.—Square granite, with wooden mast and cask at top.

Monument Bar, entrance to Beverly Harbor, Massachusetts.—Square granite, wooden mast, cage at top.

Ram's Horn Beacon, entrance to Beverly Harbor, Massachusetts.—Square granite, wooden mast.

Lobster Rocks, Beverly Harbor, Massachusetts.—Stone, with wooden spindle.

Black Rock, Gloucester Harbor, Massachusetts.—Iron spindle with cage at top.

Harbor Rock Beacon, Gloucester Harbor, Massachusetts.—Iron spindle with ball and cage at top.

Five-Pound Island Beacon, Gloucester Harbor, Massachusetts.—Granite base with iron spindle and ball at top.

Lobster Rock, Annisquam Harbor, Massachusetts.—Square granite beacon. Has been rebuilt.

Lane's Point, Annisquam Harbor, Massachusetts.—Square wooden beacon.

Point Neck Rocks, Entrance to Essex Harbor, Massachusetts.—Iron spindle, with ball at top.

Black Rocks, Newburyport Harbor, Massachusetts.—A stone pier, 15 feet square and 15 feet high, has been erected in the place of the iron spindle, and will be surmounted by a wooden pyramid painted red.

North Pier, Newburyport Harbor, Massachusetts.—Wooden crib filled with stone.

South Pier, Newburyport Harbor, Massachusetts.—Wooden crib filled with stone.

Dry Salvages, off Cape Ann, Massachusetts.—Holes have been drilled in this ledge and a day mark is being erected.

Harding's Ledge, Boston Bay, Massachusetts.—Holes are being drilled in this ledge; when completed a day mark will be erected.

BUOYS.

Owing to the want of another tender for buoy purposes it was found impossible to care for the buoys as thoroughly as desirable, and another tender will be sent as soon as possible to assist in the work of the district. Thirty-one spar buoys and nine iron buoys have been lost by ice and other causes during the year.

DEPOTS.

Cohasset, Massachusetts.—The buoy depot at Cohasset for the northern part of the district was temporarily adopted in its present position from motives of economy, the ground belonging to this establishment, and the sheds which had been used by the stone cutters and other workmen employed in the construction of Minot's Ledge light-house, serving for buoy sheds, but it was never intended that the location should be a permanent one, the channel of approach being very narrow, crooked, and shoal, and freezing early in the season, cutting off access to the depot by the tenders and causing great inconvenience.

For these reasons the sheds and wharf have not been repaired and as they are now fast going to decay it is not thought advisable to expend more money upon them. In view of the unfitness of this location, an appropriation is asked for the purpose of transferring the depot to Lovell's Island in Boston Harbor, which belongs to the Government, and is admirably suited to the purpose as the channel near the island is never closed by ice, and the island can be approached at all stages of the tide. An estimate for this purpose is included in the annual estimates.

Wood's Hole, Massachusetts.—The building occupied by the lampist has been repaired. To put this useful depot in good order and efficient condition, an appropriation of \$5,000 is asked for, and is submitted in the estimates.

[7.]

THIRD DISTRICT.

The third district extends from Gooseberry Point, Massachusetts, to include Squam Inlet, New Jersey, and embraces all the aids to navigation on the sea and sound coasts of Rhode Island, Connecticut, and New York, Narragansett and New York Bays, Providence and Hudson Rivers, Whitehall Narrows, and Lake Champlain.

Inspector.—Commodore James H. Strong, United States Navy, to June 30, 1873. Commodore Stephen D. Trenchard, United States Navy, since June 30, 1873.

Engineer.—Col. I. C. Woodruff, Corps of Engineers, Bvt. Brig. Gen. U. S. A.

In this district there are:

Light-houses and lighted beacons	117
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1873.....	6
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873	9
Light-ships in position	6
Light-ships for relief	3
Fog-signals operated by steam or hot-air engines.....	8
Day or unlighted beacons.....	39
Buoys actually in position	465
Buoys for relief and to supply losses.....	283
Steam-tenders for supply and for inspection, "Putnam" and "Cactus".....	2
Steam-tender for engineer purposes, "Mistletoe".....	1
Supply-steamer for supplying the light-houses of the Atlantic and Gulf coasts, "Fern".....	1

The numbers preceding the names of stations correspond with the light-house list of the Atlantic, Gulf, and Pacific coasts, and the northern and northwestern lakes of the United States, issued January 1, 1873.

LIGHT-HOUSES AND LIGHTED BEACONS.

The Whale, Narragansett Bay, Rhode Island.—In the last annual report it is stated that "This is a reef of rocks awash at all stages of the tide, and a dangerous obstruction to navigation in the approach to the west channel of the Narragansett Bay. This channel is habitually used by the daily line of Providence steamers which pass the locality during the night, carrying large numbers of passengers and valuable freights, and it is recommended that a light and fog-bell be erected on the ledge. The estimate of the engineer of the district for the structure is \$35,000, which is embraced in the estimates of the board."

The recommendation is renewed, also the estimate for the structure, namely, \$35,000.

122. *Beaver Tail, Rhode Island.*—The first-class fog-signal, a Daboll trumpet, twotwenty-four-inch engines, authorized, was completed and put in operation at the close of the month of October, 1872.

The signal was operated during four hundred and ninety-three and one-half (493½) hours of fog, throughout the past year.

124. *Newport Harbor, Goat Island, Rhode Island.*—The fog-bell authorized was erected, and the striking-apparatus put in readiness for use on the first of March, 1873.

— *Muscle Bed, Narragansett Bay, Rhode Island.*—A beacon-light and fog-bell have been erected. The light was exhibited and the fog-bell was ready for operation on the 1st of August, 1873. The illuminating-apparatus is dioptric of the 6th order of the system of Fresnel, and shows a fixed red light over an arc of 270°. The focal plane is 31 feet above the sea, and the light can be seen in clear weather at a distance of 10 $\frac{7}{10}$ nautical miles. The bell is struck by machinery at intervals of 20 seconds.

131. *Conimicut, river Providence, Rhode Island.*—The dwelling for the keeper, authorized by the appropriation made by the last Congress, is in progress under contract; on its completion the site of the present dwelling on Nyatt Point will be sold at public auction, as provided in the act making the appropriation for the new dwelling.

132. *Bullock's Point, river Providence, Rhode Island.*—The beacon-light authorized was erected and the light was exhibited on the 4th of November, 1872. It is on a shoal off the point on the east side of the channel. The pier is of granite and the illuminating-apparatus is dioptric of the 6th order of the system of Fresnel, and shows a fixed red light.

A dwelling for the keeper is recommended. The estimated cost of the dwelling, together with that of enlarging the foundation, is \$15,000.

133. *Sabin's Point, river Providence, Rhode Island.*—The structure, embracing pier and dwelling of granite, has been completed, and the light first exhibited on the 4th of November, 1872.

It is situated on a shoal off the point, in 8 feet of water, near the eastern side of the channel. The pier on which it is built and the dwelling are of granite. The illuminating-apparatus is dioptric, of the 6th order of the system of Fresnel, and shows a fixed white light.

134. *Pumham Rock, river Providence, Rhode Island.*—The boat-house and landing-wharf authorized have been completed. The light was changed from white to red on the 1st of October, 1872.

135. *Fuller's Rock, river Providence, Rhode Island.*

136. *Sassafras Point, river Providence, Rhode Island.*—These beacon-lights are on opposite sides of the river and are distant about one mile.

The purchase of a site and the erection of a dwelling for the keeper

are recommended, as very great difficulty is experienced in securing a suitable person to attend the lights at the compensation fixed for such beacons. It is supposed that \$5,000 would be adequate for the object, and it is therefore recommended. The light at Sassafra Point was changed from white to red October 1, 1872.

137. *Point Judith, Rhode Island.*—The first-class steam fog-signal authorized has been erected and put in operation. The apparatus is a syren, in duplicate, receiving the steam from the same boiler.

The number of hours of fog during the year is five hundred and forty-eight, during which the signal was in operation.

138. *Block Island, Rhode Island, (northerly.)*—The grading and paving for the protection of the dwelling and the site against the sand-drifts have been completed, and the measure has proved effectual in arresting the waste of the sands in the vicinity of the structure.

139. *Block Island, (southerly,) Rhode Island.*—The plans for the light-house and first-class steam fog-signal have been prepared, but the difficulty of obtaining to the title, and consequent delays, have prevented the commencement of the structures. The site was finally purchased in the month of July, and preparations are in progress for the erection of the fog-signal, which will be completed during this season. Measures will be taken to place the light-house under contract, so that the structure may be begun early in the spring.

141. *Montauk Point, New York.*—The first-class fog-signal, two twenty-four-inch engines and Daboll trumpet, authorized, has been erected, and was put in operation on the 1st of May, 1873.

142. *Stonington Harbor, Connecticut.*—Very extensive general repairs are needed, and an appropriation of \$1,500 is asked for the purpose.

146. *New London Harbor, Connecticut.*—The fog-signal, second-class, two eighteen-inch engines and Daboll trumpet, authorized, has been commenced, and the building has been enlarged for its housing. The signal will be ready for operation early in October.

The fog-signal was in use two hundred and eighty-two and one-half (282½) hours during fog, but the duration of fog was much greater, for the former signal was out of repair, and was not sounded.

148. *Race Rock, Long Island Sound, New York.*—The work was discontinued for the remainder of the season early in the month of September, when adverse weather was experienced.

The plan was modified with the view of a concrete foundation in place of the riprap; and work under the new contract was commenced early in the month of May, since which the contractor has made considerable progress, having completed the laying of the facing or dimension-stone. The preparations for the laying of the concrete foundation are progressing, derricks are being erected, breakwater of riprap laid, &c.

149. *Little Gull Island, Long Island Sound, New York.*—The duplicate syren of the second class was erected and prepared for use in the month of September, 1872.

The draught of the chimney of the duplicate was found defective, and necessary alteration to remedy the defect has been made.

The number of hours of fog during the year is five hundred and thirty-four, (534,) during which the syren was in operation.

In the last annual report it is stated that "This station needs an appropriation of \$5,000 for completing the landing, reference to which was made in the last annual report.

"There is special need for the facilities of a landing for the reason that the shelter from the sea is so limited that the difficulty of landing supplies of the station, including a large quantity of coal for the steam

fog-signal, is unusually great. The recommendation for the appropriation of \$5,000 for completion of the landing is renewed."

The recommendation is again submitted.

152. *Long Beach Bar, Long Island, New York.*—The breakwater for the protection of the iron screw pile light-house has been completed, and danger from the flow of ice is not apprehended.

154. *Saybrook, Lynde Point, Connecticut.*—The fog-bell frame needs rebuilding. This and the general repairs of the station will require an appropriation of \$1,500, which is included in the estimates.

155. *Calves Island, Connecticut.*

156. *Brockway's Reach, Connecticut.*

157. *Devil's Wharf, Connecticut.*—The protection of the foundations of these lights has been carried to completion.

160. *Faulkner's Island, Long Island Sound, New York.*—In the last annual report it is stated that "the wasting away of the clay bank continues slowly during the freezing and subsequent thawing of the soil. The beach requires to be protected at an estimated cost of \$2,500, which is recommended to be appropriated." The recommendation is renewed.

161. *New Haven Harbor, Connecticut, Southwest Ledge.*—The appropriation of \$50,000 for commencing a light-house on this ledge has been applied to the foundation of the structure, which was decided by the board should be an iron tube 24 feet in diameter, filled with concrete, and surrounded by riprap. This foundation is under contract, and it is to be completed by the 1st of May, 1874.

There will be required \$50,000 additional for the structure, for which an estimate is submitted.

163. *Stratford Point, Connecticut.*—In the last annual report it is stated that "the buildings of this station are very old and unfit for occupation. An estimate for a suitable dwelling, over which the tower may be placed, was submitted in the last annual report. It is recommended that the amount be appropriated, viz, \$15,000." The recommendation is renewed.

164. *Stratford Point Shoal, Long Island Sound, New York.*—An appropriation of \$50,000 was made for the commencement of a light-house to supersede the light-ship at this station.

The nature of the shoal has been examined by boring into the shoal, the result of which is considered favorable for the iron tubular foundation, or concrete as may be finally determined.

The amount of the existing appropriation will suffice for the foundation, which will carry the work above high water.

An additional appropriation of \$50,000 will be required to continue the structure, and an estimate is submitted.

166. *Bridgeport Harbor, Connecticut.*—The better protection of the iron screw pile light-house against the floating ice is deemed necessary, and a coping of heavy stones to resist the ice is proposed, for which there is required the amount of \$5,000, for which an estimate is submitted.

167. *Black Rock, Connecticut.*—In the last annual report it is stated that "the tower and keeper's dwelling (erected in 1808) are in an advanced state of decay, and need rebuilding. The new structure may be planned with the tower over the keeper's dwelling." The recommendation is renewed, and an estimate is submitted.

168. *Penfield Reef, Connecticut.*—The riprap foundation and pier, including the landing, and all of granite, have been completed, and the contractor for the dwelling and tower, also of granite, has commenced this portion of the structure. The light will, doubtless, be exhibited early during the coming winter season.

170. *Eaton's Neck, New York.*—The supply of fresh water for the steam fog-signal was found to be failing very rapidly, and it became necessary to drive an artesian well and build an accessory cistern. The well has been driven, and the supply of fresh water is found to be adequate to all the wants of the signal. The number of hours' duration of fog in which the signal was operated during the year is 494½.

171. *Lloyd's Harbor, New York.*—The jettee built for the protection of the site of the dwelling and light has not fully answered the purpose for which it is intended.

The abrasion continues, and threatens the destruction of the site. The light subserves only a local purpose. The amount of \$2,000 for the protection of the site is recommended.

173. *Execution Rocks, New York.*—The number of hours' duration of fog for the year during which the signal was operated, was 284½.

175. *Hart Island, New York.*—The patent from the State of New York for the site of the light-house has not been obtained, and consequently the work is suspended. The contract for the structure has been conditionally awarded, and work will be commenced as soon as the patent is secured from the State.

178. *Blackwell's Island, East River, New York.*—On the 23d of September, 1872, there was exhibited for the first time a fixed red light from a handsome tower constructed by the department of public charities of the city of New York, and the light is maintained by it.

The illuminating apparatus furnished by the United States is dioptric, of the 4th order of the system of Fresnel, and the focal-plane is 54 feet above the sea.

182 and 183. *Highlands of Navesink, New Jersey.*—Fencing and grading of the grounds are much needed. An appropriation of \$1,500 is, therefore, asked for the purpose.

185. *East Beacon, Sandy Hook, New Jersey.*—The abrasion of the beach threatened the destruction of the dwelling and tower. The encroachment of the sea was so rapid that the removal of the building was out of the question. Resort was then had to brush jetties, one of which was built on each side of the building; the result proved favorable; the accumulation of sand being very rapid in the vicinity of the building, but the abrasion continued to the westward. Under the appropriation of \$20,000 for this protection, jetties of brush have been commenced, and three are in progress; a fourth will be commenced. The accumulation of sand increases with the progress of the work on the jetties. The number of hours of fog at this station during the year was 539½; during which the signal, a syren, was in operation.

186. *West Beacon, Sandy Hook, New Jersey.*—The jetties of crib-work built some years since for the protection of this site needs rebuilding. There will be required for this purpose an appropriation of \$8,000.

187. *Conover Beacon, New Jersey.*—The wooden tower is so far decayed that its rebuilding becomes a case of necessity. The estimate for the work is \$3,000.

193. *Princess Bay, New York.*—The protection sea-wall under contract is still in progress. It is completed with the exception of the jetties, three in number, about 50 feet in length.

194. *Fort La Fayette, New York.*—The location of the fog-bell was finally decided to be on the sea-wall of the fort on the east side of the Narrows. The bell has been erected and was put in operation on the first day of August.

195. *Fort Tompkins, New York.*—The dwelling and tower surmounting the dwelling have been completed. The lantern remains to be

placed on the tower, and the light will be exhibited therefrom in a short time. The temporary light will then be extinguished.

197. *Fort Columbus, New York Harbor.*—The fog-bell was erected on the sea-wall on the northwest extremity of Governor's Island, and put in operation during the month of February, 1873.

198. *Bergen Point, New Jersey.*—The large bell struck by machinery has been substituted for the small one struck by hand.

203. *West Point, New York.*—The light was exhibited from the new beacon during the month of September, 1872. The apparatus is dioptric, of the 6th order of the system of Fresnel, and shows a fixed white light over 270° of the horizon. The focal-plane is 40 feet above the river.

204. *Esopus Meadows, New York.*—The light was exhibited from the new building during the month of August, 1872.

The supporting pier and the light-house are built of granite, near the west side of the river; the apparatus is dioptric, of the 5th order of Fresnel, and illuminates an arc of 270° of the horizon, with a fixed white light. The focal-plane is 58 feet above the river, and the light can be seen in clear weather 12 nautical miles. Proposals were solicited for the sale and removal of the old stone-dwelling, but none were received. Instructions have been given to have the building torn down, and the stone to be thrown around the base as riprap.

207. *Hudson City, New York.*—The pile foundation and pier are under contract. The plans for the dwelling and tower are being prepared, and the work will be put under contract in good season.

211-222.—*Hudson River Beacons, New York.*—The portable beacons were removed during the month of November and stored at Stuyvesant Depot. Stake-lights were placed temporarily until the close of navigation. Repairs, more or less, were required at the sites of the lights, owing to the abrasion of freshets. The beacons were replaced during the month of May, and repainted.

470. *Crown Point, Lake Champlain, New York.*—The improvements authorized by the appropriation have been made, and consist of a barn, and general repairs of the dwelling and grounds.

471. *Barber's Point, Lake Champlain, New York.*—The light was first exhibited at this station on the opening of navigation on the lake. The station being isolated, the keeper is obliged to keep a horse to procure supplies for family use, the nearest town being about two and a half miles. A barn, therefore, becomes necessary, for which an estimate of \$1,000 is submitted.

473. *Juniper Island, Lake Champlain, Vermont.*—The bell-frame needs rebuilding, for which, and the general repairs of the station, an appropriation of \$1,000 is submitted.

476. *Colchester Reef, Lake Champlain, Vermont.*—A gale of unusual violence, on the 15th and 16th of January, damaged the dwelling to some extent; and the shock of the waves was so great as to greatly alarm the keepers, and to cause the tower to sway so much that the lens was thrown from its pedestal and damaged. The ice also threatened the foundation; and it is known that this produces effects of a serious character. In order to anticipate casualty to the building, and to quiet alarm for its safety in storms and against ice, an appropriation of \$5,000 is asked for riprapping with large stone the base of the structure.

477. *Bluff Point, Valcour Island, Lake Champlain, New York.*—After many vexatious delays in the search of title to the site, the owner of the land refused to convey the deed unless certain conditions were guaranteed to him, namely, the right to construct a wharf near the site, and to have the right of way across the light-house grounds.

These conditions were assented to, as the use of the wharf will also be secured to the United States. The purchase was concluded in April, and the contractor for the building was duly notified to commence the structure. The cellar has been opened in solid rock, and large portions of the materials are on the grounds.

480. *Cumberland Head, Lake Champlain, New York.*—The purchase of the land adjacent to the light, required to open the view of the light to the northward, has been concluded, and the land has been fenced. The necessary clearing of the trees to open the light will be made.

482. *Isle La Motte, Lake Champlain, New York.*—The recommendations for a dwelling at this station, at an estimated cost of \$8,000 in the annual reports of past years, are renewed and are indeed urged.

REPAIRS.

At each of the following stations in the third district, repairs, more or less extensive, have been made during the year :

122. *Beaver Tail, Rhode Island.*
123. *Lime Rock, Rhode Island.*
124. *Newport Harbor, Rhode Island.*
125. *Rose Island, Rhode Island.*
131. *Conimicut, Rhode Island.*
132. *Bullock's Point, Rhode Island.*
133. *Sabin's Point, Rhode Island.*
134. *Punham Rock, Rhode Island.*
135. *Fuller's Rock, Rhode Island.*
136. *Sassafras Point, Rhode Island.*
137. *Point Judith, Rhode Island.*
138. *Block Island, Rhode Island.*
140. *Watch Hill, Rhode Island.*
141. *Montauk Point, New York.*
142. *Stonington Harbor, Connecticut.*
146. *New London Harbor, Connecticut.*
149. *Little Gull Island, New York.*
152. *Long Beach Bar, New York.*
154. *Saybrook, (Lynde Point,) Connecticut.*
155. *Calves Island, Connecticut.*
156. *Brockway's Reach, Connecticut.*
157. *Devil's Wharf, Connecticut.*
160. *Faullner's Island, New York.*
161. *New Haven Harbor, Connecticut.*
163. *Stratford Point, Connecticut.*
166. *Bridgeport Harbor, Connecticut.*
167. *Black Rock, Connecticut.*
170. *Eaton's Neck, New York.*
173. *Execution Rocks, New York.*
174. *Sand's Point, New York.*
179. *Great West Bay, New York.*
180. *Fire Island, New York.*
- 182-183. *Highlands of Navesink, New Jersey.*
185. *East Beacon Sandy Hook, New Jersey.*
187. *Conover Beacon, New Jersey.*
188. *Chapel Hill, New Jersey.*
190. *Waackaack, New Jersey.*
191. *Elm Tree Beacon, New York.*
193. *Prince's Bay, New York.*

- 196. *Robbin's Reef*, New York.
- 198. *Bergen Point*, New Jersey.
- 200. *Passaic Light*, New Jersey.
- 204. *Esopus Meadows*, New York.
- 205. *Rondout*, New York.
- 206. *Saugerties*, New York.
- 208. *Four-mile Point*, New York.
- 209. *Coxsackie*, New York.
- 210. *Stuyvesant*, New York.
- 212. *New Baltimore Dike*, New York.
- 213. *Five-Hook Island*, New York.
- 214. *Coeyman's Bar*, New York.
- 215. *Roha Hook*, New York.
- 216. *Schodack Channel*, New York.
- 218. *Cow Island*, New York.
- 219. *Parada Hook*, New York.
- 220. *Van Wie's Point*, New York.
- 221. *Cross Over*, New York.
- 222. *Cuyler's Dike*, New York.
- 454-469. *Whitehall Narrows*.
- 470. *Crown Point*, New York.
- 476. *Colchester Reef*, Vermont.
- 480. *Cumberland Head*, New York.

The following-named stations in the third district require repairs and renovations during the current and ensuing years:

- 132. *Bullock's Point*, Rhode Island.
- 135. *Fuller's Rock*, Rhode Island.
- 136. *Sassafras Point*, Rhode Island.
- 142. *Stonington Harbor*, Connecticut.
- 149. *Little Gull Island*, New York.
- 154. *Saybrook*, (*Lynde Point*), Connecticut.
- 160. *Faulkner's Island*, New York.
- 163. *Stratford Point*, Connecticut.
- 166. *Bridgeport Harbor*, Connecticut.
- 167. *Black Rock*, Connecticut.
- 171. *Lloyd's Harbor*, New York.
- 182-183. *Highlands of Navesink*, New Jersey.
- 186. *West Beacon Sandy Hook*, New Jersey.
- 187. *Conover Beacon*, New Jersey.
- 454-469. *Whitehall Narrows*.
- 471. *Barber's Point*, New York.
- 473. *Juniper Island*, Vermont.
- 476. *Colchester Reef*, Vermont.
- 482. *Isle la Motte*, New York.

The following-named stations in the third district are not mentioned elsewhere:

- 126. *Dutch Island*, Rhode Island.
- 127. *Poplar Point*, Rhode Island.
- 128. *Prudence Island*, Rhode Island.
- 129. *Bristol Ferry*, Rhode Island.
- 130. *Warwick*, Rhode Island.
- 144. *Morgan's Point*, Connecticut.
- 145. *North Dumpling*, Long Island Sound.

- 150. *Gardiner's Island*, New York.
- 151. *Plum Island*, New York.
- 153. *Cedar Island*, New York.
- 159. *Horton's Point*, New York.
- 162. *New Haven Long Wharf*, Connecticut.
- 165. *Old Field Point*, New York.
- 169. *Norwalk Island*, Connecticut.
- 172. *Great Captain's Island*, New York.
- 176. *Throgg's Neck*, New York.
- 177. *North Brother Island*, New York.
- 178. *Blackwell's Island*, New York.
- 184. *Sandy Hook*, New Jersey.
- 189. *Point Comfort Beacon*, New Jersey.
- 192. *New Dorp Beacon*, New York.
- 199. *Corner Stake*, New Jersey.
- 201. *Elbow Beacon*, New Jersey.
- 202. *Stony Point*, New York.
- 472. *Split Rock*, New York.
- 474-475. *Burlington Beacons*, Vermont.
- 478-479. *Plattsburgh Beacons*, New York.
- 481. *Point au Roche*, New York.
- 483. *Windmill Point*, Vermont.

LIGHT-SHIPS.

- 121. *Brenton's Reef*, off *Brenton's Reef* entrance to *Newport Harbor*, *Rhode Island*.
- 143. *Eel Grass Shoal*, off *Mystic*, *Connecticut*, in *Fisher's Island Sound*.
- 147. *Bartlett's Reef*, off *New London*, *Connecticut*, in *Long Island Sound*.—This vessel needs repairing at an estimated cost of \$500.
- 158. *Cornfield Point*, *Long Island Sound*, off mouth of river *Connecticut*.—This vessel needs small repairs at an estimated cost of \$300.
- 164. *Stratford Point*, off *Stratford Point*, on *Middle Ground*, in *Long Island Sound*.—This vessel will be superseded by a light-house.
- 181. *Sandy Hook*, off entrance to *New York Bay* six miles from *Sandy Hook* and *Highlands of Navesink Lights*.—On the 15th of February, 1873, the lights of this vessel were changed from white to red, complaints having been made that they were sometimes mistaken for the Highland (Navesink) lights. These lights are in good condition, except it is otherwise specified.

Relief Light-ships Nos. 17 and 20 are in good order for service.

Relief No. 23, formerly stationed upon *Willoughby Spit Channel* to *Hampton Roads*, *Virginia*, is being thoroughly repaired and refitted at a cost of \$1,800.

Relief No. 14.—This vessel, from age and service, was, upon examination, found not worth repairs, and was, on the 7th of October last, sold at public auction, and the proceeds, \$615, turned into the Treasury.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- 122. *Beaver Tail*, *Rhode Island*.—A first-class Daboll trumpet, in duplicate.
- 137. *Point Judith*, *Rhode Island*.—First-class siren, in duplicate.
- 139. *Block Island*, (southerly) *Rock Island*.—First-class siren, in duplicate, (building.)
- 141. *Montauk Point*, *Long Island*.—First-class Daboll trumpet, in duplicate.

146. *New London, Connecticut*.—Third-class Daboll trumpet, in duplicate.

149. *Little Gull Island, New York*.—Second-class siren, in duplicate.

170. *Eaton's Neck, New York*.—Second-class siren, in duplicate.

173. *Execution Rocks, New York*.—Third-class Daboll trumpet, in duplicate.

185. *Sandy Hook, entrance to New York Harbor*.—First-class siren, in duplicate.

Light-Ship Fog-signal in Long Island Sound.—The immense number of passengers who are afloat nightly in vessels in Long Island Sound, between New York, Fall River, Stonington, Providence, and Norwich, and other eastern cities, and the great amount of fog on the sound, demand that one or more steam fog-signals be placed on the light-ships which lie in the track of these vessels, and an appropriation is asked of \$5,000 for this purpose.

DAY OR UNLIGHTED BEACONS.

1. *East Lime Rock, east side of Newport Harbor*.—A square granite structure, surmounted by an iron spindle and red cage.

2. *South Point, Rose Island, Narragansett Bay*.—("Rose Island Spindle.") A square granite structure, surmounted by a spindle and cage-work keg, painted black.

3. *Halfway Rock, three-fourths of a mile southward of Prudence Island Point, Narragansett Bay*.—A spindle with square cage. Should be painted with horizontal stripes, for a channel on either hand.

4. *Warwick, or Spindle Rock Beacon, entrance to Greenwich Harbor, west channel of Narragansett Bay*.—Spindle with square cage-work day-mark, painted black.

5. *Pawtucket Beacon, Narragansett Bay, Providence River*.—A round granite base, whitewashed, surmounted by a spindle with a black ball.

6. *Pumham Beacon, Providence River, Rhode Island*.—A round stone base, whitewashed, with spindle, black ball and vane.

8. *Borden's Flats, opposite to Fall River, Rhode Island*.—A square granite beacon, with iron column and square day-mark of cage-work, painted black.

9. *Castle Island, near north end of Hog Island, Bristol Harbor*.—A round stone beacon, whitewashed, surmounted by a spindle and red ball.

10. *Allen's Rock, Warren River*.—A square granite base, and pyramid, one-eighth of a mile north of Adams' Point.

11. *White Rock Beacon, at the entrance of Wickford Harbor, Narragansett Bay*.—A round stone beacon, with iron column and square day-mark. This beacon has been damaged by ice, and needs repair.

12. *Watch Hill Reef Spindle, entrance to Fisher's Island Sound, from light-house, southwest by south three-fourths of a mile*.—An iron spindle on a rock which is bare at low water, surmounted by a square cage painted black.

13. *Sugar Reef Beacon, Fisher's Island Sound*.—Destroyed; to be replaced.

14. *Catumb Reef Beacon, Fisher's Island Sound*.—An iron-pile beacon with conical cage-work day-mark.

15. *East Spindle, entrance to Fisher's Island Sound by Lord's Channel*.—A spindle with square cage-work day-mark; being on starboard of Lord's Channel.

16. *West or Wicopesset Spindle Rock, entrance to Fisher's Island Sound*

by Lord's Channel—northwest of East Spindle, two-thirds of a mile.—An iron spindle, with square cage-work day-mark, painted black.

17. *Latimer's Reef Spindle, Fisher's Island Sound, one mile northwest of east point of Fisher's Island, and three-fourths of a mile southeast of Eel-grass Shoal light-vessel.*—An iron spindle bearing a square cage-work day-mark, painted with horizontal stripes.

18. *Ellis's Reef, Fisher's Island Sound, three-fourths of a mile northwest of Eel-grass Shoal light-vessel.*—An iron spindle with a square cage-work, painted black.

19. *Ram Island Reef Spindle, Fisher's Island Sound, one-half mile south-east of Ram Island.*—An iron spindle with square cage-work, painted black. The spindle is somewhat bent.

20. *Whale Rock Spindle, ("Spindle on the Whale,") entrance to the Mystic River.*—A stone beacon has been erected during the year.

21. *Crook's Spindle, Mystic River.*—An iron spindle with a quarter-keg on top. The spindle is bent over.

— *Pawtucket Point Spindle.*—Hitherto this spindle has been kept at private expense. A letter from the collector at Stonington, praying that it be maintained by the Board, has been received.

22. *Black Ledge Beacon, entrance to New London Harbor.*—An iron shaft bearing a cage-work day-mark, formed by two cones connected at the vertices.

The spindle and day-mark have disappeared, and a buoy marks the ledge at present. A new stone beacon will be constructed under an existing appropriation therefor.

23. *Groton Long Point Beacon, Fisher's Island Sound.*—An iron spindle with cage-work in the form of an inverted cone, painted red.

24. *Potter's or Seaflower Reef Beacon, one mile northwest of North Dump-ling light-house.*—Square granite beacon, without day-mark, erected during the past year.

25. *Saybrook Beacon, Connecticut River.*—A stone beacon, with globe, on Saybrook Bar.

26. *Hen and Chickens, Long Island Sound.*—An iron spindle bearing a square cage painted red.

27. *Branford Reef Beacon, Long Island Sound.*—A granite beacon, with iron shaft and black ball.

28. *Huncher Rock, or Black Rock Beacon, west side of entrance to Black Rock Harbor, Connecticut.*—An iron pile beacon, with cage on top.

29. *Southwest Ledge Spindle, entrance to New Haven Harbor, Connecticut.*—The new light-house on this ledge, to take the place of the one on Five-Mile Point, has been commenced. The site of the spindle, carried away by ice, is marked by a spar-buoy.

30. *Quix's Ledge Spindle, entrance to New Haven Harbor.*—An iron spindle, with a cask on top, on a rock dry at half tide.

31. *Stratford River Beacon, entrance to Stratford River.*—A granite beacon, with iron column and day-mark.

32. *Outer Beacon, Bridgeport Harbor, Connecticut.*—A frustum of a square wooden pyramid, with a cask on top of a spar.

33. *Inner Beacon, Bridgeport Harbor, Connecticut.*—A wooden structure, like the outer beacon.

34. *Southport Beacon.*—Granite beacon, with iron column and day-mark.

35. *Southport Breakwater Beacon.*—A granite structure, with iron column and day-mark.

36. *Norwalk Beacon, southwest of Norwalk Island, Connecticut.*—A granite structure, with iron shaft and day-mark.

37. *Great Reef of Norwalk Island, entrance to Norwalk Harbor.*—A wooden spindle, with cage day-mark.

38. *Sand Spit Beacon, Sag Harbor, Long Island, New York.*—A square stone beacon and wooden tower.

39. *Oyster Pond Point, Plum Gut, entrance to Gardiner's Bay.*—A granite beacon in course of erection, the foundation being up to low-water mark.

40. *Success Rock Spindle, Long Island Sound.*—An iron shaft with conical cage-work.

41. *Romer Shoal Beacon, New York Bay.*—A granite structure in the form of a frustum of a cone, bearing a wooden mast and square cage day-mark.

42. *Mill Reef Beacon, opposite New Brighton, in Kill Van Kull.*—A sheet-iron beacon, filled in with concrete, and secured to a granite base. It is conical in shape, and supports an iron shaft with an iron cage on top.

43. *Stepping Stones, Long Island Sound, New York.*—A day-beacon of granite is urgently recommended for this obstruction, very dangerous in its character. One of the large steamers navigating the sound ran upon it recently. It is marked by a can-buoy, but it is difficult to retain marks of this kind in position, owing to the tows and vessels passing so near. Attention has been called to this danger by masters of steamers and others. The estimate for the granite beacon is \$6,000.

BUOYS.

The buoyage of the district is in good condition. Nearly all the buoys in the bay of New York were carried off by the ice during the past winter, but were recovered.

Sixty buoys of all kinds were lost during the year, valued with their moorings at \$2,987.28.

The grading of the grounds and the general repairs of the buildings at the general depot at Staten Island have been continued. The grounds in front and rear of lamp-shop and near the north gate have been graded and partly laid in grass. The engine-room of the lamp-shop has been enlarged and a duplicate boiler placed there as a reserve, and a suitable 6-inch drain to conduct to the cesspool the water coming from the springs in the bank and overflowing the floor of the boiler-room. A 12-inch drain has been laid to conduct the water from the roof of the oil-vault, and a 12-inch drain from the cellar of the office building, all connecting with the main 18-inch drain of the yard.

The original drains, being only 6-inch diameter, became clogged and unserviceable.

Flagging has been laid from the gate at the south entrance along the front of the shop, office, and store-house nearly to the north gate, on the ends of each of the buildings, and thence to the oil-vaults.

Steam radiators have been introduced into the office building for the more perfect heating of the rooms of the building. The steam is furnished by the boiler of the lamp-shop.

The front of the north wharf has been extended so as to make an equal projection with the south wharf, to arrest injury to the basin from the flow of the ebb-tide into the basin.

It is proposed to apply a portion of the new appropriation of \$5,000 to the introduction of an elevator of approved kind into the lamp-shop building, to ensure a safer method of transferring the lens apparatus into the store-rooms.

Grading of the grounds will be continued, and flagging, so far as the funds will admit.

The appropriation will not be adequate for building the cisterns recommended in the last annual report. A further sum of \$5,000 will be needed for the purpose and for the general repairs and preservation of the buildings, dwelling, grounds, &c. In view of enlarging the basin, either to embrace the whole or a part of the water-front of the depot, as may be deemed advisable, there will be required for commencing the enlargement the sum of \$30,000.

The capacity for storage is at certain times found inadequate. The addition of a brick story to the oil-shed, and raising upon this story the present frame building, would, it is believed, relieve the storage-room. The brick story would furnish a better store-house for the oil received in barrels, and awaiting inspection and testing, than the frame building, which is too hot for such a purpose, causing leakage and loss of oil. The cost of such addition and change would be \$20,000.

The total amount therefore required for the general depot is \$55,000.

Lens apparatus received from France and shipped from light-house depot, Staten Island, from July 1, 1872, to June 30, 1873.

	First order.	Second order.	Third order.	Third-and-a-half order.	Fourth order.	Fifth order.	Sixth order.	Steamer lenses.	Pressed lenses.	Canal lenses.	Totals.
Received	2	2	3	2	13	14	11	3	1	5	56
Delivered	1	3	2	1	11	6	9	1	.....	5	39
Total	3	5	5	3	24	20	20	4	1	10	95

List of boxes, barrels, bundles, packages, cans, and kegs received at and shipped from light-house depot, Staten Island, from July 1, 1872, to June 30, 1873.

	Boxes.	Barrels.	Packages.	Total.
Received	2,929	3,886	5,627	12,442
Delivered	2,949	3,921	6,235	13,105
Total	5,878	7,807	11,862	25,547

List of cases containing illuminating apparatus received at and shipped from light-house depot, Staten Island, from July 1, 1872, to June 30, 1873.

	Lamps &c.	First order.	Second order.	Third order.	Third-and-a-half order.	Fourth order.	Fifth order.	Sixth order.	Steamer lenses.	Pressed lenses.	Canal lenses.	Total.
Received	22	50	85	43	24	53	42	14	8	6	14	361
Delivered .....	.....	47	80	23	11	33	14	27	10	2	15	262
Total	22	97	165	66	35	86	56	41	18	8	29	623

LIGHT-HOUSE BOARD.

621

List of articles manufactured and repaired in lamp-shop, at light-house depot, Staten Island, from July 1, 1872, to June 30, 1873.

	Lenses.	Lamps.	Lamp burners.	Miscellaneous articles.	Totals.
Manufactured	3	160	245	296	704
Repaired	6	47	49	1,670	1,772
Total	9	207	294	1,966	2,476

GENERAL DEPOT OF THE LIGHT-HOUSE ESTABLISHMENT AT STATEN ISLAND, NEW YORK.

Buoys and appendages received at and shipped from light-house depot, Staten Island, from July 1, 1872, to July 31, 1873, inclusive.

	Can-buoys.			Nun-buoys.			Spar-buoys.	Sinkers.				Ballast-balls.		
	First class.	Second class.	Third class.	First class.	Second class.	Third class.		First class.	Second class.	Third class.	Stone.	First class.	Second class.	Third class.
Received	8	8	1	20	5	9	2	.....	.....	.....	171	.....	.....	.....
Shipped	8	16	1	5	9	16	2	.....	.....	.....	158	10	16	10
Total	16	16	1	25	9	16	2	.....	.....	.....	329	10	16	10

[8.]

FOURTH DISTRICT.

The fourth light-house district extends from Squam Inlet, New Jersey, to and including Metomkin Inlet, Virginia. It includes the sea-coast of New Jersey below the Highlands of Navesink, the bay-coasts of New Jersey and Delaware, the sea-coasts of Delaware and Maryland, and part of the sea-coast of Virginia.

Inspector.—Com. W. H. Macomb, United States Navy, until his death, August 12, 1872; Capt. Reigart B. Lowry, United States Navy, from August 29, 1872, to June 30, 1873; Capt. Thomas G. Corbin, United States Navy, present inspector.

Engineer.—Col. I. C. Woodruff, Corps of Engineers, Brevet Brigadier-General, United States Army, until May 16, 1873; Lieut. Col. W. F. Reynolds, Corps of Engineers, Brevet Brigadier-General, United States Army, present engineer.

In this district there are :

Light-houses and lighted beacons	19
Light-houses finished and lighted during the year ending July 1, 1873	1
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873	5
Light-ships, (in position)	2
Light-ships, (for relief)	1

Fog-signals operated by steam or hot-air engines	0
Day or unlighted beacons	0
Buoys actually in position	110
Spare buoys for relief and to supply losses	116
Tenders (steam) for inspection, (Violet)	1
Tenders (steam) for construction and repairs, (Rose)	1

The number preceding the names of stations correspond with those of the light-house list of the Atlantic, Gulf, and Pacific coasts of the United States, issued January 1, 1873.

LIGHT-HOUSES AND LIGHTED BEACONS.

223. *Barnegat, sea-coast of New Jersey.*—The semi-monthly measurements along the beach near the light-house have been continued, and no important changes of the water-lines are apparent, the works for protecting the beach having effected the object of their construction. The changes of the position of the sand-hill north of the dwelling are very marked. It has drifted toward the dwelling; and has already reached the store-house.

225. *Absecum, sea-coast of New Jersey.*—The semi-monthly measurements of the beach have been continued throughout the year. There have been but few changes in the water-lines since last report, the dangerous action having for the present, at least, ceased. The sand along the beach above high water has accumulated, and beach-grass is appearing on it.

The north channel into the inlet has become deeper, and is used almost exclusively. The south channel has filled up to about 5½ feet over the bar at low water, while the north channel has about 8 feet at the same stage.

The authorities of Atlantic City have not yet furnished the deed from the owners of the property for the occupation of the land where it was proposed to construct jetties for the protection of the light-house site, and the appropriation therefor has reverted to the Treasury.

226. *Hereford Inlet, sea-coast of New Jersey.*—The site has been selected and bids have been received for the construction of the light-house. The cession of jurisdiction by the legislature of New Jersey to the Government of the United States has been granted.

232. *Mispillion, Delaware Bay.*—The structure authorized by the act of Congress re-establishing the light has been erected, and the light exhibited. It is in Delaware Bay near the mouth of Mispillion River, and was completed and lighted for the first time on the 15th of June, 1873. The light is a fixed white light of the sixth order of the system of Fresnel, and is shown from a wooden frame tower, connected with the dwelling of the keeper, both colored gray, with the exception of the lantern on the tower, which is black. The focal flame is 48 feet above the water.

233. *Brandywine Shoal Light-Station, Delaware Bay.*—This structure having stood for twenty-five years, and being one of the earliest examples of iron-pile light-houses, and subject since its construction to annual assaults by great fields of ice in the breaking up of the ice of the river and bay, it is an interesting as well as important point to know the effect of time and salt water upon it. This question being one which interested the Engineer Department of the Army, which is using iron quite extensively in the improvements in the Delaware, Lieutenant-Colonel Kurtz, in charge of these improvements, proposed to the light-house engineer of the district to unite their facilities and have an ex-

amination made for the mutual benefit of the two departments. Capt. M. R. Brown, Corps of Engineers, is stationed at Lewes, Delaware, under Colonel Kurtz's orders, and had in his service a diver and the other facilities required for making the proposed examination, but was without the means of reaching the locality; accordingly the tender *Rose* was ordered to report to Captain Brown for this duty.

The light-house was visited on the 30th and 31st of July, and seven of the house-piles and three of those of the ice-fender or breaker were examined. The results of this examination, as given by Captain Brown, are to be found in a table which accompanied the report of the engineer of the district. It seems evident, from the table, that the action on the iron has been quite irregular, some of the piles not having worn perceptibly, while others have diminished in diameter quite half an inch.

The following extracts from the report of Captain Brown will be of interest:

The platform of the light-house, we found, was more than 20 feet from the surface of the water, and it was at once apparent that we were obliged to work from a temporary platform, which we must build on horizontal braces about six feet from the surface of the water at mean stage of tide. Some heavy planks were found at the light-house, which were lowered and put in place as platforms, to serve as a base to hold the air-pump, &c., and to admit of some little convenience in working.

Not having much previous knowledge of the light-house I had somewhat underrated the scope and difficulty of the work involved in a thorough examination of the structure. The whole number of piles in the substructure is 77, and nearly all are covered with considerable metamorphosed iron, difficult in most cases to scrape off, and many with coral and other adhering substances, which add to the difficulty. The current here is quite strong, and around the piles is broken into numerous eddies. The water is about 9 feet deep at low water.

The horizontal braces at about the plane of low water have, in many localities, dropped to the bottom; the cast-iron collars which held them having broken, apparently by the weight of the superincumbent ice. In this way the lower system of braces is almost completely gone on the north side to an east and west line, just south of the north pile of the main structure, (1848.) They are also gone in the center of the south half of the octagon. Occasional braces, about one-third the original number, are out of place in the south end of the fender or ice-breaker, and, in fact, so few remain throughout the whole structure in this lower system that it is practically nearly useless, since the remainder are bent downward at various angles, as though by a weight, and they appear ready to follow soon the fate of the others.

These latter being supported just above the bottom by remnants of collars, rendered it difficult for a diver to walk about in a strong current; and since considerable time was required to move our temporary platform from one locality to another, it was apparent that we must measure piles so near to each other (in groups) as to necessitate few changes of the platform, in order to obtain results of any value in an inspection so limited in time as this was, for various evident reasons.

I judge that a thorough examination of the entire structure would consume two or three weeks of fair weather, and would probably yield results of considerable value and of great interest.

All of the piles are more or less perceptibly wanting in verticality, but very few of them seriously so. The two most remarkably inclined abnormally are marked X and Y on the diagram accompanying this report. They are so bent as to be inclined about 15° and 10° , respectively, to the vertical above water.

No great departure from a horizontal plane is noticeable in the platform of the light-house, but it appears to me that the southeast portion over one of the piles (X in the diagram) is slightly inclined downward to the southeast.

The light-house itself exhibits nothing abnormal. Many of the diagonal braces in vertical planes far above the surface of the water are so peculiarly corroded as to resemble, in a striking degree, the exterior bark of a red-oak tree, with deep seams and scales.

The notes on the diagram and tables seem to indicate all else not included in this report which your instructions and my limited opportunities appear to call for.

It is proper to say that the departure from verticality in the piles and the destruction of the lower system of braces referred to by Captain Brown took place soon after the structure was built. In 1855 it was

decided not to depend on the lower braces. Before that date there was no platform over the "fender" then consisting of 30 piles; in 1857 or 1858 the outer row of 38 piles was put down, thus more than doubling the strength. Then also the wooden superstructure and platform were put in, thus giving additional strength; since then the strength of the structure has been sufficient, and the only points to be guarded against are the decay of the wooden portions and the destruction by time of the iron.

236. *Cross Ledge Shoal, Delaware Bay.*—An appropriation of \$50,000 for commencing a light-house to replace the light-ship was made at the last session of Congress. The survey of the site is now in progress.

237. *Makon's River Light-Station.*—In October last repairs were made to the plank platform around the building. Sketches have been forwarded showing the abrasion of the marsh at this site. For several years the board has recommended the removal of the light-house to a more favorable site, and as the time cannot be distant when this must be done, it is not deemed necessary to make further repairs. The amount required for the new light-house, as given in previous reports, is \$15,000, and the time required for its erection would be about six months.

— *Ship John Shoal, Delaware Bay.*—An appropriation of \$50,000 for commencing a light-house at this shoal was made at the last session of Congress. A survey of the site is now in progress.

— *Bulkhead Shoal, Delaware River.*—An appropriation of \$50,000 was made at the last session of Congress for commencing a light-house at this shoal. A survey of the site is now in progress.

— *Pea-Pach Island, Delaware River.*—An appropriation of \$8,000 for the erection of a light-house on or near the south end of the island was made at the last session of Congress. A survey of the site is now in progress.

REPAIRS.

At each of the following-named stations in the fourth district there have been repairs and renovations more or less extensive since the last annual report.

223. *Barnegat*, sea-coast of New Jersey.

228. *Cape May*, sea-coast of New Jersey.

220. *Cape Henlopen*, sea-coast of Delaware.

230. *Cape Henlopen Beacon*, entrance to Delaware Bay.

231. *Delaware Breakwater*, entrance to Delaware Bay.

234. *Maurice River*, New Jersey, mouth of Maurice River, New Jersey.

235. *Egg Island*, New Jersey, Delaware Bay.

238. *Cohansey*, New Jersey, Delaware Bay.

239. *Bombay Hook*, Delaware, Delaware Bay.

240. *Reedy Island*, Delaware, Delaware Bay.

241. *Christiana*, Delaware, mouth of Christiana River, Delaware Bay.

242. *Fort Mifflin*, Pennsylvania, Delaware River.

243. *Fenwick's Island*, sea-coast of Delaware.

The following are the names of light-stations in the fourth district not mentioned elsewhere in this report:

224. *Tucker's Beach*, sea-coast of New Jersey.

244. *Assateague*, sea-coast of Virginia.

LIGHT-SHIPS.

227. "*Five Fathom Bank*," on *Five Fathom Bank off the Capes of the Delaware*.—This ship is in good condition, but needs some minor repairs, which will be made at an early day.

236. "*Cross Ledge*," on *Cross Ledge Shoal in Delaware Bay*.—This vessel, needing extensive repairs was removed from her station and "Relief No. 18" was substituted in October last. The latter was forced from her station by ice drifts, December 24, 1872, and could not be replaced till February 12. She was again driven away on the 26th of February, and was replaced on the 11th of March.

Relief No. 18 is in good condition, and is now, temporarily, on *Cross Ledge Shoal, Delaware Bay*.

Winter Quarter Shoal.—Nearly half way from the capes of the Delaware to the capes of Virginia, six and a half miles from the nearest land, and directly in the track of our immense coast-trade, lies the danger known as *Winter Quarter Shoal*, which has caused many wrecks, and is a source of anxiety to the masters of all vessels passing that way. It is recommended that this shoal be marked by a light-ship, and an appropriation of \$50,000 is asked for that purpose.

BUOYS.

The buoyage of the fourth district is in good order.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

There are no day or unlighted beacons in this district.

DEPOT.

Christiana, Delaware.—A bulk-head has been constructed along the bank of the depot between the two wharves, and a portion of the space between the wharves has been excavated to serve as a winter harbor for the steam-tender and the relief light-vessels.

[9.]

FIFTH DISTRICT.

The fifth district extends from *Metomkin Inlet, Virginia*, to include *New River Inlet, North Carolina*, and embraces part of the sea-coasts of *Virginia and North Carolina, Chesapeake Bay, and the James and Potomac Rivers*.

Inspector.—Commodore Fabius Stanly, United States Navy.

Engineer.—Maj. Peter C. Hains, Corps of Engineers, Bvt. Lieut. Col., United States Army.

In this district there are—

Light-houses and lighted beacons.....	70
Light-houses finished and lighted during the year ending July 1, 1873.....	3
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873.....	7

Light-ships	0
Fog-signals operated by steam or hot-air engines	0
Day or unlighted beacons	100
Buoys actually in position	634
Spare buoys for relief and to supply losses	376
Tenders (steam) Heliotrope (buoy-tender) and Tulip, (for engineer's construction and repairs)	2
Tenders (sail) Maggie (buoy-tender) and Spray, (engineer's tender for construction and repairs)	2

The numbers preceding the names of stations correspond with the light-house list of the Atlantic, Gulf, and Pacific coasts of the United States issued January 1, 1873.

247. *Cape Henry, on the south side of the main entrance to Chesapeake Bay, Virginia.*—The annual report of the Light-House Board contains the following statements in regard to the construction of a new tower and keeper's dwelling for this light-station:

The tower is a frustum of an octagonal pyramid, built on a raised foundation of loose stone, some thirty feet above the level of the sea. The masonry of the outside is a soft sandstone, with an inside brick cylinder, the latter having been built in 1857, at which time the station was last refitted. Of the eight faces of the tower, six of them show on the outside large cracks or openings, extending from the base upward. Four of them are apparently less dangerous than the other two, and alone would not warrant any great apprehensions of danger, but the latter, viz, those on the north and south faces, where the strength of the masonry is lessened by openings for windows, are very bad, extending from the base almost to the top of the tower. These cracks cannot be seen on the inside, on account of the brick cylinder, (which is of more recent construction than the outside masonry,) and doubtless terminate at the air-space, between the outer and inner walls. At present the tower is in an unsafe condition, and there is no way of repairing the damage satisfactorily, and a new one must be built. This old tower has done good service, having been built in 1791, and is now the oldest tower on the coast, south of Cape Henlopen; but it has seen its best days, and now, from age, and perhaps defective workmanship, it is in danger of being thrown down by some heavy gale.

The light is of the second order, and cannot be seen as far at sea as its importance, in respect to location, demands. It is undoubtedly one of the first lights, in point of importance, on the coast. A new tower should be built at this station without delay, and the light made of the first order. A good site can be had near the present location, on Government land, and materials for building purposes can be landed without difficulty. It also should be noted that the keeper's dwelling is in a dilapidated condition, and at too great a distance from the tower to insure proper attendance. It is a frame building, and is now more than thirty years old. It is too small for the number of keepers at this station, and should be enlarged. At present it affords very poor protection to the keepers from inclemency of the weather in winter. A new dwelling is an absolute necessity for this station.

The above recommendation is renewed, and an appropriation of \$50,000 is asked to commence the work.

248. *"The Thimble" Shoal, at the entrance to Hampton Roads, Virginia.*—The work on the structure, which at date of last annual report was in progress, was finished October 1, 1872, and the light exhibited for the first time on the night of October 15. At the same time the light-ship anchored near this shoal, but on the opposite side of the channel, was withdrawn. This light-house replaces the last light-ship in this district. The light is of the fourth order, and shows red flashes at intervals of 30 seconds. The station is provided with two fog-bells, one on the north, the other on the south side of the light-house, which are struck simultaneously by machinery at intervals of 5 seconds.

251. *Lambert's Point, on the shoal off Lambert's Point, Elizabeth River, Virginia.*—A few months after this light-house was completed, it settled about 14 inches on the west side, on account of an unequal distribution of supplies left at the station, and the soft character of the soil on which the screw-flanges rested. It was leveled, however, without difficulty and at little expense, by lowering those piles that had not settled, by means of the water-jet process. The light-house was then secured

in a level position by driving an extra pile at each corner of the structure, and relieving the main piles of a portion of the weight by means of struts connecting the two. The light-house is now firm.

253. *White Shoals, screw-pile light-house, James River, Virginia.*—This light-house had formerly a bell rung by hand for a fog-signal. During the past year it has been supplied with one of Stevens's fog-bell machines, which strikes the bell at intervals of ten seconds.

254. *Point of Shoals, James River, Virginia.*—This light-house had formerly a fog-bell rung by hand in foggy weather. It has been supplied with a machine which strikes the bell with two blows at intervals of 5 seconds, then after an interval of 20 seconds the two blows are repeated, and so on.

— *Dutch Gap Canal, James River, Virginia.*—Plans and specifications have been prepared for a keeper's dwelling and two small beacons under the appropriation made therefor by Congress, and the necessary land for site purchased at a merely nominal price, from the city of Richmond. The cession of jurisdiction in this case comes under a general law, passed by the State, at the meeting of the last legislature, consequently no delay will be experienced, as is usually the case, by the necessity of having a special act passed. The keeper's dwelling is to be a plain frame structure, located on the high ground midway between the two beacons. The latter will be frame structures, boarded up and arranged with a room in each for supplies. The lights will be of the sixth order, one at each end of the cut. It is proposed to advertise for bids for their construction at once.

— *Solomon's Lump, in Kedge's Strait, between Tangier Sound and Chesapeake Bay.*—The last annual report contained the following remarks and estimates relating to the necessity of establishing a light at this place, which are repeated:

In compliance with a resolution of the House of Representatives, an examination and report to Congress were made during last session, upon the necessity and expediency of establishing a light to mark the shoal known as Solomon's Lump, in Kedge's Strait, between Tangier Sound and Chesapeake Bay. Solomon's Lump is a point of land on the north end of Evan's Island. There is a shoal that extends out a considerable distance from this point in a northerly direction, and is a source of danger to vessels navigating Kedge's Strait at night. Near its extreme point is the regular channel. The shoal itself has not more than about 5 feet water on it, to a point near the red buoy, which marks its extreme northerly end. At night this buoy cannot be seen a sufficient distance to be of any use. The only light in this vicinity is that on Fog Point, about one and a fourth miles in a west south west direction; but on account of its distance and location, it affords no security to vessels from going ashore on the reef off Solomon's Lump. The light at Fog Point was established in 1827, before the introduction of the screw-pile system of light-houses, and though it has served to mark the entrance to Kedge's Strait for a long time, it is of little value as compared with other positions that could have been selected for a screw-pile structure, which would not only have marked the entrance to the strait, but would have been a guide all the way through. A light established on the shoal off Solomon's Lump, near its extreme point, and in 5 feet water, or on the shoal on the opposite side of the channel, would accomplish both these objects, and render navigation through Kedge's Strait safe at all times. As the sailing course in either direction would be a straight line, passing just north of the light-house at Solomon's Lump, in case a light was established there, that at Fog Point would be no longer of use and could be discontinued. It would therefore not increase the number of lights nor add anything to the annual cost of maintenance.

An appropriation of \$15,000 is asked for to establish a light-house off Solomon's Lump, to take the place of that at Fog Point.

270. *Point Lookout, north side of the entrance to Potomac River, Maryland.*—At the date of last annual report, the work of establishing a fog-signal at this station was commenced under the general appropriation for fog-signals. The signal is a bell of large size, struck by machinery

at intervals of ten seconds. It was finished and in operation November 2, 1872.

275. *Thomas Point Shoal, north side of the mouth of South River, Maryland.*—An appropriation of \$20,000 was made during the last session of Congress for a screw-pile light-house to be built on the shoal that makes off from Thomas Point, Md., to take the place of the old light-house on land, which is in need of extensive repairs, and which, on account of its distance from the track of vessels navigating the bay, is of comparatively little use at any time, and perfectly useless in foggy and thick weather, as the light cannot be seen, and the distance is too great for a fog-bell to be heard. The location on the extreme point of the shoal is one of great exposure. In view of this fact, and with the experience of Love Point light-house during the winter of 1872-'73 before us, it was deemed expedient to change the plan of this light-house, and instead of building it on screw-piles, as was at first intended, to build it on a more solid structure, that could be depended on at all times to safely withstand the heavy ice-floes that form above it in the bay. A cast-iron tube filled with concrete was therefore decided on, similar to the one now being built for the front light of the Craighill Channel range, at the mouth of the Patapsco River. Plans for the light-house have been prepared and a careful examination of the locality made by the district engineer, with a view to determine the proper method of sinking the tube in position. The light-house will stand in 8 feet water, on the extreme easterly point of the shoal, which position is close to the main channel of the bay. Borings were made at the site selected, and the shoal, below about 1 foot of soft mud and shell, was found to consist of hard blue sand and shell, with a slight trace of mud to a depth of 20 feet. It is believed that a secure foundation can be had at a depth of 12 feet or less. The bearing capacity of the material on which the structure will rest has not yet been tested, but will be before the exact depth of the foundation is definitely fixed. The tube will be of the form of a frustum of a cone to a height of 12 feet from the bottom; above this, it will be cylindrical, the diameter of the base being 30 feet, that of the cylinder 24 feet. The shell will be built up in sections, bolted together through stout flanges and sunk in position by filling it with concrete. It will be protected on the outside from the scour of the tide by a riprap of loose stone. The keeper's dwelling will rest on this solid structure. It is supposed that the tube may be sunk in position by merely excavating the material from the inside, though it is possible that one or both of the pneumatic processes may have to be resorted to. This light-house will cost considerably more than one on screw-piles, and an additional appropriation of \$25,000 is therefore required.

278. *Love Point Shoal, mouth of Chester River, Maryland.*—This light-house during the winter of 1872-'73 sustained considerable injury from fields of heavy, floating ice. Two of the ice-breaker piles were carried away, and two of the main columns of the light-house broken, so that it became necessary for a time to discontinue the light. Under an appropriation of \$10,000 made at the last session of Congress, the light-house has been repaired and the structure-protected by a riprap of loose stone placed around the light-house, forming an artificial island. The amount appropriated was not sufficient to carry the riprap as high as it should be. The location is one of the most exposed in the district, and it is therefore recommended that an additional appropriation of \$5,000 be made to complete it.

279. *Craighill's Channel, range-beacons, upper or rear light, mouth of Pa-*

Patapsco River, Maryland.—Owing to the lateness of spring and the severity of the winter of 1872-'73, considerable delay was experienced in locating this range line, as it had to be done with the utmost care on account of the length and the narrowness of the channel it is intended to mark. This made it possible for the work to be done only in very calm weather, in consequence of which work on the foundation of the structure did not commence until the month of April. Further delays were occasioned by unforeseen difficulties arising from the character of the ground on which the light-house rests. A careful examination showed that the soil on top was firm, hard sand, to a depth of two feet. Below this was a thin layer of sand and mud, mixed with stones, then soft mud to a depth of fifteen feet. A pile and grillage foundation became necessary to support the piers on which the columns of the frame-work rest, to build which it was necessary to construct a coffer-dam inclosing the entire work. The light-house stands in two feet of water, mean low tide. The coffer-dam, which was commenced the middle of April, was 60 feet by 60 feet, and consisted of two rows of sheet-piling about 18 inches apart, filled in with clay puddling and sustained in place by string-pieces nailed to piles driven at distances apart of 15 feet. The sheet-piling was put down with rapidity and satisfactorily by the water-jet process. The dam was then pumped out, and the foundation piles (after some delay owing to the breaking of the dam on two occasions during heavy gales) were driven and cut off. The grillage was finished in June, and work on the piers commenced. There are nine piers, built of Port Deposit granite. It was necessary to make them strong, as the ice is piled up very heavily here sometimes during the winter. The piers were finished in August.

The light-house will be an open frame-work of the form of a frustum of a pyramid of four sides, the corner columns being of cast iron resting on cast-iron disks, which are anchored to the masonry of the piers. The focal plane is to be 105 feet above ordinary tide. The keeper's dwelling will stand within the base of the pyramid, through which an inclosed stairway will pass, leading to the lantern. The cost of this structure was necessarily increased by the difficulties encountered in getting a secure foundation, and the appropriation that was made for the two range-lights (front and rear) will not be sufficient to complete them. It is necessary, however, to place both of them in a condition to resist the ice-floes of winter. The interests of commerce require that the range-lights of which this is one should be established without unnecessary delay, as the channel they will mark is the one now used by the largest class of vessels coming into the port of Baltimore.

In order, therefore, that commerce may not suffer from the want of these lights, it is designed to establish a temporary light on the unfinished structure until another appropriation can be made to complete the work, to do which will require for this light-house an appropriation of \$10,000, which is earnestly recommended.

280. *Craighill's Channel, range-beacon, lower or front light, mouth of Patapsco River, Maryland.*—When the original appropriation for Craighill Channel range-lights was made, it was designed to build the front beacon on screw-piles. During the winter of 1872-'73, however, the ice formed so heavily in the Chesapeake Bay, in the vicinity of the proposed site of this light-house, that it was deemed advisable to change the plan and build a more solid structure that could, beyond all doubt, safely withstand the heavy ice-floes by which it will be assailed. It was therefore, decided to place the keepers' dwelling, surmounted by a lantern, on a tubular foundation of cast iron filled with concrete; the cast-

iron tube, between high and low water and for at least two feet above and below the space included between those limits, to be 2 inches thick, the other portions to be $1\frac{1}{2}$ inches thick. The tube consists of two parts, the lower portion, for a height of 12 feet, being in the form of a frustum of a cone 30 feet in diameter at the base, 24 feet at the top; the upper portion to be a cylinder of the same diameter as the top of the frustum of the cone to which it is joined. The tubing will be cast in sections, each section being divided into twenty-four parts, joined together through flanges by wrought-iron bolts. The lower section of the tubing will be bolted to a grillage or flooring consisting of four layers of timber each 12 inches thick, forming a caisson, which will be sunk in position below the bottom of the bay, by filling it with concrete. Borings with an artesian-well apparatus were made after the site had been selected, (which was fixed upon in 17 feet water mean tide,) to determine the character of the soil on which the light-house is to rest. It was found that for a depth of 22 feet the soil is the softest kind of mud, so soft, in fact, that an ordinary pile, stood on end, would penetrate 20 feet under the action of its own weight. Below this alternate thin layers of sand, mixtures of sand, mud, and shell were found to a depth of 20 feet more, with no signs of a solid foundation within 60 feet of the water's surface. It was therefore determined to drive a cluster of piles, cut them off at a level of 27 feet below the surface of the water and lower the caisson on to them by filling it with concrete; and, in order to protect the light-house from lateral vibration and the scour of the tides, to build a rip-rap wall of loose stone around it. After duly advertising for bids, contracts were accordingly made for driving and cutting off the piles of the foundation; building a pier from which the work of sinking it could be carried on; for the fabrication of the metal work forming the caisson and for sinking it in position. A circular space was first dredged out to a depth of 10 feet, in June, and the work of driving the piles for the foundation and temporary pier commenced in July. The iron work was also completed and delivered in that month. Owing, however, to rough weather, the work has been somewhat delayed. It is expected that the caisson will be in position by the middle of October. It is desirable that this light, taken in connection with the other one, just referred to and which forms the range for Craighill's Channel, should be established as soon as possible. It was therefore determined to place a temporary light on the caisson in its unfinished state, the appropriation not being sufficient to complete it.

The change in the character of this structure from what was first intended will add considerably to its cost, and an additional appropriation of \$25,000 is therefore asked for.

As soon as the lights of the Craighill Channel range are established, the two lights at North Point will be discontinued.

— *Shipping Point, Potomac River, Virginia.*—An appropriation of \$9,000 was made by act approved June 10, 1872, for a light-house to mark the entrance to the anchorage in Quantico Creek, Virginia, drawings and specifications for which have been prepared. A general act was also passed by the State of Virginia, ceding jurisdiction over sites purchased or to be purchased by the United States for light-house purposes. The act approved March 3, 1873, authorized the Light-House Board to place the light-house provided for by the previous act anywhere in the near vicinity of Shipping Point that might be deemed proper. An examination of the river was accordingly made by the engineer and inspector of the district, both of whom agree that a light at Shipping Point would be of little, if any, use to navigation. Neither is

there any place in the near vicinity of Shipping Point at which a light-house would be of use. The place most in need of a light-house in the Potomac River is at or near Matthias Point. It is suggested that the appropriation for Shipping Point be allowed to revert to the Treasury, and, in lieu thereof, that an appropriation of \$20,000 be made for a light at the latter place. The wording of the act leaving it discretionary with the Light-house Board to locate the light-house at such place in the near vicinity of Shipping Point as they deem proper, conveys some latitude in regard to the location of the light-house, but it was not supposed that the act contemplated the possibility of its location 24 miles distant, which is the distance of Shipping Point from Matthias Point.

— *Port Tobacco Flats, in the bend of Potomac River opposite Matthias Point.*—This is one of the most difficult places for experienced navigators, who are familiar with the river, to pass at night. Few places occur where experienced pilots cannot tell where they are by soundings; at this place, however, soundings run from 100 feet to 5 feet within a space of a hundred yards. The current, which is strong, sets directly on the flats; both at the flood and ebb tides, which renders it bad enough for sailing-vessels even by daylight, but at night the difficulty is much aggravated by the want of some guide to point out the dangerous spot. It is uncommon sight to see a vessel aground on these flats. The United States naval steamer Frolic went ashore here during the summer of 1873, and remained for some time. It is recommended that an appropriation of \$40,000 be made for a light-house at this place, with the proviso that the appropriation for a light-house at Shipping Point revert to the Treasury.

— *Currituck Beach, midway between Cape Henry and Body's Island, sea-coast of North Carolina.*—An appropriation was made at the last session of Congress for a light-house at or near Poyner's Hill, midway between Body's Island and Cape Henry. This point was found to be near Whale's Head Hill, about two miles north of Poyner's Hill. Soon after the appropriation was made, a suitable site was selected and steps were at once taken to secure the necessary land. This has been accomplished, and work at the site can be commenced as soon as the necessary cession of jurisdiction is made by the State. The light-house will be a first-order sea-coast tower, to be built of brick, similar to the structure at Body's Island. The focal plane will be 150 feet above the level of the sea, and can be seen at a distance of eighteen nautical miles. Owing to the shallowness of the water in Currituck Sound, through which vessels carrying material will have to pass to land the same, the freighting of the material entering into the construction of the tower will be expensive, as it will be necessary to unload vessels some six or eight miles from the landing. It is proposed to do this with flat-boats that will not draw more than three feet water, loaded. This light has long been needed by the commerce of the country, and its necessity was recognized some time ago by Congress making an appropriation, which reverted to the Treasury. Its establishment will complete the system of sea-coast lights on the coast of North Carolina. An appropriation of \$60,000 is asked for this work.

300. *Body's Island, sea-coast of North Carolina.*—At the date of last annual report this light-house was nearly completed. The light was first exhibited October 1, 1872, shortly after which a flock of wild geese flew against the lantern, breaking three panes of glass and considerably damaging the lens apparatus. It was found necessary to protect the lantern by a wire-screen which would break the force of the blow when

wild fowl fly against it. This was done, and no further trouble from this source has been experienced.

301. *Cape Hatteras, sea-coast of North Carolina.*—The tower at this light-station has been painted in spiral bands alternately black and white, there being four bands, two black and two white, each one making one and a half revolutions about the tower, the object being to render it more distinct at a distance, and consequently a better day-mark on this low, sandy coast. Some slight repairs were made at the station at the same time.

— *Hatteras Inlet, Pamlico Sound, North Carolina.*—The want of a light at this entrance to the sounds of North Carolina has long been felt. It is the best inlet leading to and from those sounds, through which there is a large trade. Vessels bound to sea through this inlet have no guide to indicate to them at night their proximity to the entrance. With steamers it is not of so much importance, as they can regulate their time to arrive off the inlet at daylight, but the sailing-vessels must take advantage of the wind. At night they dare not approach the inlet, as a dangerous shoal, called Oliver's Reef, makes out into the sound, the position of which cannot be accurately determined, except by having it marked by a light-house. It is designed to place the light-house provided for by act approved March 3, 1873, on Oliver's Reef, north side of the entrance to Hatteras Inlet. An examination by the engineer of the district has been made, and the work will be commenced without unnecessary delay. The light-house will be on screw-piles, and show a fixed red light.

311. *Roanoke Marshes, on the east side of the narrow channel connecting Pamlico and Croatan Sounds, North Carolina.*—The following remarks touching this light-house were made in the last annual report in regard to rebuilding the structure:

It was built in 1860, on what was at that time a marsh, which was dry, or nearly so, at low water. The foundation consists of seven wood piles covered with cast iron; the latter, when the structure was first built, being screwed into the ground several feet. Since then the marsh has been washed away, so that there are now 10 feet water at the light-house. The piles being of wood, as soon as they were exposed by the washing away of the shoal below the depth covered by the cast-iron sleeve, were attacked by worms. In order to save the light-house from falling, three coppered piles were driven at each angle of the structure, capped by heavy squared timbers. A short time ago a raft drifted against the light-house, and carried away three of the copper piles above referred to. The house has settled some inches on the west side, and though the damage sustained by the striking of the raft has been repaired, it is not considered in a safe condition, nor can it be made so, except at great expense, for which an appropriation would be necessary. It will be cheaper in the end to build a new structure, and an appropriation for this purpose is recommended. The estimated cost of a light-house near the present site, but in about 6 feet water, is \$15,000.

313. *North River, on a shoal at the mouth of North River, North Carolina.*—This station was supplied with a fog-bell and machine to strike it at intervals of 5 seconds.

316. *Cape Lookout, sea-coast of North Carolina.*—Under the appropriation made therefor, a new keeper's dwelling, which was much needed, was finished in April, 1873. At the same time repairs were made to the tower. The latter was then colored in diagonal checkers, to render it more distinct at a distance, and, consequently, more useful as a day-mark, for the same reason as at Cape Hatteras.

REPAIRS.

At each of the following-named light-stations in the fifth district there have been repairs and renovations, more or less extensive, made during the year.

247. *Cape Henry*, on the south side of the main entrance to Chesapeake Bay, Virginia.

249. *Old Point Comfort*, on the north side of the entrance to Hampton Roads, Virginia.

265. *Jane's Island*, entrance to Little Annapessex River, Tangier Sound, Maryland.

266. *Somers' Cove*, entrance to Little Annapessex River, Tangier Sound, Maryland.

271. *Hooper's Straits*, on the shoal abreast of entrance to Honga River, Maryland.

272. *Cove Point*, four miles to the north of the entrance to Patuxent River, Maryland.

274. *Choptank River*, entrance to Choptank and Treadhaven Rivers, Maryland.

284. *Fort Carroll*, on Fort Carroll, in Patapsco River, Maryland.

293. *Piney Point*, on the east side of Potomac River, Maryland.

295. *Lower Cedar Point*, on the end of Yates's Shoal, west side of Potomac River, Virginia.

296. *Upper Cedar Point*, on end of shoal off Upper Cedar Point, Maryland.

299. *Bowler's Rock*, on the shoal of that name, Rappahannock River, Virginia.

309. *Pamlico Point*, on south side of entrance to Pamlico River, North Carolina.

The following are the names of the light-stations in the fifth district not mentioned elsewhere:

245. *Hog Island*, on west point of Hog Island, Great Matchepungo Inlet, Virginia.

246. *Cape Charles*, on Smith's Island, north side of entrance to Chesapeake Bay, Virginia.

250. *Craney Island*, on the west side of channel, near the mouth of Elizabeth River, Virginia.

252. *Naval Hospital*, on the wharf at the naval hospital, Elizabeth River, Virginia.

255. *Deep Water Shoals*, on the shoal above Mulberry Island, on James River, Virginia.

256. *Jordan's Point*, on Jordan's Point, James River, Virginia.

257. *Cherrystone*, on the shoal west side of entrance to Cherrystone Inlet, Virginia.

258. *Back River*, south side of entrance to Back River, Chesapeake Bay, Virginia.

259. *York Spit*, on easterly end of York Spit, entrance to York River from Chesapeake Bay, Virginia.

260. *New Point Comfort*, north side of entrance to Mobjack Bay, west side of Chesapeake Bay, Virginia.

261. *Wolf Trap*, on the east end of Wolf Trap Shoal, Chesapeake Bay, Virginia.

262. *Stingray Point*, south side of mouth of Rappahannock River, Virginia.

263. *Windmill Point*, on Windmill Point Shoals, north side of mouth of Rappahannock River, Virginia.

267. *Smith's Point*, on the shoal on southeast side of Potomac River, west side of Chesapeake Bay, Virginia.

268. *Fog Point*, on Smith's Island, opposite the mouth of Potomac River, Maryland.

269. *Clay Island*, northern extremity of Tangier Sound, at the mouth of Nanticoke River, Maryland.

273. *Sharp's Island*, entrance to Choptank River, Maryland.

276. *Greenbury Point*, on the north side of the entrance to Severn River, Maryland.

281. *Seven-Foot Knoll*, on a lump of that name at the mouth of Patapsco River, Maryland.

285. *Hawkins' Point*, on shoal near Hawkins' Point, Patapsco River, Maryland.

287. *Leading Point*, on Leading Point, south side of Patapsco River, Maryland.

288. *Lazaretto Point*, north side of Baltimore Harbor, Maryland.

289. *Pool's Island*, on Pool's Island, near the mouth of Gunpowder River, Chasapeake Bay, Maryland.

290. *Turkey Point*, on a point separating the mouths of Elk and Susquehanna Rivers, at head of Chesapeake Bay.

291. *Fishing Battery*, on Fishing or Donoho's Battery, entrance to Susquehanna River, Maryland.

292. *Havre de Grace*, on Concord Point, near Havre de Grace, Maryland.

294. *Blackstone's Island*, near the entrance to Clement's Bay, Potomac River, Maryland.

297. *Fort Washington*, on the wharf at Fort Washington, Maryland.

298. *Jones' Point*, on west side of Potomac River, near Alexandria.

302. *Cape Hatteras Beacon*, near the southern extremity of Cape Hatteras Point, North Carolina.

303. *Ocracoke*, near the entrance to and on the north side of Ocracoke Inlet, North Carolina.

304. *Southwest Point Royal Shoal*, on the southwest point of Royal Shoal, near Ocracoke Inlet, North Carolina.

305. *Northwest Point Royal Shoal*, on the northwest point of Royal Shoal, in Pamlico Sound, North Carolina.

306. *Harbor Island*, on Harbor Island Bar, between Pamlico and Cove Sounds, North Carolina.

307. *Brant Island Shoal*, in southern part of Pamlico Sound, North Carolina.

308. *Neuse River*, on a shoal in east end of Piney Point, Neuse River, North Carolina.

310. *Long Shoal*, on the east point of Long Shoal, North Carolina.

312. *Croatan*, between Croatan and Albemarle Sounds, North Carolina.

314. *Wade's Point*, on the shoal, west side of Pasquotank River, North Carolina.

315. *Roanoke River*, near the mouth of Roanoke River, North Carolina.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the fifth district:

Smith's Point, south side of the mouth of Potomac River; old tower, colored white.

Bodkin's Point, south side of the mouth of Patapsco River; old tower, colored white.

Day's Point, half a mile from Day's Point, James River, Virginia; an iron shaft with cage on top.

Woodstock, entrance to Bell's Bay, &c., North Carolina; spar with barrel.

Hunting Quarter, Cove Sound, North Carolina, in mid-channel; spar with barrel.

Wilson's Bay, in Cove Sound, North Carolina, mid-channel; spar with barrel.

Piney Point, Cove Sound, North Carolina, mid-channel; two spars with barrels.

Yellow Shoal, Cove Sound, North Carolina, mid-channel; spar with barrel.

Bushes' Bluff Shoal, north side of entrance to the Elizabeth River, Virginia; an iron pile with cage on top.

There are, beside the above-named beacons, forty stake-beacons planted to mark channels in Cove Sound and other places.

There is an appropriation for three day-beacons in the Potomac River. It is designed to make them of iron. Drawings are now being prepared, and their construction will be taken in hand at an early day.

DEPOTS.

Lazaretto Point, Patapsco River, Maryland.—A number of spar-buoys and two iron beacons were made here during the year. Other buoys were repaired and painted, and a number of new sinkers made.

The wharf at this depot is in need of considerable repairs, which should be done without unnecessary delay. It is too small for the purpose, and should be extended so that a supply of coal could be kept there. The depot is much in need of a blacksmith's shop, which should be separate from the store-house, and in which small forging could be executed.

The estimate cost of repairs to the wharf and building a blacksmith's shop is \$4,000, for which an appropriation is asked.

It should be further added in regard to the fifth district that there is a very large number of buoys to be cared for, and in the northern parts of the district there is always much complaint when they are shifted by the ice, in consequence of the delay, which cannot be prevented so long as the Light-House Establishment has but one steam-tender for the purpose. It is therefore earnestly recommended that an appropriation of \$50,000 be made at the next session of Congress for a new steam-tender for buoy service in this district.

[10.]

SIXTH DISTRICT.

The sixth district extends from New River Inlet, North Carolina, to and including Cape Canaveral light-house, Florida, and embraces part of the coast of North Carolina, the coasts of South Carolina and Georgia, and part of the coast of Florida.

Inspector, Commander Charles S. Norton, United States Navy.

Engineer, Maj. Peter C. Hains, United States Engineers, brevet lieutenant colonel United States Army.

In this district there are—

Light-houses and lighted beacons.....	33
Light-houses finished and lighted during the year ending July 1, 1873.....	4
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873.....	6
Light-ships, (in position).....	4
Light-ships, (for relief).....	1
Fog-signals operated by steam or hot-air engines.....	None
Day or unlighted beacons.....	44
Buoys actually in position.....	235
Spare buoys, (for relief and to supply losses).....	39
Tender (steam) Atlantic, (buoy-tender).....	1
Tender (sail) Mignonette, (used in engineer's constructions and repairs).....	1

The numbers preceding the names of the stations correspond with those given in the "List of light-houses, lighted beacons, and floating lights of the Atlantic, Gulf, and Pacific coasts of the United States, published January 1, 1873."

— *Orton's Point, west bank of Cape Fear River, North Carolina.*— There was a light formerly at this place, which was discontinued during the war, and has not been re-established. An inspection of the chart will almost of itself show its value.

For some distance above and below this point the river is quite wide, the banks are low, and shoals extend from the eastern shore about three-quarters of the distance across the river. There is good water close up to the west bank, and vessels going either up or down stream would have little difficulty in navigating at night if there was a light here to guide them.

The engineer of the district made a personal examination of this abandoned station in March. The light was formerly exhibited from a lantern on a keeper's dwelling, which had been built close up to the water's edge. The house is now in ruins. The walls and a portion of the flooring remain; but as the house was built on wooden piles, some of them have decayed, others have been eaten by the worms, and they no longer form a reliable support. It would cost more to repair the old house than to build a new one. It is, therefore, recommended that an appropriation be made to re-establish this light by building a new light-house on cast-iron piles close to the site of the old one.

The material in the latter can be used as a rip-rap protection to the shore, which has washed away somewhat under the abrasive action of the water. The light should be of the fifth order, illuminating an arc of 220°. The estimated cost of such a structure at or near this point is \$15,000, for which an appropriation is asked.

— *Campbell's Island, Cape Fear River, North Carolina.*—The re-establishment of this light, which was extinguished during the war, would render the navigation of this river at night comparatively safe. It is one of the most difficult places to pass at night that can be found on the river below Wilmington. The channel is narrow, the river wide; the shoals from the east and west banks approaching close to each other at the point where the course is changed. The establishment of a screw-pile light-house at this point is practically the re-establishment of the light at Campbell's Island, and it is deemed of more importance at the present time than any other light on the Cape Fear River. Nothing remains of the old light-house. An appropriation of \$15,000 is therefore asked for a light-house at or near Campbell's Island.

319. *Oak Island Beacons, at the main entrance to Cape Fear River, North Carolina.*—The recommendation of last year in regard to an

appropriation of \$4,000 for the establishment of these beacons in order to secure a better range is renewed. It is as follows:

These beacons mark the range over the bar at the Oak Island entrance to Cape Fear River. They are, however, badly located, being so near each other that considerable deviation from the true course is necessary to make them appear to separate. The front beacon is an open-frame frustum of a square pyramid, resting on a rail tramway, which allows of its being moved to the right or left, to suit the changes in the channel. The rear light is placed on a wooden tower immediately over the center of the keeper's dwelling. The shore-line at this place, as at many others on the southern coast, is not permanent, being washed away by the abrasive action of the sea. The latter has gradually encroached upon the land till at present the high-water mark is only a few feet from the front beacon, which renders it in imminent danger of being destroyed in any southeasterly gale. The two beacons being already so close together as to have their usefulness seriously impaired, the front beacon cannot be moved back any further. To move both would be an expensive undertaking at this place, and would necessitate the discontinuance, for a time, of the lights; beside, there is no appropriation available. It would be more satisfactory, and doubtless cheaper in the end, to build two new frame beacons, detached from the keeper's dwelling. The present ones could then remain as they now are until the new ones are established. By this means the change would cause no inconvenience to commerce, and such locations and relative elevation could be given them as would make them much more useful than they now are.

It is very important that this range be well maintained, as the channel which it marks is the most reliable, permanent, and the deepest of the several entrances to Cape Fear River. An appropriation of \$4,000 is therefore asked to re-establish the range.

322. *Cape Romain, on Raccoon Key, South Carolina.*—This tower is 150 feet high, built in the form of a frustum of an octagonal pyramid, resting on a concrete foundation. In September, 1868, it was discovered that slight cracks had opened on the north and south faces, in which the windows are placed. For a time these openings remained as they were when first discovered; since then additional cracks have opened on the westerly faces, and the tower has settled considerably on that side, so much, in fact, as to require a re-adjustment of the lens. The deflection of the tower is now $23\frac{1}{2}$ inches from the vertical, and in all probability will increase; should it do so, the old tower will have to be replaced by a new one on a more secure foundation. Careful and frequent observation will be made to determine this fact.

— *Charleston Main Light, on the south end of Morris Island, South Carolina.*—The site of the old light-house at this station, which was destroyed during the rebellion, is on land owned by the Government, to which the State ceded jurisdiction many years ago. It is proposed to locate the new structure, for which an appropriation was made at the last session of Congress, at or near the same spot. The tower will be of brick, of the first order, 150 feet high, and of the form of a frustum of a right cone, resting on an octagonal base. A contract was made for the iron work of the tower with the lowest bidder, after having advertised publicly for bids. It is proposed to commence work on the foundation as soon as the sickly season is over. An additional appropriation of \$60,000 is asked for this work.

322. *Hunting Island Light, on the north end of Hunting Island, South Carolina.*—The site for this light-house has been selected at a point nearly a mile from the north end of the island. This was deemed necessary, as the north point of the island is still washing away under the abrasive action of the sea. The land at the north end is very low, however, and is overflowed by high tides, which doubtless facilitates this action. It is nevertheless believed that after a few hundred feet more are washed away it will cease, as the point of the island will then be protected from the action of the strong ebb tides by Harbor Island. In view, however, of the continued washing of the shore it was deter-

mined to make the light-house of cast iron, in sections, which can be taken down and removed in case of necessity, though it is not believed that such an emergency will arise.

A contract was made with the lowest bidder, after due public notice, for the fabrication of the metal work of the light-house, and a working party dispatched to the site to build a temporary wharf at and a roadway leading to the landing. Temporary quarters for workmen and store-houses for material have been erected. On account of the unhealthiness of the climate, however, this work has had to be suspended. A watchman has been left to take charge of Government property. It is proposed to resume operations about the 1st of November. An additional appropriation of \$20,000 is asked for this work.

334, 335. *Daufuskie Island Range Beacons, Calibogue Sound, South Carolina.*—The work of building the keeper's dwelling and range beacons was contracted for early in the spring, and was to have been completed by the middle of May, but owing to unavoidable delays in the transportation of material to the site, and afterward by the sickness (incidental to the climate) of the contractor and his workmen, the time has been extended to the middle of September, when it is confidently expected that the work will be entirely completed, and that the beacons will be lighted by the first of next October.

336. *Tybee, Entrance to Savannah River, Georgia.*—The following statement and recommendation for an appropriation of \$50,000 for the commencement of a new tower at this station, in last annual report, is renewed. As then stated, "the tower is not in a safe condition, owing to the damage it sustained in the cyclone of 1871. This tower is very old, having been built in 1793. It is a frustum of an octagonal pyramid, built of Savannah brick. Five of its faces show dangerous cracks. As stated in a previous report, its great age and neglect during the war render it impracticable to properly repair it. An appropriation of \$50,000 is therefore asked to commence the building of a new structure. This can be done without delay on Government land near the site of the present tower."

337. *Tybee Beacon, ranging with the main light, entrance to Savannah River, Georgia.*—The encroachment of the sea upon the southerly point of the island has made it necessary to remove the front beacon, a skeleton-frame structure. This has been done, and the beacon set back 400 feet to a safe position and placed on a new foundation. At the same time it was thoroughly repaired.

— *Tybee Knoll, Savannah River, Georgia.*—Plans and specifications for the light-house authorized by the appropriation at last session of Congress, to take the place of the light-ship now stationed there, have been prepared, and a contract made for the fabrication of the iron-work and lantern. The light-house will be a square structure on five wooden piles incased in cast-iron sleeves, with two additional fender-piles, one up and the other down stream. The light will be of the fifth order. The station will be provided with a fog-bell struck by machinery.

349-350. *Amelia Island north range beacons, on the north end of Amelia Island, Florida.*—The front beacon has been moved about 200 feet northward, to range through a new channel that opened to the north of the old channel.

351-352. *Amelia Island main light, entrance to Fernandina Harbor, Florida.*—The keeper's dwelling, which was in a dilapidated condition, has received extensive repairs and renovations. The tower and beacon have also been repaired and renovated, the cost of these repairs being paid for out of the general appropriations for repairs and incidental ex-

penses of light-houses. The plank walk between the tower and beacon is entirely worn out, and it is proposed to replace it with an earthen causeway.

355. *Saint Augustine, north end of Anastasia Island, Florida.*—As noticed in the last annual report, work on the new tower for this station had to be suspended for want of funds after the foundation had been carried up several feet above the ground. Work was resumed, however, as soon as the new appropriation became available. At the present date the tower has been built up to a height of 42½ feet, and the first flight of stairs set. The material is all on hand for completing the tower, and the work will be pushed along with rapidity.

During the suspension of operations a small force was engaged in building jetties of coquina and brush to prevent the abrasive action of the sea. The experiment proved very satisfactory. The water had cut into the bank rapidly previous to the building of the jetties, so that only about 10 feet remained between the corner of the old light-house and high-water mark. The jetties not only stopped the washing away of the bank, but accumulated material to the southward of them so that the shore began to extend out into the sea again. Unfortunately coquina rock has not sufficient weight to prevent its being washed out of place during gales, occurring at the time of spring-tides, so that the present jetties are only temporary expedients, and should have a portion of the coquina replaced by some heavier material to render them permanent. A few hundred tons of granite is much needed for this purpose.

It is expected that the present appropriation will complete the tower and enable the light to be exhibited, but a keeper's dwelling will be required, as there are not sufficient or proper accommodations at the old light-house for three keepers—the number required to attend a first-order light-house—and the distance is too great from the new tower to insure proper attendance, even if the present dwelling were suitable. An appropriation of \$20,000 is asked to build four jetties to protect the site, and a keeper's dwelling for the station.

— *Mosquito Inlet, east coast of Florida.*—The following statement in the last annual report in regard to the establishment of a new light at this place is repeated:

In common with all the inlets and harbors on the east coast of Florida, this bar shifts constantly, so that no soundings can be relied on. The general effect of westerly winds is to reduce the depth of water, and that of northeasterly gales to increase it; thus the inlet may be opened or closed one or more times each year. The wrecks lying on or near the bar give a practical illustration of the uncertainty of the channel. For all practical purposes of construction of a light-house, it may, however, be safely assumed that the material can be delivered without any very serious difficulty or delay, although additional expense would be incurred by reason of the remoteness of the station and the small-sized vessels that would be required for transportation. As regards the necessity of a light at this point, it is manifest that the commerce passing through the inlet would not justify an expenditure by the United States for a light for merely local purposes, or at least that there are other points that may justly take precedence of it. But a light-house between Saint Augustine and Cape Canaveral lights is necessary, as one of a system of coast lights, and Mosquito Inlet is undoubtedly the proper site, as in the first place the light there would answer the double purpose of a harbor and coast guide, and in the second place, for a landing-place, both for the original construction and subsequent supply and inspection, which could be made with more safety and certainty there than at any other point along the open-sea beach. A tower 150 feet high, lighted by a first-order Fresnel lens, is recommended for this position, and for the commencement of its construction an estimate of \$60,000 is submitted.

The distance from Saint Augustine to Cape Canaveral is ninety-five miles, of which there is an unlighted space of sixty miles.

356: *Cape Canaveral, on the northeast pitch of Cape Canaveral, sea-coast of Florida.*—This station has received extensive repairs and renova-

tions, of which it was much in need. The roofs of the keepers' dwelling and the kitchen have been shingled and provided with gutters. The veranda has been rebuilt and the plastering repaired. The tower, which is of iron, has been painted throughout, the outside being colored in horizontal bands, alternately black and white, which renders it visible at a greater distance, and consequently a better day-mark. The old tower was white.

REPAIRS.

At each of the following-named light-stations in the sixth district there have been repairs and renovations, more or less extensive, during the last year, viz :

317. *Federal Point*, New Inlet, entrance to Cape Fear River, North Carolina.

319-320. *Oak Island Beacons*, entrance to main channel, Cape Fear River, North Carolina.

321. *Georgetown*, entrance to Pedee River and Georgetown, South Carolina.

323. *Bull's Bay*, north end of Bull's Bay Island, South Carolina.

325-326. *Morris Island Beacons*, south end of Morris Island and entrance to Charleston Harbor, South Carolina.

327-328. *Sullivan's Island Beacons*, on Sullivan's Island, South Carolina.

336-337. *Tybee Light and Beacon*, entrance to Savannah River, Georgia.

339. *Cockspur Beacon*, on east end of Cockspur Island, Savannah River, Georgia.

340. *Oyster Beds Beacon*, on the oyster-beds, Savannah River, Georgia.

341. *Obstructions light*, on the obstructions, Savannah River, Georgia.

343-344. *Sapelo*, entrance to Doboy Sound, Georgia.

345-346. *Wolf Island Beacons*, entrance to Doboy Sound, Georgia.

347. *Saint Simon's*, entrance to Saint Simon's Sound, Georgia.

348. *Little Cumberland*, entrance to Saint Andrew's Sound, Georgia.

349-350. *Amelia Island north range beacons*, on the north end of Amelia Island, Florida.

351-352. *Amelia Island main light*, entrance to Saint Mary River and Fernandina Harbor, Florida.

355. *Saint Augustine*, (old light-house,) on Anastasia Island, entrance to Saint Augustine, Florida.

356. *Cape Canaveral*, on northeast pitch of the cape, Florida.

The following are the names of the light-stations in the sixth district not mentioned elsewhere :

329. *Fort Sumter*, on Fort Sumter, Charleston Harbor, South Carolina.

330. *Castle Pinckney*, on Castle Pinckney, Charleston Harbor, South Carolina.

331. *Combahee Bank*, on the southeast point of Combahee Shoal, Saint Helena's Sound, South Carolina.

332. *Fig Island Beacon*, on the east end of Fig Island, in Savannah River, Georgia.

LIGHT-SHIPS.

"*Frying Pan Shoals*," off Cape Fear, North Carolina.—This vessel was extensively repaired in Wilmington, North Carolina, and towed to Charleston, South Carolina, October 29, 1872, where she remained as a

relief till June 23, 1873, when she was taken to her present position, taking the place of Relief No. 32, which was temporarily on the station. The general condition of the vessel is good.

324. "*Rattlesnake Shoal*," off Charleston, South Carolina.—The spar-deck is now being recalcked, and the vessel is otherwise in good condition.

333. "*Martin's Industry*," off Port Royal, South Carolina.—Is in good condition and needs no repairs.

338. "*Tybee Knoll*," on Tybee Knoll, mouth of Savannah River, Georgia.—This vessel was placed on her station on September 6, 1872, relieving No. 33, which was towed to Charleston, and, by direction of the Treasury Department, was sold at auction, being unfit for repairs. She needs considerable repair, but will not be removed from her station for that purpose till the completion of the screw-pile light-house at Tybee Knoll, which will render the further use of a light-ship at that place unnecessary.

Relief No. 32.—On the night of the 6th of May, 1873, this vessel, then stationed on Frying-Pan Shoals, North Carolina, was run into by the Norwegian bark Mimi and considerably damaged. She was relieved by Light-ship No. 34 on June 24, and towed to Charleston, South Carolina, where the damages caused by the collision were repaired at the expense of the Mimi. Other repairs, not resulting from the collision, were put upon her, and she is now in good order and ready for service.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

The following is a list of the unlighted beacons in the sixth district:
Bald Head, mouth of Cape Fear River, North Carolina; old tower discontinued on the establishment of the Frying-Pan Shoal light-ship.

Price's Creek, Cape Fear River, North Carolina, discontinued during the rebellion, not relighted.

Campbell's Island, Cape Fear River, North Carolina, discontinued during the rebellion; brick house with iron lantern.

Orton's Point, Cape Fear River, discontinued during the rebellion, open-frame beacon.

Fort Point, Georgetown, South Carolina, discontinued during the rebellion.

Cape Romain, South Carolina; old tower, near the present light-house.

Fort Ripley, iron screw-pile with cage, recently placed on the site of Fort Ripley, Charleston Harbor, South Carolina.

Battery Light, (White Point Garden,) Charleston; iron spindle; light discontinued during the rebellion.

Savannah City beacon, Georgia; iron spindle; light discontinued during the rebellion.

Saint John's River, Florida, old tower at the south side of entrance to river Saint John.

Cape Canaveral, Florida, old tower.

Dumb beacons at *Oyster Rocks*, river Savannah, near Cockspur Island, two iron-pile beacons.

Savannah River day-marks, two wooden beacons at Jones's Island and two on Long Island.

Saint John River, wooden piles planted along the river Saint John between its mouth and Jacksonville.

BUOYS.

The buoyage of this district is in very good condition.

DEPOTS.

Fort Johnson, Charleston Harbor, South Carolina.—Temporary repairs have been made during the past year, sufficient to keep the wharf standing until the contemplated change to Mount Pleasant can be made.

Mount Pleasant, Charleston Harbor, South Carolina.—The want of a light-house and buoy depot in this district has long been felt, that at Fort Johnson being only regarded as a temporary expedient; and not suitable for the purpose for various reasons, among which may be mentioned the difficulty of workmen and others in reaching it, except by special conveyance; bad location, being exposed to a heavy sea during the prevalence of northerly winds, and its proximity to the stone jetties built to prevent the abrasive action of the sea, rendering it frequently dangerous for a vessel to attempt to land.

A site was found at Mount Pleasant; which is reached by a ferry-boat from Charleston, is in a good harbor, and much more suitable in every way. Steps have been taken to secure a title, in conformity with the provisions of an act of the State legislature of South Carolina which enabled the United States to condemn land for light-house purposes when the owners thereof are unable to make a lawful conveyance.

It is proposed to build a wharf on iron piles. Borings have been made to test the character of the foundation, and work will be commenced as soon as the title is perfected. An appropriation of \$20,000 for this purpose is included in the annual estimates.

[11.]

SEVENTH DISTRICT.

The seventh light-house district extends from Cape Canaveral, on the eastern coast of Florida, to Cedar Keys, on the Gulf coast, including the light-house at the latter point, but not at the former. It embraces nearly the whole peninsula of Florida, the whole of the Florida Reef, and the Tortugas Keys.

Inspector.—Commander Albert Kautz, United States Navy.

Engineer.—Lieut. Col. Chas. E. Blunt, Corps of Engineers, brevet colonel, United States Army.

In this district there are:

Light-houses and lighted beacons	11
Light-houses finished and lighted during the year ending July 1, 1873.....	0
Light-houses for which appropriations were available but which were not finished on the 1st of July, 1873	1
Light-ships	0
Fog-signals operated by steam or hot-air engines	0
Day or unlighted beacons	60
Buoys actually in position	95
Spare buoys for relief and to supply losses.....	68
Tenders (steam) Geranium, (buoy-tender) Arbutus, (used in engineer's constructions and repairs).....	1

The numbers preceding the names of stations correspond with those of the "List of light-houses, lighted beacons, and floating-lights of the Atlantic, Gulf, and Pacific coasts of the United States," issued January, 1873.

360. *Alligator Reef, Florida Reefs.*—This new structure, an iron-pile

light-house, has been brought nearly to completion during the year, and will be lighted early in the coming winter. It will meet the long-existing want of an additional guide in the now unlighted space between Carysfort Reef and Dry Bank light-houses, and will be a very important aid in the dangerous navigation along the Florida Reefs. It is erected in a very exposed position upon the northeast extremity of Alligator Reef, in five feet of water, but within two hundred yards of the deep water of the Gulf. The nearest land, Indian Key, four miles to the westward, has been used during the erection of the structure as a depot-quarters for the mechanics and laborers employed upon the work, and for machine-shop, smithy, &c. A new wharf was built at this key, upon which were landed the materials of the light-house when sent from the North, where the iron-work of the structure, with the keeper's dwelling and lantern, were manufactured.

The site, which covers an octagon of 56 feet diameter, was selected after careful borings. A temporary platform was erected upon this site, supported on mangrove piles shod with iron, and driven 5 feet into the bottom in partially indurated coral rock. A small landing-wharf or jettee for receiving materials was also built in connection with this platform. The platform being completed, the nine heavy cast-iron foundation-disks were accurately placed at the center and angles of the octagon, the surface of the coral rock being first smoothed and leveled for each disk. By an ingenious system of gauges the disks were set in their positions, with their proper relative distances. The talent and perseverance of the assistant engineer of the district have nowhere been more conspicuously shown than in the placing of these disks upon which the whole structure depended; the difficulties of the operation being enormously increased by the necessity of doing the work under water.

The foundation-piles pass through the centers of the disks and rest by shoulders upon them. These piles are of solid wrought iron, 26 feet long, and 12 inches in diameter, and pointed at their lower ends, the upper ends being lathe-turned and cut off in a plane at right-angles to the axis. The pile-driver used in driving them carried a hammer of 2,000 pounds, which was hoisted by the portable steam-engine which was used throughout the construction, and proved an invaluable aid, being easily moved about the platform. The piles were kept accurately vertical during the driving by purchases attached to their heads, which were moved according to the indications of a spirit-level applied to their tops. The penetration into the coral at each blow of the hammer, with an average fall of 18 feet, varied from one-half inch to one and a half inches, and about one hundred and twenty blows brought the shoulder of the piles into contact with the disks, giving them a depth in the coral-limestone rock of 10 feet.

The piles being driven, their tops were brought into one horizontal plane 11 feet above the water, by cutting off the necessary metal by a tool specially devised for the purpose. This done, the cast-iron sockets which fit on the heads of the piles and receive in their upper part the feet of the next series of columns, were put in their places. This second series consists of nine solid wrought-iron pillars 10 inches in diameter.

It is considered unnecessary to go any further into the details of the progress of the work, which, at the date of this report, has been carried to the base of the lantern. Great delays have occurred during the construction, owing to the exposed position of the light-house, the sea breaking heavily on the reef at times, rendering landing on the platform of men and materials impracticable, sometimes for several days in succession.

The completed structure will be similar, except in color, to the light-house upon "Dry Bank." The character of the light, however, will be different, being scintillating, flashing every five seconds, every sixth flash red. The focal flame will be 139 feet above the level of the sea, and will be visible from a deck 15 feet above the water eighteen nautical miles. The approximate position of the light is latitude $24^{\circ} 51' 2''$ north; longitude $80^{\circ} 37' 10''$ west.

363. *Key West*.—A new third-order lantern has been placed on this light-house, raising the tower and the focal plane 5 feet, and a great improvement has been recognized in the light by all approaching it. The wide sash-bars of the old lantern caused a marked diminution of the brilliancy of the light in certain directions.

— *Fowey Rocks*.—The old light-house at Cape Florida (366) is so situated as to be almost useless as a guide to navigators, who are unanimous in the expression of the opinion that it should be replaced by a new one built at the dangerous locality called "Fowey Rocks." For the commencement of this new light-house an appropriation of \$100,000 will be required.

REPAIRS.

No repairs have been made at any of the light-stations of the district during the year, owing to the entire working force of the district being engaged at Alligator Reef.

During the coming year repairs will be needed at the following stations:

358. *Carysfort Reef*, (repairs of iron-work and painting.)

361. *Dry Bank*, (painting.)

362. *Sand Key*, (renewal of stair-tower, water-tanks, painting, &c.)

366. *Dry Tortugas Harbor*, (new lantern.)

The renovations at Sand Key light-house must be of so extensive a character that a special appropriation of \$20,000 is asked for them.

The following are the names of the light-houses of this district not heretofore mentioned in this report:

357. *Jupiter Inlet*, between Jupiter Inlet and Gilbert's Bar, Florida.

363. *Northwest Passage*, Key West, Florida.

365. *Dry Tortugas*, on Loggerhead Key, Florida.

367. *Egmont Key*, Tampa Bay, Florida.

368. *Sea-Horse Key*, Cedar Keys, Florida.

LIGHT-SHIPS.

There are no light-ships in the seventh district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

The line of iron day-beacons on the shoaler portion of the great Florida Reef, and marking out its general outline along the Gulf, has been completed during the year by the erection of thirteen beacons.

This line of beacons is in two series, one on points heretofore occupied and where beacons have been renewed, and a second in new positions. The first series is distinguished by letters from A to P, and the second by numbers from 1 to 8.

BUOYS.

The buoyage of this district is in excellent condition.

[12.]

EIGHTH DISTRICT.

The eighth light-house district extends from Cedar Keys, Florida, to the Rio Grande, Texas, and embraces a part of the Gulf coast of Florida, and the coasts of Alabama, Mississippi, Louisiana, and Texas.

Inspector.—Commander Robert Boyd, jr., United States Navy.

Engineer.—James H. Simpson, colonel Corps of Engineers, brevet brigadier-general, United States Army, until December 31, 1872; A. N. Damrell, captain Corps of Engineers, brevet major, United States Army, until January 23, 1873; W. F. Reynolds, lieutenant-colonel Corps of Engineers, brevet brigadier-general, United States Army, until March 31, 1873; A. N. Damrell, captain Corps of Engineers, brevet major, United States Army, present engineer.

In this district there are—

Lights and lighted beacons.....	50
Lights finished and lighted during the year ending July 1, 1873.....	2
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873.....	8
Light-ships, (in position).....	1
Light-ships, (for relief).....	0
Fog-signals, operated by steam or hot-air engines.....	2
Day or unlighted beacons.....	15
Buoys actually in position.....	110
Spare buoys for relief and to supply losses.....	132
Tenders (steam) Dandelion, (buoy tender) Ivy, used in engineer's constructions and repairs.....	2
Tenders (sail) Magnolia, (used in engineer's constructions and repairs,) Pharos, and Guthrie, (temporarily detailed for construction of Trinity Shoals and Timbalier light-houses).....	3

The numbers preceding the names of stations correspond with those of the list of light-houses, lighted beacons, and floating lights of the Atlantic, Gulf, and Pacific coasts of the United States, issued January, 1873.

LIGHT-HOUSES AND LIGHTED BEACONS.

370. *Dog Island, Saint George's Sound, Florida.*—As mentioned in the last annual report, the brick tower built here in 1838 was in imminent danger of destruction by the undermining of its foundation, caused by the encroachment of the sea on the south beach of the island. No funds being available to replace the light-house by the erection of a new one farther inland, and the necessity for prompt action, to prevent the extinction of the light, being imperative, it was decided to remove the lens and lantern from their perilous position and place them on the top of the keeper's dwelling, (an ordinary square wooden building on iron screw-piles,) situated farther from the beach. This was accomplished by the party engaged on general repairs, and the light is now in a position of temporary security. As the beach wears away and approaches the present location of the light, so as to endanger it, the tower will have to be rebuilt on some more permanent site, and an appropriation will be requisite. It is presumed, however, that the light is safe for some time to come, and a discussion of the merits of the proper location and character of the new tower is consequently reserved for a future report.

— *Saint Andrew's Bay, Florida.*—The amount of \$22,000 recommended in the last report for the establishment of a light as a guide to the entrance to Saint Andrew's Bay has been granted by the act approved March 3, 1873. The commerce of the bay is not very important, the surrounding country being thinly inhabited; yet there is found here a harbor unexcelled by any on the Gulf coast for vessels of not more than 18 feet draught. The principal use of the light will be, therefore, as a guide to a harbor of refuge. A survey has been made of the entrance to the bay, in order to obtain data for determining intelligently upon the most suitable plan for the structure, its location with reference to its greatest value as a light, and the most secure position in regard to any contingent changes of the topography through the denuding action of the sea. Accordingly a design of a two-story wooden dwelling on brick piers, with tower supporting the lantern attached, has been made.

The focal plan of the light (which will be of the fourth order) will have an elevation of 43 feet 8 inches above the ground, or nearly 60 feet above the water. The light-house will be situated on the main-land, facing the entrance, and in front of and a short distance from it will be placed two small beacon-lights, which will range two distinct channels into the bay, the main channel bearing toward the light north $22\frac{1}{2}^{\circ}$ east, and the other north 20° west. It is proposed to immediately begin preparations for the work at an early day.

375. *Sand Island, off entrance to Mobile Bay, Alabama.*—At the close of the last fiscal year the tower had reached a height of 9 feet 6 inches above the grade-line; and a month later it was raised to 19 feet 6 inches, when the exhaustion of the appropriation caused the suspension of operations. Enough funds were reserved to pay for the brick, which had been engaged by contract; and the shipment of them, as well as that of iron-work, to the station, was continued after the removal of the working party.

As an appropriation of \$20,000 was granted by the last Congress for the completion of the Sand Island light-house, operations were resumed in April, 1873, and the work was energetically prosecuted.

At the close of the month of July the tower was built up to a height of 113 feet above the grade-line. Its total height to the focal plane of the light will be 125 feet, or 132 feet above sea-level, and the visibility of the light will extend to a distance of seventeen and one-half nautical miles. A notice to mariners has been published, which advertises the exhibition of the light for the first day of the coming September.

The erection of a substantial wooden dwelling for the keepers is in progress. The Sand Island beacons described in the last annual report, to guide vessels clear of the neighboring shoals, will probably be established at a trifling cost, from the general appropriation for the station.

376. *Mobile Point, entrance to Mobile Bay, Alabama.*—The temporary sixth-order beacon, which for a number of years has done service here, has been replaced by a fourth-order iron tower, 30 feet in height, which, with the additional elevation of the bastion of Fort Morgan, upon which it stands, gives a height of 50 feet above sea-level to the focal plane. The light is fixed red. The iron-work of the tower was manufactured in Washington, and shipped to the station in November. Its erection on the brick and concrete foundation, which had been prepared for it, was completed in January, and on the 15th of February the old light was extinguished and that in the new tower exhibited.

377. *Dog River Bar and Choctaw Bar Channel, Mobile Bay, Alabama.*—The manner of tending these temporary range-lights was changed in December, by taking their care out of the hands of a contractor and

placing them under the immediate superintendence of the keeper of Battery Gladden light-house. For this service one of the launches formerly employed in the engineering operations of the district was detached and manned by two seamen. The change has been found to work well for the interests of the Light-House Establishment. The use of the beacons is to guide vessels through a narrow-dredged channel 45,000 feet long in Mobile Bay. Their arrangement and character is not of the best, as they were established hastily at the time of the commencement of the dredging operations, and only for temporary purposes. In the last annual report it was remarked that on the completion of the channel a change would be necessary. The time has now arrived to definitely propose a plan and recommend an appropriation. The channel does not follow a straight line from the deep water at the mouth of Mobile River to the curve of 13 feet water, at which place it ends, but there are several bends. To mark each angle with a light is an expensive manner of aiding its navigation. Experience in using the cheapest form of lights (common ships' lanterns, as at present) has showed that they are frequently liable to go out, especially in the winter season. To care for them by running from one to the other in a sail-boat is an uncertain method, as the winds are frequently contrary and the weather and sea rough. To maintain them through the provision of an especial keeper at each light would be an unwarrantable expense, both in the first cost of erecting a separate light-house provided with keeper's dwelling, at each station, and its future maintenance. It seems, then, that the most economical plan would be to mark the southern extremity of the channel with a conspicuous unlighted beacon, on cast-iron socket piles, surmounted by a hoop-iron wicker-globe about 6 feet in diameter.

The parts of such a beacon are on hand, complete, except the globe. In front of Battery Gladden, a short distance off in the water, and bearing south 53° east from it, should be established a beacon on screw-piles, provided with a sixth-order light. It would be a simple framework in which to suspend the lens at a proper height above the water, and would be connected with a small wooden tower placed on Battery Gladden Island by means of an endless wire cable, to which would be attached the lens. The light would be lighted by the keeper of Battery Gladden light-house in the small tower on the island, and drawn out to the beacon in the water by means of crank and sheaves provided, as in the case of the pier-light at Oswego. In this manner the light could be tended in the stormiest season. The beacon just described and the Battery Gladden light would range a course which would strike through the outer dumb beacon at the entrance to the dredge-channel, six and two-third miles distant from Battery Gladden light-house, and vessels coming up the bay would be enabled by keeping the range to find the dumb beacon at the south end of the channel. (Battery Gladden light-house is situated near the head of the channel, but to the eastward of it, and the above described is the only way in which it could be brought into the service of its navigation.) The angles of the channel would next be marked by dumb beacons, consisting simply of five wooden piles, four placed at the angles and one in the center of a square, and having two faces of planking nailed to the diagonal corner piles. Between the principal turn-beacons piles should be driven, not very far apart, alternately on opposite sides of the channel, and marked in some distinguishing manner. By having them close enough a vessel could navigate the channel in almost any night. To carry out the above-described system an appropriation of \$8,000 is asked.

—*Grant's Pass, between Mobile Bay and Mississippi Sound, Alabama.*—

On the 27th of December, in the year 1864, a fifth-order light was established on the south side of the channel. The tower was of the temporary kind, still standing at Sand Island, with an elevation of 25 feet to the focal plane. It soon fell into decay by the action of the sea-worms on the wood, and in 1866 was abandoned for want of funds to rebuild or repair it. For several years afterward a light was maintained by a private party, who has recently extinguished it. The Pass is a narrow channel, and affords the only water communication between Mobile Bay and Mississippi Sound. The re-establishment of the light would be a great benefit. It should be an ordinary wooden structure, on iron screw-piles, prepared for a depth of from 2 to 5 feet water. An appropriation of \$20,000 is respectfully recommended.

— *Horn Island Pass, Mississippi Sound, Mississippi.*—The appropriation of \$22,000 asked for in the last annual report having been granted, a survey of the Pass and eastern end of Horn Island was made to decide upon a plan and location for the light-house. The result of the observations was, that a fourth-order wooden structure on iron screw-piles, similar to that at Cat Island, was found to be the most suitable for the objects intended. The plans being all ready, proposals for the iron-work were invited, bids were received and opened on the 2d day of July, and the contract for the iron-work of foundation and lantern awarded to a firm in Baltimore, to be completed on or before the 21st day of October next. The superstructure will be got out by hired labor, and the building erected by the same means. It will stand on the eastern end of Horn Island, a sandy point elevated 3 feet above the water. It is expected that before the next spring the light will be in operation.

386. *Saint Joseph's Island, entrance to Lake Borgne, Louisiana.*—The palmetto-pile breakwater proposed for this station has been built. It has three sides facing around from northeast to the southeast, and meeting each other at angles of 120°. It has a total length of 260 feet. No further danger is now apprehended from the denudation of the land around the light-house.

388. *Tower Dupré, at entrance of Mississippi and Mexican Gulf Ship-Canal, Louisiana.*—The small use made of this canal, with little prospect of any increase in the future, would not warrant the erection of a light-house, and it is therefore recommended that the project of building a light at either Proctorsville or Tower Dupré be abandoned. The balance of the appropriation for Proctorsville light-station has reverted to the Treasury.

390. *Point Aux Herbes, Lake Pontchartrain, Louisiana.*—The erection of a light-house at this point has not yet been undertaken, the title to the land on which it is proposed to build not having been acquired, though the officers of the Light-House Establishment have done all in their power to forward it. The plans are all ready.

— *Errol Island, Gulf of Mexico, Louisiana.*—A light to illuminate the dark space not covered by the lights at Chandeleur and Pass à l'Outre has been recommended in several annual reports. Errol Island seems to be the proper point, as it is almost exactly midway, or twenty-six miles from Chandeleur and Pass à l'Outre light-houses. The question of its establishment has received additional force since it is expected that the proposed Fort Saint Philip Ship-Canal will soon be undertaken. The canal is intended to form a never-failing means of access from the deep water of the Gulf to the Mississippi River, for vessels of the greatest draught. It will debouch into Isle au Breton Pass, southwest, twenty-three miles distant from the selected site of the light-house. The re-entrant position of the canal entrance debars its selection, as the

point for the establishment of a sea-coast light, while the situation of Isle au Breton, just opposite, and seven miles farther seaward, would not equally enough divide the dark gap, which the proposed light-house is to fill. When the canal is built a light will be needed at its entrance. The proposed light-house on Errol Island will be useful in the navigation of Chandeleur Sound, which is much used by coasters.

The light-house should be of the first or second order, and to insure its existence, in the event of any future changes in the topography of the island, like those of the past, an iron tower on screw-piles, the same as those now building at Trinity Shoal and Timbalier Island, would be a proper one, but the Board is of the opinion that the construction of a light-house in this vicinity may be deferred till the canal approaches completion.

400. *Southwest Pass, Mississippi River, Louisiana.*—The new tower to take the place of the old one built in 1831 was, on the 1st day of July, nearly finished; since that date the remainder of the work has been completed and lighted. The iron-work for it was manufactured in Ohio and shipped by sea to the site, arriving there in December. The construction was energetically prosecuted, and a long looked for aid to the commerce of New Orleans will now guide vessels to the principal outlet of the river Mississippi. The old brick tower had sunk several feet into the soft ground, and had inclined 3 or 4 feet from the perpendicular.

For several years it had been in a dilapidated condition, and the light was of an inferior order, compared with the importance of its position. The plan for the foundation of the new light-house was designed after careful study of the treacherous nature of the soft alluvial formation of the Delta of the Mississippi. It is octagonal in shape, and 58 feet 8 inches lesser diameter. It consists, first, of 185 square piles driven 4 feet apart, to a depth of about 33 feet. At 6 feet below the tops of the piles, which are 1 foot below low water, a horizontal course of 12-inch square timbers are notched into the piles. Below the timbers a mass of shell concrete 2 feet thick is rammed about the piles, and on the timbers rests a floor of 3-inch plank. Above the flooring are a second and third course of timbers notched into the piles, and laid at right angles with each other, and diagonally to the first course. A mass of concrete is forced into the interstices of the timbers, and filled up to a height of 4 feet above the third tier, bringing the top of the foundation to about 18 inches above mean level of the water.

The superstructure is a skeleton iron tower, of the same character as those now building at Trinity Shoals and Timbalier Island, and is bolted strongly to the timbers of the foundation. It is composed of six series of eight cast-iron columns, placed at the angles of an octagon, and strongly braced and tied by wrought-iron rods. On the sixth series stands the watch-room and lantern, the ascent to which is by means of a stairway winding around the axis of the tower, and inclosed in a riveted plate-iron cylinder. The keeper's dwelling rests on the first series of columns. It is octagonal in plan, two stories in height, and is built of riveted plate-iron, sheathed inside with wood.

402. *Timbalier, entrance to bay of Timbalier, Louisiana.*—A small portion of the iron-work for this light-house was shipped from New York, and on its arrival at South West Pass, in June, was stored until the preparations for its erection could be completed.

The lumber and material for the construction of the platform, necessary to aid the work in its erection, was sent to the station by the light-house tenders Guthrie and Magnolia and landed on the beach convenient to the site. A working force was sent to the station early in July and the

building of the platform was commenced immediately on their arrival; it is proposed to urge the work forward with all possible dispatch. It is intended that the platform shall be large enough to hold the iron-work of the tower, and give sufficient room for the quarters of the working party, thus dispensing with the necessity of keeping large vessels moored close to the work.

Previous to the definite location of the site of the light-house a thorough survey of West Timbalier Island and the surrounding waters was made, as in the absence of any correct charts the nature of the bay of Timbalier was almost unknown.

The funds at present available for the erection of the tower are inadequate for its completion, and an appropriation of \$15,000 to complete it is recommended.

404. *Southwest Reef, entrance to Atchafalaya Bay, Louisiana.*—An appropriation of \$5,000 to protect the iron tower at this station from impending destruction is available. The first floor and gallery are 11 feet 9 inches above mean low water. Occasionally extraordinary tides, caused by southerly gales, visit the locality, rise nearly to the level of the floor, and cause the sea to beat with all its force against the lower part of the building. It is proposed to raise the tower off of its foundation, lengthen each of the four piles, which compose it, by bolting to them cast-iron columns, secured by a proper system of bracing, and lowering the tower again into place.

An appropriation of \$15,000 has also been made for the establishment of a steam fog-whistle. The building containing the machinery will be supported on screw-piles, and be connected with the light-house by a passage-way. It is proposed to prosecute both works at the same time as soon as the material can be manufactured. An additional appropriation of at least \$5,000 will be required for these two works.

405. *Trinity Shoal, off coast of Louisiana, Gulf of Mexico.*—The first-order iron tower for this station was shipped from New York, and stored at Southwest Pass in June, as in the case of the Timbalier light-house. The same plan of operations proposed to be pursued in the erection of the latter structure is laid out for Trinity Shoal, except that the platform will be but 100 feet square, and is intended to accommodate the workmen only, while the material will be kept on board a vessel anchored near. Greater difficulty is anticipated in putting down the platform, owing to the greater depth of water and the more exposed situation, it being twenty miles from the nearest land.

The material for the platform and the working party are now at the station, and the work of driving piles has already commenced, and will be continued as rapidly as the weather will permit.

As in the case of Timbalier, the present appropriation is insufficient to finish the tower; an additional sum of \$20,000 is needed for that purpose.

406. *Calcasieu, entrance to river and Lake Calcasieu, Louisiana.*—Strenuous efforts were made to obtain a title to the site selected for the light-house, but without any definite result. The iron work arrived in February, and for the above reason had to be stored at the depot at head of the passes, where it now remains. The old appropriation reverted to the Treasury on the 1st of July, 1873. A new appropriation of \$14,000 is asked for the purchase of land for a site, and the transportation and erection of this light-house.

409. *Bolivar Point, entrance to Galveston Bay, Texas.*—The recommendation of operations at Bolivar Point, which had been suspended for want of funds, was undertaken in August last. A party was organ-

ized in New Orleans and sent to the station. By the end of October, the tower was finished, but the light could not be exhibited until the 19th of November, by reason of delay in the arrival of the lantern-glass. The two-acre lot on which the light-house and keeper's dwelling are built was inclosed by a picket-fence.

413. *Matagorda, entrance to Matagorda Bay, Texas.*—By reason of the exhaustion of the former appropriation, the work on the construction of this light-house was suspended July 31, 1872.

Additional funds having been granted, operations were again begun last May. A few days' work sufficed to complete the brick and concrete foundation, the iron-work on the tower was completed before the close of the present month, and the new light will be exhibited, for the first time, on the 1st day of September, as advertised in the printed "notice to mariners."

The design of the tower is very much like that at Bolivar Point, being conical in form and composed of cast-iron sections bolted together. The light will be of the third order, flashing every 90 seconds. A one and one-half story keeper's dwelling, of wood, is building near the light-house. The grounds have an area of ten acres, two of which will be inclosed by a picket-fence.

418. *Brazos Island Beacon, entrance to Brazos Santiago, Texas.*—The recommendation of an appropriation of \$25,000 found in the last annual report for rebuilding this light-house is repeated. The present tower is one of several, hastily built, to serve temporary purposes, in place of those destroyed during the war. Those at Sand Island, Bolivar Point, and Matagorda, which were of a plan similar to that of Brazos Island, have been or are being replaced by suitable structures, and it is now desirable that this, the last of the kind, should give way to a more durable building. It has already been used a much longer time than was anticipated when it was erected, and in view of its condition something should be speedily done to render the light more surely permanent. The board is of the opinion, in view of the large amount of work to be done in the eighth district under existing appropriations, that an appropriation for this work should be deferred till another session of Congress.

REPAIRS.

At each of the following-named stations in the eighth district there have been repairs made, more or less extensive, during the past year:

- 369. *Saint Marks, entrance to Saint Marks River, Florida.*
- 371. *Cape Saint George, Florida.*
- 372. *Cape San Blas, Florida.*
- 373. *Pensacola, entrance to Pensacola Bay, Florida.*
- 407. *Sabine Pass, entrance to Sabine River, Louisiana.*
- 410. *Half-Moon Shoal, Galveston Bay, Texas.*
- 411. *Red Fish Bar, Galveston Bay, Texas.*
- 412. *Clopper's Bar, Galveston Bay, Texas.*
- 416. *Half-Moon Reef, Matagorda Bay, Texas.*
- 417. *Aransas Pass, Texas.*
- 418. *Brazos Island Beacon, entrance to Brazos Santiago, Texas.*
- 419. *Point Isabel, Brazos Santiago, Texas.*

It is proposed to make repairs at the following-named stations in the eighth district during the coming year:

- 379. *Round Island, Mississippi Sound, Mississippi.*
- 380. *East Pascagoula River, Mississippi.*

- 381. *Ship Island*, Mississippi Sound, Mississippi.
- 382. *Biloxi*, Mississippi Sound, Mississippi.
- 383. *Cat Island*, Mississippi Sound, Mississippi.
- 384. *Pass Christian*, Mississippi Sound, Mississippi.
- 385. *Morrill's Shell Bank*, Mississippi Sound, Mississippi.
- 387. *Rigolets*, Pleasanton's Island, Louisiana.
- 389. *West Rigolets*, east entrance to Lake Pontchartrain, Louisiana.
- 391. *Port Pontchartrain*, Lake Pontchartrain, Louisiana.
- 392. *Bayou Saint John*, Lake Pontchartrain, Louisiana.
- 393. *New Canal*, Lake Pontchartrain, Louisiana.
- 374. *Tchefuncte River*, Lake Pontchartrain, Louisiana.
- 395. *Pass Manchac*, Lake Pontchartrain, Louisiana.
- 396. *Chandeleur*, Chandeleur Island, Gulf of Mexico, Louisiana.
- 397. *Pass a l'Ouvre*, Mississippi River, Louisiana.
- 399. *Head of Passes*, Mississippi River, Louisiana.
- 401. *Barrataria Bay*, Louisiana.
- 403. *Ship Shoal*, Gulf of Mexico, off coast of Louisiana.
- 410. *Half-moon Shoal*, Galveston Bay, Texas.

The following are the names of light-stations in the eighth district, not mentioned elsewhere. They are in good condition and have not required attention in the past year and most probably will not need any in the coming year :

- 374. *Pensacola Bar Beacon*, entrance to Pensacola Bay, Florida.
- 378. *Battery Gladden*, Mobile Bay, Alabama.
- 398. *South Pass*, entrance to Mississippi River, Louisiana.
- 414. *West Shoal*, entrance to Matagorda Bay, Texas.
- 415. *East Shoal*, entrance to Matagorda Bay, Texas.

LIGHT-SHIP.

408. *Galveston*, inside of *Galveston Bar*, Texas.—This vessel, being in need of repair, was relieved by a chartered schooner, towed to New Orleans, docked, thoroughly repaired and refitted. She is now in good order.

FOG-SIGNALS.

Pass a l'Ouvre.—A 12-inch steam-whistle, in good condition.

Southwest Pass.—A 12-inch steam-whistle, in good condition.

Both of the above have had the supply-pipes of the whistles lengthened, to give increased range to the sound, the tall swamp-grass obstructing it. They are now frequently heard distinctly a distance of twelve miles.

Fog-bells have been ordered by the board and will be put up the coming year at the light-houses at *Half-moon Shoal*, *Red Fish Bar*, and *Clopper's Bar*, Galveston Bay, Texas.

Fog-bells to be rung automatically should also be placed on the light-houses to be erected at *Saint Andrew's Bay*, Florida, *Horn Island Pass*, Mississippi, and *Calcasieu*, Louisiana, from the appropriation for those stations.

Fog-bells are greatly needed at many light-stations on the west coast of Florida, and the coasts of Alabama, Mississippi, Louisiana, and Texas, and an appropriation of \$5,000 is asked for the purpose.

DAY OR UNLIGHTED BEACONS.

The day beacons in the eighth district are all in good condition. Repairs have been made to the following named :

Beacons Nos. 1, 2, and 4, composed of four palmetto piles each, entrance to River Saint Mark's, Florida.

Stake Island, Southwest Pass, Mississippi River.—Iron-pile beacon surmounted by hoop-iron globe.

North Breaker Beacon, entrance to Galveston Bay, Texas.—An iron-pile beacon surmounted by a hoop-iron globe.

The palmetto beacons mentioned in the last report as about to be established in the upper part of Pensacola Bay have been placed. They are six in number; are placed, to mark lamps having less than 5 feet of water, in Santa Maria de Galvaez and Blackwater Bay. They are composed of seven palmetto piles each, grouped in a bunch and bolted together, the central pile projecting higher than the others and capped with a barrel.

BUOYS.

The buoyage of this district is in good condition.

DEPOTS.

Buoy and Coal Depot, Fort Pickens, Florida.—This depot was thoroughly repaired and placed in perfect order.

Coal Depot, Mobile Point, entrance to Mobile Bay, Alabama.—For the convenience of the steam-tenders in the service of the district, a coal platform, 50 feet square, and inclosed by a fence, was laid during the year, at a slight cost, and 278 tons of coal were stored on it. Its situation is not of the best for the purpose, as the wharf faces the north, and being at the southern shore of the bay is exposed to the accumulated force of the waves advancing thirty miles across it. It is only during calm weather or easterly and southeasterly winds that vessels can lay along side.

Buoy and Coal Depot, head of the Passes, Mississippi River.—An appropriation of \$10,000 was granted by the act approved March 3, 1873, for the protection of the depot from the erosion of the shore.

Very recently the wharf, which for a long time threatened to give way, at last fell into the river. The great expense of building protective works and their limited duration by reason of the constant changes going on in the banks of the river, and the fact that the head of the Passes is out of the way of communication by either telegraph or mail, make it extremely advisable that the depot be changed to another locality. There seems to be no better one in this portion of the district than at the new light-house at Southwest Pass. The very substantial wharf built to aid the construction of the light-house is still there. It has a front of 67 feet and a width of 32 feet. From it a wooden pier about 700 feet long leads to the light-house. A crane and tramway, provided with trucks, are already there. By extending the wharf some 30 feet on one side would give a good coal-platform, while a buoy-shed, engineer's and inspector's store-rooms might be built on either side of the pier connecting the wharf and light-house. The wharf fronts on a sheltered bayou about three-quarters of a mile from the main channel of the Mississippi, free from all eroding action which has given such trouble at head of the Passes. The place is also in easy communication by mail and telegraph. The buoy-shed and store-house at head of the Passes could be taken down and re-erected at the new depot, and the lumber which is being used for the temporary platforms at Timbalier and Trinity Shoal could be made available when those works are finished. It is therefore recommended that the depot at head of the Passes be abandoned, and a new one established at Southwest Pass, and that the \$10,000 already

appropriated for the protection of the old depot be made available for the preparation of the new one, and an additional appropriation of \$5,000 be made for the same purpose. The combined amount of \$15,000 ought to establish a new, commodious and secure depot, better in every respect than the old one, and one which will probably never require protective works, whereas the old one, after the expenditure of the amount already appropriated for works of protection, will require an equal amount next year for a new wharf and general repairs, and a much larger amount within two years for securing it against the washing of the river, a total of probably \$30,000 or \$40,000.

[13.]

TENTH DISTRICT.

The tenth district extends from the mouth of Saint Regis River, New York, to include Grassy Island light-house, Detroit River, Michigan, and embraces all the aids to navigation on the American shores of Lake Erie, Lake Ontario, and river Saint Lawrence.

Inspector.—Commodore Napoleon Collins, United States Navy.

Engineer.—Maj. G. L. Gillespie, Corps of Engineers, United States Army, until March 31, 1873; Maj. Franklin Harwood, Corps of Engineers, United States Army, present engineer.

In this district there are:

Light-houses and lighted beacons.....	57
Light-houses finished and lighted during the year ending July 1, 1873.....	2
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873.....	2
Light-ships.....	0
Fog-signals operated by steam or hot-air engines.....	0
Day or unlighted beacons.....	1
Buoys actually in position.....	83
Spare buoys for relief to supply losses.....	51
Tenders.....	0

485. *Cross-over Island, Saint Lawrence River, New York*.—The tower and dwelling remain as reported last year. As a measure of economy the sooner a new tower and dwelling are authorized the better, as very expensive repairs will be shortly absolutely necessary to make the building tenable, and to maintain the light. As stated last year, the structure is not worth repairing, and it would be a waste of money to do so, excepting as a matter of pressing necessity. An appropriation of \$14,000 is required for a new tower and dwelling.

488. *Rock Island, Saint Lawrence River, New York*.—The tower and dwelling are in a similar condition to that of Cross-over Island. A new tower is imperatively necessary. The dwelling might be repaired, but it is not considered economical in the end to do so, as it would only be postponing the building of a new one a few years, and it would probably cost less to build tower and dwelling together now. An appropriation of \$14,000 is required for a new tower and dwelling.

495. *Fair Haven, Little Sodus Bay, Lake Ontario, New York*.—A title for the four-acre lot, mentioned in last annual report, was obtained in November, 1872, and sealed proposals for building the keeper's dwelling were publicly invited December 23, 1872. A contract was entered into February 13, 1873, and work was commenced in the middle of March. An elevated walk was built from the beach to the beacon.

496. *Big Sodus Beacon, (front,) New York*.—A wooden beacon was built in September and October, 1872, on the Light-house Crib at the head of west pier, and a fixed white light has been exhibited since Octo-

ber 29, 1872, from a sixth-order lens illuminating 360°. The former front "Range" beacon was removed from the middle of west pier. An elevated walk 1,150 feet long was erected from new beacon.

——. *Puttneyville, Lake Ontario, New York.*—A timber beacon showing a fourth-order light will be erected in the course of the year 1873-74.

501. *Oak Orchard, Lake Ontario, New York.*—An elevated walk, extending 800 feet to the beacon, was built in the spring of 1873.

——. *Thirty-Mile Point, Lake Ontario, New York.*—An appropriation was made at the last session of Congress for a lake-coast light at this point. The plans have been prepared and the structure will be commenced at an early day.

——. *Olcott, Lake Ontario, New York.*—A timber beacon showing a fourth-order light will be erected during the summer and fall of 1873.

503. *Dunkirk, Beacon, Lake Erie, New York.*—An elevated walk was built, extending 900 feet to the beacon. The beacon is old and needs renewing. An appropriation of \$5,000 is required.

511-512. *Presque Isle Beacon, ranges Nos. 2 and 3, entrance to Presque Isle Bay, Pennsylvania,* were both rebuilt during the year. An appropriation of \$8,000 is required.

514. *Peninsula Beacon, range No. 2, Lake Erie, Pennsylvania,* being in danger of being washed into the lake by its encroachments, a protection breakwater will be built in front of it during the summer and fall of 1873.

515. *Presque Isle, Lake Erie, Pennsylvania.*—An appropriation was made June 10, 1872, for a new tower and keeper's dwelling attached. Proposals were publicly invited in July for the delivery of the necessary building materials, but no acceptable offers were made, except for the stone of foundation, the water-table, and for the metal work of tower; the other materials had to be bought in open market, and the plans approved by the Light-House Board had so far to be altered as to substitute iron for stone in the cases of sills, outside steps, and tablet, and as to use of brick, instead of stone, above the water-table. These different dispositions delayed the work so much that ground could not be broken before September 2, 1872, and the progress of the structure was furthermore made slow by the difficulty of landing materials, the shore being so dangerous that in the calmest weather only approach is possible, and that no insurance company would take any risks in vessels or cargoes; and notwithstanding all the precautions taken and delays incurred, a scow with 6,000 bricks was lost.

The masonry of the dwelling being completed, and that of the tower nearly so, by the end of November the house was roofed, the tower covered, and the openings were boarded up, and the work was suspended December 8, 1872, until April 16, 1873.

The light-house was ready for exhibiting the light and for occupancy on July 1, 1873. The buildings consist of a tower with keeper's dwelling attached, built of brick on a limestone foundation.

The apparatus is a Fresnel lens of the fourth order, showing a fixed white light, varied with red flashes, (F. W. V. R.) at intervals of one minute, the height of focal plane above lake level being 57 feet. Arc of visibility is from E. S. E. $\frac{1}{2}$ E. by northward to S. W. by W. The light will be exhibited on and after July 12, 1873.

516. *Conneaut, Lake Erie, Ohio.*—The keeper's dwelling was completed and accepted. The beacon-crib is in such a ruinous condition that extensive repairs are imperatively necessary, but inasmuch as these repairs would cost nearly as much as a new beacon at the head of west pier, a site much more suitable and more convenient of access to the

keeper's dwelling, which is on the opposite side of the river from the present beacon, will be placed there. An appropriation of \$4,000 is required for a new beacon.

517. *Ashtabula, Lake Erie, Ohio.*—An appropriation was made March 3, 1873, for building a new pier-head beacon. As an extension of the west pier is contemplated, on the head of which the new beacon is to be placed, the construction of the same is deferred, and it is recommended to continue the appropriation to June 30, 1875.

519. *Grand River, Fairport, Lake Erie.*—The west pier of entrance to the harbor at this station is being extended 400 feet, and as the frame beacon is very old and needs renewing, it should be taken down and a new frame beacon should be erected at the pier-head of the new extension. An appropriation of \$4,000 is required.

520. *Cleveland, Lake Erie, Ohio.*—The buildings were successfully completed, and the dwelling occupied by January 1, 1873. The light has been exhibited from the new tower since the opening of navigation of 1873. The station is now in fine order.

521. *Cleveland, Beacon No. 1, Lake Erie, Ohio.*—Being in a ruinous state, and having settled considerably to the east, should be rebuilt. Complaints have been made of the insufficiency of the pier-lights at this place, and it has been suggested that a fixed red light of the fifth or sixth order should be placed at the pier-head in lieu of the pair of common lanterns which are now there. The matter will have the attention of the board. An appropriation of \$10,000 is required.

523. *Black River, Lake Erie, Ohio.*—This station has no keeper's dwelling. An appropriation of \$4,000 was asked for last year for the construction of a frame dwelling similar to the one at Ashtabula, Ohio, but was not granted. On account of the considerable rise in the price of real estate in the village, an appropriation of \$5,000 is required, and is earnestly urged as a measure of economy, as the place is growing rapidly and the value of property steadily increasing.

525. *Huron, Lake Erie, Ohio.*—The title-papers being accepted by the Attorney-General in August, the contractors collected materials immediately and began the construction of the keeper's dwelling in September. After serious delays, occasioned particularly by sickness of the workmen, the dwelling was completed in January, and occupied on February 1, 1873.

— *Sandusky Bay, Ohio.*—Access to the city wharves is had from Cedar Point over a shoal through which the United States has been dredging, and will shortly complete a channel over the most favorable ground, but which will have two turns or elbows at present marked by buoys. These buoys are continually in danger of being carried away by rafts or barges, and when this occurs the channel is left undefined, often resulting in serious delays to shipping. These turning-points should be permanently defined, and it is therefore respectfully recommended to establish two day-beacons of construction similar to that located at Dunkirk, N. Y. An appropriation of \$12,000 is required.

533. *Maumee Outer range, (rear.)*—An appropriation of \$12,000 was asked for last year (see last annual report) for erecting two day-beacons in the southwest channel. A board of engineer officers, engaged in making plans for the improvement of the channels, recommended in the early part of 1873, instead of these beacons, two iron light-houses, and an estimate was made for \$40,000.

The reasons given in advocating the establishment of day-beacons in Sandusky Bay, are still more cogent in this instance, for scarcely a month elapses during the season of navigation without one or the other

of the can-buoys being carried away, while the displacement of one or more of the spars is of weekly occurrence.

An appropriation of \$14,000 would be required for two day-beacons in the outer range.

538. *Monroe, Lake Erie, Michigan.*—The keeper's dwelling is in a ruinous condition; has no foundation, except a few rotten logs, and has a very exposed position, now entirely unsafe.

The pier-head needs renewal, but cannot be touched without endangering the dwelling. Eighty rods back from its present position, there is a safe beach about 5 feet high above the water.

It is recommended to build a house there of the same model as at Oak Orchard or Fair Haven, New York, leaving the tower for the present, which is on a safe pile foundation.

An appropriation of \$5,000 is required for building keeper's dwelling.

— *Point Mouillé, Lake Erie, Michigan.*—Constant casualties have occurred, especially during the fall of 1872, by reason of vessels grounding on Bar Point, a dangerous shoal jutting out from the Canada shore. As this shoal is in Canada waters, the United States can take no measures there for the preservation of our commerce. Yet, last year, the pecuniary loss incurred there to citizens of the United States, if saved, would not only have sufficed to establish a light, but also to maintain it for several years.

The loss occurs in this wise: Vessels entering and leaving river Detroit, notwithstanding the aid of Bois Blanc (Canadian) and Gibraltar (American) lights, have no definite guide as to when to change their course to their destination on Lake Erie, or *vice versa* in going into the river Detroit. Hence many vessels, especially in heavy weather, turning too soon, come to grief on Bar Point Shoal.

It has been suggested that all this can be avoided by establishing off Point Mouillé (see topographical chart of west end of Lake Erie) a beacon-light in such a position that vessels rounding it can take their course either to or from Detroit with perfect safety.

The Board is informed that the beacon need stand in not more than 24 feet water on a foundation of compact sand and gravel.

The matter, which is deemed of importance, will have the immediate attention of the Board.

539. *Gibraltar, Detroit River, Michigan.*—An appropriation was made, June 10, 1872, for rebuilding the tower and dwelling; sealed proposals were publicly invited, in July, for the delivery of the necessary materials, but without result. Except the metal-work for the tower, the materials had to be purchased in open market.

A temporary tower was built, and a light from a steamer-lens was exhibited August 10, 1872.

The old tower was removed, as also the old dwelling, and the new buildings, a tower with dwelling attached, of brick, erected upon the light-house lot.

The buildings were completed in January, 1873, and the dwelling occupied February 1, 1873.

The focal plane of the new tower is 47 feet above the level of the river Detroit.

REPAIRS.

At each of the following-named stations in the tenth district there have been made repairs and renovations, more or less, during the year:

486. *Sister Island*, river Saint Lawrence, New York.

488. *Rock Island*, river Saint Lawrence, New York.

489. *Tibbett's Point*, Lake Ontario, New York.

- 490. *Galloo Island*, Lake Ontario, New York.
- 491. *Horse Island*, Lake Ontario, New York.
- 493. *Oswego*, Lake Ontario, New York.
- 498. *Big Sodus Bay*, Lake Ontario, New York.
- 499. *Genesee*, Lake Ontario, New York.
- 501. *Oak Orchard*, Lake Ontario, New York.
- 502. *Niagara Fort*, mouth of Niagara River, New York.
- 503. *Horseshoe Reef*, Buffalo, New York.
- 504. *Buffalo Breakwater*, north end Lake Erie, New York.
- 506. *Buffalo*, light-station and depot.
- 507. *Dunkirk*, Lake Erie, New York.
- 509. *Erie Harbor*, Pennsylvania, Lake Erie, Pennsylvania.
- 510. *Presque Isle*, *Beacon range*, Erie, Pa., No. 1-2.
- 513, 14. *Peninsula-Ranges 1-2*, Erie, Pa.
- 516. *Conneaut*, Lake Erie, Ohio.
- 517. *Ashtabula*, Lake Erie, Ohio.
- 518. *Grand River*, Lake Erie, Ohio.
- 521. *Cleveland Beacon*, Cleveland, Ohio.
- 524. *Vermillion*, Lake Erie, Ohio.
- 525. *Huron*, Lake Erie, Ohio.
- 526. *Cedar Point*, Lake Erie, Ohio.
- 527. *Cedar Point Beacon*, Lake Erie, Ohio.
- 531. *Turtle Island*, Lake Erie, Ohio.
- 532. *Maumee Outer range*.
- 534. *Maumee Middle range*.
- 536. *Maumee Inner range*.

Stations at which repairs in the tenth district will be made during the next year:

- 484. *Ogdensburgh*, river Saint Lawrence, New York.
- 486. *Sister Island*, river Saint Lawrence, New York.
- 487. *Sunken Rock*, river Saint Lawrence, New York.
- 490. *Galloo Island*, Lake Ontario, New York.
- 491. *Horse Island*, Lake Ontario, New York.
- 492. *Stony Point*, Lake Ontario, New York.
- 495. *Fair Haven*, Lake Ontario, New York.
- 498. *Big Sodus Bay*, Lake Ontario, New York.
- 499. *Genesee*, Lake Ontario, New York.
- 502. *Niagara Fort*, mouth of Niagara River, New York.
- 504. *Buffalo Breakwater*, (north end,) Buffalo, N. Y.
- 507. *Dunkirk*, Lake Erie, New York.
- 509. *Erie Harbor*, Lake Erie, Pennsylvania.
- 515. *Presque Isle*, Lake Erie, Pennsylvania.
- 516. *Conneaut*, Lake Erie, Ohio.
- 517. *Ashtabula*, Lake Erie, Ohio.
- 518. *Grand River*, Lake Erie, Ohio.
- 524. *Vermillion*, Lake Erie, Ohio.
- 525. *Huron*, Lake Erie, Ohio.
- 526. *Cedar Point*, Lake Erie, Ohio.
- 528. *Marblehead*, Lake Erie, Ohio.
- 529. *Green Island*, Lake Erie, Ohio.
- 530. *West Sister*, Lake Erie, Ohio.
- 531. *Turtle Island*, Lake Erie, Ohio.
- 532. *Maumee Outer range*, Lake Erie, Ohio.
- 534. *Maumee Middle range*, Lake Erie, Ohio.
- 536. *Maumee Inner range*, Lake Erie, Ohio.
- 540. *Mamajuda*, Detroit River, Michigan.
- 541. *Grassy Island*, Detroit River, Michigan.

LIGHT-HOUSE BOARD.

659

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot air in this district.

DAY OR UNLIGHTED BEACONS.

Dunkirk Harbor, New York, in good order.

BUOYS.

The buoyage of the district is reported in good order.

DEPOT.

The depot at Buffalo, New York, is in good order, and fills all the wants of the district.

[14.]

ELEVENTH DISTRICT.

The eleventh district embraces all aids to navigation on the northern and northwestern lakes, above Grassy Island light-station, Detroit River, and includes Lakes Saint Clair, Huron, Michigan, and Superior, and the straits connecting them.

Inspector.—Commodore Alexander Murray, United States Navy.

Engineer.—To May 1, 1873, Maj. O. M. Poe, Corps of Engineers, Bvt. Brig. Gen., United States Army; after that date Maj. Godfrey Weitzel, Corps of Engineers, Bvt. Maj. Gen., United States Army.

There are in this district:

Light-houses and lighted beacons.....	100
Light-houses finished and lighted during the year ending July 1, 1873.....	5
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873.....	15
Light-ships.....	0
Fog-signals, operated by steam or hot-air engines.....	7
Day or unlighted beacons.....	1
Buoys actually in position.....	145
Spare buoys for relief, and to supply losses.....	84
Tender (steam) Haze, buoy-tender and supply vessel, (common to tenth and eleventh districts).....	1
Tender (steamer) Warrington, (used in engineer's constructions and repairs)....	1
Tender (sail) Belle, (used in engineer's constructions and repairs).....	1

The numbers preceding the names of stations correspond with the light-house list of the northern and northwestern lakes, issued January 1, 1873.

542. *Windmill Point, Michigan, entrance to Lake Saint Clair.*—This station was built in 1838 and refitted in 1867. It is an important station, as it is a guide to the whole commerce of the lakes to Lake Saint Clair and the Detroit River. Both tower and dwelling are old and dilapidated, and new structures are recommended at a cost of \$18,000.

544. *Saint Clair Flats Beacon, Lake Saint Clair, Michigan.*—It having become evident that the crib which surrounds this beacon was settling and drawing with it the tower, a survey was made of its condition on the 18th May, 1873. It was found that the north corner of the crib was 1.51 feet lower than the south corner, and the tower at the focal plane was $5\frac{1}{2}$ inches out of plumb. On the 5th August, 1873, another survey was made, and the north corner found to be 1,665 feet lower than the

south, and the tower 5.95 inches out of plumb. This shows considerable movement in about two and a half months. The drawings of this station show that the tower is founded upon piles driven very deeply, and the crib is built close against the tower on all sides. The only way in which this can be remedied is to rebuild the crib, and for this purpose an appropriation of \$10,000 is asked.

545-546. *Saint Clair Flats Canal*.—The work of protecting the lower wing of the west dike of the canal, upon which No. 545 is founded, has been completed, and the station is now in a secure condition.

547. *Fort Gratiot Light-Station, Lake Huron, Michigan*.—The greatest necessity exists for a new dwelling at this station, the one now used having been built fifty-three years ago, and is no longer worth repairing. An estimate of \$10,000 is submitted for the purpose.

— *A lake coast-light between Fort Gratiot and Point Aux Barques, Lake Huron, Michigan*.—The recommendation contained in the annual reports for several years past, for a coast-light to divide the long distance between Fort Gratiot and Point Aux Barques, is respectfully repeated. No argument seems to be necessary to show the necessity for this light, and an estimate of \$40,000 is submitted.

Port Austin, Lake Huron, Michigan.—The steps necessary to obtain the requisite site and begin the construction of the station have been taken.

549. *Tawas, (Ottawa,) Lake Huron, Michigan*.—This station was originally built on the end of Tawas Point, on the north shore of Saginaw Bay, Michigan. Since that time the point has steadily made to the southward and westward, and the extremity of it is now more than a mile from the light. No extensive repairs or improvements have been made, as the necessity for the removal of the light has long been foreseen. It is intended to guide into the harbor of Tawas, which, from its situation so near the mouth of the much-dreaded Saginaw Bay, is of great value, and much resorted to for refuge. The construction of a light on the extremity of the present point, if possible, would be quite expensive, and it is an open question whether some other disposition should not be made to meet the requirements of navigation. An estimate of \$30,000 is submitted for a light or lights to guide into Tawas Bay, Michigan, leaving the proper arrangement to future discussion.

551. *Saginaw Bay, Lake Huron, Michigan*.—The present dwelling is very old and dilapidated. It was originally built of rubble masonry, and has been repaired until no longer worth repairing. Nothing short of a new dwelling will be economical, and an estimate of \$8,000 for building one is submitted.

557. *Spectacle Reef, Lake Huron, Michigan*.—The important work at this place has been carried on during the year with all possible expedition and success. At the close of the month of June, 1872, six courses of stone had been cut and set, and the six succeeding courses had been prepared at the harbor and then transferred to the crib. Up to the 15th of August, the eleven succeeding courses of stone had been set in the tower. This brought the work up to the seventeenth course inclusive, completing the entire cut-stone masonry of the solid portion of the tower. At the close of the season of 1872, the masonry had been advanced to the setting of the fifth upper course inclusive, except one stone not delivered in time to be used, but which was subsequently received. During the month of October a cargo of stone was delivered, which completed the entire quantity of cut-stone required. The cutting of the stone had been continued at the harbor to the completion of the tenth upper course.

A severe gale in the month of September had done considerable damage, though only of a temporary character, exposing the east face of the crib where it had not been sheathed to protect it from the ice during the winter, sweeping away the temporary cribs, and nearly destroying the workmen's quarters. The quarters were rebuilt, other repairs made, and the sheathing completed as far as was intended, with the exception of the east side, which was left until the following season.

The gale which occurred on the night of the 28th of September continued during the following morning. It was from the northeast, and of unusual severity. Some idea of its violence, and the damage done, may be had from the description by the superintendent of construction, who states:

The sea burst in the doors and windows of the workmen's quarters, tore up the floors and all bunks on the side nearest the edge of the pier, carried off the walk between the privy and pier, and the privy itself, and tore up the platform between the quarters and the pier. Everything in the quarters was completely demolished, except the kitchen, which remained serviceable. The lens, showing a temporary light, and located on top of the quarters, was found intact, but out of level. Several timbers on the east side of the crib were driven in some four inches, and the temporary cribs were completely swept away. The north side is now so filled up that the steamer can no longer lie there. A stone weighing over thirty pounds was thrown across the pier, a distance of 70 feet; but the greatest feat accomplished by the gale was the moving of the revolving derrick from the northeast to the southwest corner. At 3 o'clock in the morning the men were obliged to run for their lives, and the only shelter they found was on the opposite (the west) side of the tower. The sea finally moderated sufficiently to allow them to seek refuge in the small cement shanty standing near the southeast corner of the crib. Many lost their clothing.

The position selected for the new quarters for the workmen was regarded as the most sheltered as it is inside the circular track, on the north side where the sea is not so heavy.

The temporary cribs having been carried away, the east face of the crib was left as much exposed as the others, and therefore the same protection by sheathing was required, but, owing to the lateness of the season, this could not be put on. The precaution was taken, however, to fill with stone those compartments of the crib, which have been occupied as boiler and coal rooms. The season's work at the station was brought to a close on the 31st of October, and with the exception of two men left to take care of the temporary light on the pier, the working party returned to Detroit. On the close of navigation the two men referred to were brought away, and two others left to take charge of the shore-station at Scammon's Harbor, until the ensuing spring.

During the month of April, 1873, a crane had been constructed for setting the stone in the upper courses of the tower, materials for the work had been ordered, and a working party organized and ready to leave for the site of the station. But owing to the unusually late opening of navigation through the Straits of Mackinac the workmen did not reach their destination until the 8th of May. Even at that date it was found necessary to remove great quantities of ice from the pier of protection, before work can be recommenced. The labor of cutting the stone at the depot at Scammon's Harbor was immediately resumed, and all the appliances and machinery, both at the harbor and at Spectacle Reef, were overhauled and put in working order. During the winter, the portion of the workmen's quarters remaining from the wreck caused by the gale of the previous fall, from which the temporary light had been exhibited, was carried away by the ice, and together with the lantern totally destroyed. This was not unexpected, and in view of the probable result, the lens had been removed and stored in a place of security. In the meantime, until a new tower and lantern could be built,

a light from an ordinary hand-lantern was exhibited and answered the purpose.

The fog-signal was uninjured, and was sounded as usual whenever necessary.

At the close of the month of June the cutting and fitting of the upper courses of stone had been completed to the sixteenth course inclusive. On the reef, after the erection of the crane, the setting of the sixth and seventh and the greater part of the eighth upper courses was completed. This very nearly finishes the masonry of the tower to the height of 50 feet above the water level. Various minor details connected with the work have also been completed, so that there is still hope that with a vigorous pushing of the work, and if no unforeseen obstacle occurs, it may be finished by the close of the season; or perhaps, with the exception of some of the interior details, this gratifying result may be accomplished, and, with the funds now available.

Mackinac or vicinity, Straits of Mackinac, Michigan.—The approach to the town and harbor of Mackinac from the westward is quite difficult at night. For many years a light-house to mark this approach has been recommended, but as yet no appropriation since that of 1854 (which long since reverted to the Treasury) has been made. The exact location of the desired light is somewhat in doubt, and an appropriation of \$15,000 for a light-house and fog-signal at Mackinac or vicinity, Straits of Mackinac, is respectfully recommended.

562. *Saint Helena, Michigan.*—The erection of a tower and dwelling, connected by a covered way, at this site, was begun about the middle of September, 1872, under appropriation made by act approved June 10, 1872. At the close of the season, November 9, the base of the tower and the masonry of the covered way were completed in readiness for the brick-work, and with the exception of one 6-inch course, the masonry of the main building was finished to the water-table. On the 9th of May, 1873, the work was resumed, and by the 30th of June the entire station was completed, except setting up the lens and some other minor details. Four men were left at the station to finish up, which will require but a short time.

— *Little Traverse, Lake Michigan, Michigan.*—The recommendation contained in the last annual report for a light-house and fog-signal to mark this fine harbor of refuge, and make it available at all times, is respectfully renewed. It has been proposed, however, to substitute a steam fog-signal for the bell recommended last year; if this substitution is approved, the estimate of last year must be increased to \$15,000.

— *Frankfort pier-head light.*—A pier-head light has just been erected at this place. A keeper's dwelling, at a cost of \$5,000, is recommended.

572. *Manistee, Lake Michigan, Michigan.*—The rebuilding of this station, destroyed by the great fire of October 8, 1871, was commenced in the month of July last and completed in September.

574.—*Père Marquette, Lake Michigan, Michigan.*—This station is still without a keeper's dwelling. The last two annual reports contained recommendations for an appropriation therefor, but none has yet been made. The estimate of \$5,000 for the purpose is respectfully renewed.

— *Pentwater, Lake Michigan, Michigan.*—A pier-head beacon-light has been erected at the outer end of the south pier at Pentwater, and connected with the shore by an elevated walk. The light was first exhibited on the 20th June, 1873. A keeper's dwelling at a cost of \$5,000 is recommended.

575. *Petite Point au Sable, Lake Michigan, Michigan.*—The site for

this station having been selected, and other preliminaries completed, a working party was placed on the ground and operations commenced in April last. A dock has been built for landing material, provisions, &c., and temporary buildings erected for the accommodation of the party and protection of the material. Excavations for foundations of the tower and dwelling have been made, and piles driven for the foundation of the tower. The coffer-dam has been built, the water pumped out, and all in readiness to commence laying the concrete.

576. *White River, Michigan, Lake Michigan.*—This light marks the entrance to the White River, on the banks and near the mouth of which are two thriving places, Whitehall and Montague. Very large interests, especially in lumber, are centered here, and a larger light than the present pier light should be placed here. There is therefore recommended an appropriation for a new station at a cost of \$15,000.

581. *Holland, Lake Michigan, Michigan.*—The appropriation of the necessary funds for a keeper's dwelling at this station was made by act approved June 10, 1872. The long delay in perfecting the title has, however, prevented the work being carried on at an earlier date. It will be taken in hand in a short time.

585. *Saint Josephs pier-head light, Lake Michigan, Michigan.*—The work of removing the beacon to the outer end of the pier, and the construction of an elevated walk, were brought to completion in November last.

588. *Calumet, Lake Michigan, Illinois.*—The difficulties in the way of obtaining title to the site of this station having at length been surmounted, the work of repairing and renovating the station was taken in hand during the month of May and completed before the 30th June, 1873.

589-590. *Chicago main and pier lights, Lake Michigan, Illinois.*—Cracks have developed in the foundation of the main light, and extensive repairs may be necessary. The extent of the injury can only be determined by a close examination, which will be made at as early a day as practicable. Attendance upon the pier light is very difficult in bad weather. It has been suggested to use ordinary illuminating gas, controlled from the main light, and thus avoid the necessity for visiting it when the weather is bad. It is doubtful whether such an experiment would be successful, since it failed under less unfavorable circumstances at Cleveland, because of condensation and freezing.

591. *Grosse Point, Lake Michigan, Illinois.*—Proposals for the construction of a second-order station at this point were invited by advertisement, and opened on the 13th August, 1872. The lowest bid was accepted, and articles of agreement were duly entered into. The work of excavation for the foundations of the tower, covered way, and dwelling, was commenced in September, and by the close of the season's work in November, the stone-work of the dwelling had been brought up to the grade, and the drains partially made. After some vexatious delays, attributed by the contractor to the inclemency of the weather, work was suspended for the winter, except the delivery of material. In April work was resumed, and during this month and the month of May good progress was made, the piles having been driven and the concrete laid for the foundation of the tower and the stone-work begun, while the brick-work of the dwelling was carried nearly to completion, as well as the roofs of the verandas, kitchens, and woodsheds, and a portion of the roof of the main building. By the 30th June, the tower was completed as far as the setting of the last course of the water-table, the passage-way and the oil-room finished to the roof, and the outside of dwelling nearly completed, having received one coat of paint. The blinds were all hung, the upper floors laid, the ceilings lathed, and the partitions of the main stairs built, and all the drains completed.

— *Racine Point, Lake Michigan, Wisconsin.*—The recommendation contained in the last three annual reports, that a lake coast-light and fog-signal be established on Racine Point is respectfully renewed, and an estimate of \$40,000 submitted therefor. This work is much needed, not only to satisfy the demands of the general commerce of Lake Michigan, but to aid in indicating the position of a very dangerous outlying reef upon which several wrecks have occurred.

596. *Racine pier-head light, Lake Michigan, Wisconsin.*—The erection of a pier-head beacon, and elevated walk to connect it with the shore, was begun in July, 1872, and a light exhibited for the first time on the 5th of September following.

597. *Milwaukee pier-head light, Lake Michigan, Wisconsin.*—The work of erecting a beacon at the outer end of the north pier, at the harbor of Milwaukee, and connecting it with the former beacon, was commenced in August, 1872. The beacon was completed and a light exhibited from it on the evening of October 30, and the elevated walk was finished in November.

— *Twin River Point, Lake Michigan, Wisconsin.*—The requisite site for a light-house at this point has been selected, and all the preliminaries completed. As soon as the title to the site has been perfected, which will doubtless soon be done, the construction of the buildings will be commenced, and completed as soon as possible.

— *Sturgeon Bay ship-canal, Lake Michigan, Wisconsin.*—At the Lake Michigan end of this important work a light and fog-signal should be established. The canal is being pushed vigorously, and there is no doubt that it will be completed as soon as a light-house can be built; and an appropriation of \$40,000 for the purpose is recommended.

— *North Bay, Lake Michigan, Wisconsin.*—By act of Congress approved July 15, 1870, an appropriation of \$7,500 was made for the purpose of establishing a light or lights to enable vessels to enter this harbor, and a price for the site required was agreed upon with the owner. But it was found impracticable for him to make a good title before the 30th of the following June, when the appropriation reverted to the Treasury. It is recommended that the amount be re-appropriated, and another attempt made to obtain title.

— *Poverty Island, Lake Michigan, Michigan.*—All the requisite preliminaries have been completed, and the erection of a light-house at this point, under the act of March 3, 1873, will be commenced before the close of this season.

614 and 615. *Grassy Island, Green Bay, Wisconsin.*—Both beacons, as well as the walk connecting them, were completed in October, 1872, and lighted for the first time November 15.

619. *Big Sable, Lake Superior, Michigan.*—The site has been selected, title obtained, plans approved by the board, and the construction of the buildings will be begun early in July of this year, and completed as soon as possible.

— *Stannard's Rock, Lake Superior, Michigan.*—Preparations are being made to begin the survey and examinations provided for at this place by act of March 3, 1873, and the survey will be completed as soon as possible. There can be no doubt as to the practicability of building a light-house to mark this dangerous rock, and it can be done now cheaper than at any future time, as the costly apparatus and machinery used at Spectacle Reef is now available for use elsewhere, and being especially adapted to works such as this must be can be at once transferred. The rock is nearly twenty miles distant from the nearest land, and forty from a suitable harbor, and the tower will probably be located

in water of about 11 feet in depth, facts which indicate a structure of the most substantial and costly kind known in light-house engineering. Because of the uncertainties attending such a construction, no detailed estimate of the probable cost can be given, but it is perfectly safe to say that it will not be less than \$300,000. Large as this sum appears to be, it is believed that the outlay is fully warranted by the necessities of the Lake Superior navigation, and an appropriation of \$200,000 is recommended with which to begin the work.

— *L'Anse, Lake Superior, Michigan.*—The site of the proposed light-house at this place, provided for by act approved March 3, 1873, has been selected, and the owners have promised to perfect the title as soon as possible, after which no unnecessary delay will take place in erecting the requisite structures and exhibiting the light.

Eagle Harbor, Lake Superior, Michigan.—The attention of the board has been called by the Chief of Engineers of the Army to the necessity of range lights to enter this harbor, and it will take early steps to determine the amount necessary for the purpose.

— *Portage Lake Ship-Canal, Lake Superior, Michigan.*—As soon as the title to the site required has been conveyed to the United States the construction of the buildings will be commenced and the light established as soon as possible, an appropriation having been made for the purpose.

— *Outer Island, Lake Superior, Wisconsin.*—Under the appropriation made by act of March 3, 1873, the construction of the building required at this new station will be begun during the present season and pushed to completion as soon as possible.

— *Sand Island, Lake Superior, Wisconsin.*—The remarks of last year's report concerning the necessity for a light-house on this island, and the estimates therefor, are respectfully renewed.

642. *Du Luth, Lake Superior, Minnesota.*—After much delay the keeper's dwelling and as much of the elevated walk as can be built at present were completed during the month of May. Owing to the damage sustained by the pier in a storm, last fall, it is not in fit condition to receive the beacon, and work has been suspended until the repairs to the pier are completed, when the contractor will be required to finish the beacon. Meanwhile a temporary light is exhibited from the outer end of the north pier of the canal.

— *Rock Harbor, (Isle Royale,) Lake Superior, Michigan.*—The necessary examinations and measurements of the old tower and other buildings at this station have been made with a view to their renovation, and the re-establishment of the light. The act of March 3, 1873, provides "for a light-house on Isle Royale, Lake Superior." The site for this has not yet been selected, but the matter will receive attention as soon as the isolated locality can be reached.

— *Passage Island, Lake Superior, Michigan.*—The annual report for the last two years has contained a recommendation for a light-house on Passage Island, together with an estimate of cost, but no appropriation has yet been made. The recommendation and estimate (\$18,000) are respectfully renewed. Some arguments have been advanced to show that the appropriation for a light-house on Isle Royale might be used for the purpose, but with these the board does not agree, as Passage Island is an entirely distinct island, at a distance of three and one-half miles from the most easterly point of Isle Royale.

PIER-HEAD LIGHTS.

The work of establishing pier-head lights is being continued as rapidly as circumstances permit. As the erection of these lights depends upon the extension of the harbor improvements it is not practicable to make an estimate in detail, but the amount of \$15,000 in the aggregate will certainly be required in this district for this purpose.

REPAIRS.

Repairs of greater or less extent have been made or are in process of execution at the following stations:

545. *Saint Clair Flats Canal*, (lower light.)

547. *Fort Gratiot*.

548. *Point aux Barques*.

549. *Tawas*, (Ottawa.)

551. *Saginaw Bay*.

553. *Thunder Bay Island*.

554. } *Presque Isle Ranges*.

555. }

556. *Presque Isle*.

558. *Detour*.

—, *Detour Fog-Signal*.

559. *Bois Blanc*.

560. *Sheboygan*.

563. *Waugoshance*.

564. *Skilligallee*.

569. *Mission Point*.

572. *Manistee*.

576. *White River*.

584. *Saint Joseph*.

586. *Michigan City*.

588. *Calumet*.

589. *Chicago*.

593. *Kenosha*.

610. *Eagle Bluff*.

611. *Chamber's Island*.

613. *Tail Point*.

617. *Point Iroquois*.

618. *White Fish Point*.

—, *White Fish Point Fog-Signal*.

624. *Marquette*.

635. *Eagle Harbor*.

639. *La Pointe*.

641. *Minnesota Point*.

Repairs and improvements are required at the following stations and will be made during the ensuing year:

548. *Point aux Barques*.

550. *Charity Island*.

553. *Thunder Bay Island*.

554. } *Presque Isle Ranges*.

555. }

556. *Presque Isle*.

558. *Detour*.

559. *Bois Blanc*.

560. *Cheboygan*.

561. *McGulpin's Point*.

- 566. *Beaver Island.*
- 569. *Mission Point.*
- 570. *South Manitou.*
- 577. *Muskegon.*
- 581. *Holland.*
- 590. *Chicago Beacon.*
- 606. *Port du Mort.*
- 609. *Escanaba.*
- 613. *Tail Point.*
- 617. *Point Iroquois.*
- 620. *Grand Island.*
- 621. *Grand Island Harbor.*
- 622. } *Grand Island Harbor Ranges*
- 623. }
- 628. } *Portage Ranges.*
- 629. }
- 631. *Gull Island.*
- 637. *Ontonagon.*
- 638. *Michigan Island.*
- 639. *La Pointe.*

BUOYS.

Buoys marking the channel in Detroit and Saint Clair Rivers, and buoys marking the dangers to navigation in the Straits of Mackinac and adjacent waters, are regularly attended to by the light-house and buoy tender Haze, placing them on the opening of navigation each year and removing them at the close, stowing the buoys belonging to the Straits of Mackinac and adjacent waters at light-house depot, Scammon's Harbor, and those belonging to Detroit River and Straits of Saint Clair at light-house depot, Detroit. All other buoys in the district are attended by contract.

DEPOT.

Under the act of June 10, 1872, the work on the light-house depot at Detroit has progressed during the year. A dwelling for the store-keeper was built and inclosed by a fence, and is occupied. A board fence was erected along the western side of the basin, between that and the adjoining glue-factory. Towards the close of last season the walls of the third story of the store-house were finished to receive the brackets, and covered with a temporary roof to protect it from the weather while operations were suspended for the winter.

In April, 1873, the work was resumed, the temporary roof removed, and the construction of the fire-proof roof of iron and slate carried to completion. Floors of wood were laid in some of the rooms, great care being exercised to see that the space between them and the supporting arches was completely filled with sand well rammed in. The landing-pier is completely worn out. It has been repaired until the supporting piles are no longer safe. No heavy weight can now be landed upon it, and an appropriation of \$8,000 for building is urgently recommended. The supply of oil for the entire lake region is landed at this depot, and as the system of lights on the lakes increases, the importance of this depot increases. Designed less than five years ago, upon a scale which was then deemed ample, it is already apparent that some extension of the buildings and conveniences will be required before many years, in order to secure all the benefits of the depot.

FOG-SIGNALS.

The five steam fog-signals which have been in use in the district during the year have given great satisfaction. Five more have been ordered for points, as follows: Marquette, Skillagallee, Manitou Island, Outer Island, and Huron Island.

Similar signals are needed at the following points, viz: McGulpin's Point, Grand Haven, Port du Mort, Pottawatomie, Gull Rock, and Granite Island; and an appropriation of \$25,000 for the purpose of establishing them is recommended.

TENDERS.

As previously reported, the Haze, (screw-steamer,) used as a supply-vessel for both the lake districts and buoy-tender for a portion of the eleventh district, is old and nearly worn out. For the last two years she has been used solely for inspection, delivering supplies, and in taking care of the larger buoys of the eleventh district. She has a very light frame, and it is not deemed best to recommend any extensive repairs. She was not built for the light-house service, but was purchased in an emergency; and while of excellent model and great economy in consumption of fuel, has a light frame, and has deteriorated to such an extent that it is recommended she be rebuilt; and for this purpose an appropriation of \$30,000 is respectfully recommended.

SURVEYS OF LIGHT-HOUSE SITES.

The pressure of other duties has prevented as rapid a prosecution of this work as is desirable. The surveys completed since last report are Tawas, (Ottawa Point,) Saint Joseph, and Holland. In addition, a number of preliminary surveys, in connection with light-houses now building or to be built, have been made. It is intended to continue the work in accordance with a settled plan of the Board as rapidly as practicable.

[15.]

TWELFTH DISTRICT.

CALIFORNIA.

This district embraces all aids to navigation on the Pacific coast of the United States between the Mexican frontier and the southern boundary of Oregon, and includes the coast of California.

Inspector.—Commander Charles J. McDougal, United States Navy, until December 1, 1872; Capt. James H. Spotts, United States Navy, present inspector.

Engineer.—Maj. N. Michler, Corps of Engineers, brevet brigadier-general, United States Army.

In this district there are—

Light-houses and lighted beacons	16
Light-houses finished and lighted during the year ending July 1, 1873.....	1
Light-houses for which appropriations were available, but which were not finished on the 1st of July, 1873	5
Light-ships	0
Fog-signals, operated by steam or hot-air engines.....	6
Day or unlighted beacons.....	1
Buoys actually in position.....	40
Spare buoys for relief and to supply losses.....	26
Tender Shubrick, common to twelfth and thirteenth districts, used for inspectors' and engineers' purposes.....	1

The numbers preceding the names of stations correspond with those of the "Light-House List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1873.

421. *Point Fermin, on west side of San Pedro Bay, California.*—A site was selected and a reservation laid off for a light-house. Proceedings have been instituted by the United States attorney, district of California, for the purpose of condemning, under the laws of said State, the land upon which to build; but as yet no result has been reached. An appropriation, made June 10, 1872, of \$20,000, is available for the establishment of a light and fog-signal at this point.

422. *Point Hueneme, entrance to the Santa Barbara Channel, California.*—As in the preceding case proceedings of condemnation of the site selected and surveyed are still progressing. An appropriation, made June 10, 1872, of \$22,000, is available for constructing a light-house at this locality.

425. *Piedras Blancas, sea-coast of California.*—An appropriation, made June 10, 1872, of \$75,000, is available for a first-order light and fog-signal at this point. A detailed survey during the early part of this year was made, and a map prepared of the locality; the height of which differing from previous information of the Board, necessitated a change in the design, which was published in the last annual report of the Board.

426. *Point Pinos, sea-coast of California.*—No information has been furnished this Office in regard to the decision of the Supreme Court in the case of the suit for condemnation of land for right of way to the light-house at this station, and which was referred to in the last annual report.

429. *Pigeon Point, sea-coast of California.*—The work on the light-house at this station was resumed in July, 1872, and completed in October. It was illuminated for the first time on the 15th of November, 1872.

— *Point Montara, sea-coast of California.*—This Point is about midway between Pigeon Point and the Golden Gate, and within a few miles of Point San Pedro. An appropriation of \$15,000 is available for a steam fog-signal here. The locality was examined and a site selected; a survey of the latter was made, and the map is being prepared by the district engineer.

434. *East Brother Island, San Pablo Bay, California, opposite Point San Pablo.*—In consequence of the apparent increasing litigation to gain possession of a site on the main-land for light-house purposes, an examination was made of the East Brother Island to ascertain if it would be a suitable locality. A special report was made by the district officers in regard to its advantages, and the selection was approved by the Board. Proposals were invited for building a light-house and a fog-signal building; for making the necessary excavations, and executing the grading; also, for building a retaining-wall. The lowest bid was accepted, and the work was commenced near the end of July.

435. *Mare Island, entrance to Straits of Karquines.*—The light-house of this station was completed by the 15th of July, although it was not quite ready for lighting at that date. An attempt was made to obtain water by digging a well, but without success. The point south of the dwelling was cut down and graded, a retaining-wall, built of rock to above high-water mark, forming a plateau for fog-signal. Inclines have been constructed from this plateau and from the plane of the dwelling to the boat-landing; windlasses, provided with turn-table and car, were set up on each. The erection of the necessary building for the fog-bell, and the sinking of a well for the weight of the machinery, still remains

to be done. A substantial picket-fence has been erected along the lines of the light-house reservation from the precipitous bluff on the east to that on the west.

436. *Point Reyes, sea-coast of California.*—An appropriation of \$10,000 was made June 10, 1872, for rebuilding and re-establishing the steam fog-signal at this station. Men and material were shipped on board the tender Fern and landed at Drake's Bay, for the purpose of erecting a new building and constructing a new coal-chute. Machinists were also sent to repair the machinery, which had suffered much damage. Large shelving pieces of rock and boulders had to be removed by drilling and blasting. The cistern requires to be cemented; cracks in the watershed, supposed to have been caused by an earthquake, had also to be closed up; the old retaining-wall had to be pulled down and rebuilt from the foundation. Owing to the constantly shifting sand around the dwelling, it became necessary to cover the surface around it with boards. The fog-signal could not be put in operation until a sufficiency of water had been collected in the cistern after the commencement of the rainy season.

Fort Ross, sea-coast of California, midway between Point Reyes and Point Arena.—In June an attempt was made to examine a reservation for a light-house, which many years ago was made by the President, but owing to the dangerous anchorage it was not deemed safe to remain at anchor a sufficient length of time to accomplish that object. Another attempt will be made by an overland route.

437. *Point Arena, sea-coast of California.*—On the 27th of June the light-station at this point was inspected, and by direction of the board an examination of the reservation was made to ascertain whether the amount of land reserved by the President at Point Arena is in excess of the wants of the light-house service.

Mendocino City, Bay of Mendocino, California.—By direction of the board examinations for light-house purposes were made at the "south point of entrance to the harbor of Mendocino City," and of a "point four and a half miles to northward of Mendocino City," surveys have been made of the localities; the necessary maps will be prepared and a special report made in regard to both.

Shelter Cove, sea-coast of California, forty-five miles north of the Bay of Mendocino.—In June an attempt was made to land at this point to examine a proposed light-house site, but a heavy swell made it too dangerous to attempt a landing.

438. *Cape Mendocino, sea-coast of California.*—There is a settlement of the ground, caused by an earthquake, in the ravine to the north of the tower, the limits of which are well defined by a continuous crack in the earth. The south line of this crack passes through one end of the cement retaining-wall and within 15 feet of the tower; this has been filled up with concrete and well rammed. Granite posts were cut and sent there to be planted at the corners of the reservation to mark its limits. A suit, *Buhue vs. Chism*, to eject the light-house keepers at this station—a suit involving the title to the site—was decided on the 10th of October in favor of the United States.

439. *Humboldt, sea coast of California, entrance to Humboldt Bay.*—An appropriation of \$10,000 is available for a steam fog-signal at the entrance to Humboldt Bay, and the district officers have selected a site on the present reservation.

REPAIRS.

At each of the following named stations repairs more or less extensive have been made during the year:

- 420. *Point Lima*.—Sea-coast of California.
 - 423. *Santa Barbara*.—Sea-coast of California.
 - 424. *Point Conception*.—Sea-coast of California.
 - 426. *Point Pinos*.—Sea-coast of California.
 - 428. *Ano Nuevo*.—Sea-coast of California.
 - 437. *Point Arena*.—Sea-coast of California.
 - 438. *Point Mendocino*.—Sea-coast of California.
 - 427. *Santa Cruz*.—Sea-coast of California, entrance to Monterey Bay.
 - 431. *Point Bonita*.—Sea-coast of California, north side of the Golden Gate.
 - 439. *Humboldt*.—Sea-coast of California, entrance to Humboldt Bay.
 - 430. *Faralones*.—Off the Golden Gate, entrance to San Francisco Bay, California.
 - 432. *Fort Point*.—San Francisco Bay, California.
 - 433. *Alcatraz Island*.—San Francisco Bay, California.
- The following are the names of light-stations in the twelfth district which are not mentioned elsewhere in this report:
- 440. *Humboldt Bar Bell-Boat*.—Off entrance to Humboldt Bay.
 - 441. *Trinidad Head*.—Sea-coast of California.
 - 442. *Crescent City*.—Crescent City Harbor, California.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- Point Conception*.—A 12-inch steam-whistle.
- Ano Nuevo Island*.—A 12-inch steam-whistle.
- Pigeon Point*.—A 12-inch steam-whistle.
- Point Reyes*.—A 12-inch steam-whistle.
- Point Area*.—A 12-inch steam-whistle.
- Point Montara*.—A 12-inch steam-whistle, (to be erected.)
- Humboldt Bay*.—A 12-inch steam-whistle, (to be erected.)
- East Brother Island*.—A 10-inch steam-whistle, (to be erected.)
- Point Bonita*.—A first-order steam-siren.

DAY OR UNLIGHTED BEACONS.

Fauntleroy Rock.—Crescent City Harbor, California.

The setting of the spindle for the day beacon in the Fauntleroy Wash Rock in the roadstead, off the town of Crescent City, was completed during the year.

BUOYS.

The buoyage of the twelfth district is in excellent condition.

DEPOT.

Yerba Buena Depot, San Francisco Bay, California.—A light-house depot on this island has been completed with the exception of placing the derrick in position; this will be done when the latter is received from the East. The wharf has been constructed and a railway laid upon it; the piles, previous to being driven, having been subjected to the Robbins creosote process for preservation. A watchman's house and a large store-house have been built adjoining the main building.

THIRTEENTH DISTRICT.

This district embraces all aids to navigation on the Pacific coast of the United States north of the southern boundary of Oregon. It extends from the forty-first parallel of latitude to British Columbia, and includes the coasts of Oregon and Washington Territory.

Inspector.—Commander Charles J. McDougal, United States Navy, until December 1, 1872; Capt. James H. Spotts, United States Navy, present inspector.

Engineer.—Maj. H. M. Robert, Corps of Engineers, United States Army.

In this district there are—

Light-houses and lighted beacons	10
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1873.....	0
Light-houses for which appropriations were available but which were not finished on the 1st of July, 1873.....	3
Light-ships	0
Fog-signals, operated by steam or hot-air engine.....	1
Unlighted or day beacons.....	0
Buoys actually in position.....	49
Spare buoys for relief and to supply losses.....	23
Tender (steam) Shubrick, common to the twelfth and thirteenth districts.....	1

The following numbers which precede the names of stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1873.

446. *Cape Foulweather, sea-coast of Oregon.*—The keeper's dwelling was completed in September, 1872. Notwithstanding the delays connected with transportation, the light-house would have been completed and the light exhibited as early as January, 1873, but for the fact that a part of the lantern had been lost at sea in transportation from the East, a fact not discovered in time to prevent the delay. Duplicates of the missing pieces have at length been received, and the light will be exhibited on the 20th of August, 1873.

— *Point Adams, south side of the entrance to Columbia River, Oregon.*—The site for the light-house and steam fog-signal to be erected at this place has been selected by the district officers. The plans have been prepared and the machinery has been shipped from the East. The fog-signal may be in operation by early spring of 1874, and the light exhibited by November following.

447. *Cape Disappointment, mouth of Columbia River, Territory of Washington.*—A neat substantial oil-house has been erected at this station during the past year to take the place of the old oil-house, which was useless.

449. *Cape Flattery, entrance to the Straits of Fuca.*—The entire dwelling needs renewal, except walls and roof. One house-cistern needs rebuilding; the light-house buildings should be inclosed by a fence; a dry store-room should be built; a boat, boatways, and tramway are required to enable keepers to safely and conveniently land supplies. Estimated cost of above repairs, \$5,000.

The present dwelling is not fit to be occupied, as the walls are damp and moldy nearly all the year, and it is totally inadequate for the accommodation of the four keepers at this station. A comfortable dwelling, similar to those at Cape Disappointment and Cape Foulweather, is greatly needed, and it would enable a better class of keepers to be retained here than would be willing to occupy the present dwelling. If a dwelling were erected, the old dwelling, without extensive repairs, would

serve as store-room, and \$18,000 would provide for necessary repairs (as above) and double dwelling for keepers.

451. *New Dungeness, Territory of Washington.*—A steam fog-whistle will be erected this season to replace the fog-bell.

— *A light in Puget Sound.*—Congress at its last session appropriated \$25,000 for a light at Point-no-Point, Territory of Washington, or such other point in Puget Sound as the Light-House Board might select. A report has been received from the district officers, recommending a site on Foulweather Bluff entrance to Hood's Canal, but the board have not yet determined in regard to it.

REPAIRS.

Repairs more or less extensive have been made at the following-named stations during the year:

449. *Cape Flattery*, entrance to the Straits of Fuca.

450. *Ediz Hook*, Straits of Fuca, Territory of Washington.

451. *New Dungeness*, Straits of Fuca, Territory of Washington.

453. *Admiralty Head*, east side of Admiralty Inlet, Territory of Washington.

Stations at which repairs are required to be made during the next year:

450. *Ediz Hook*, Straits of Fuca, Territory of Washington.

452. *Smith's or Blunt's Island*, inside the Straits of Fuca, Territory of Washington.

453. *Admiralty Head*, Admiralty Inlet, Territory of Washington.

The following are the names of light-stations in the thirteenth district, not mentioned elsewhere:

443. *Cape Blanco*, sea-coast of Oregon.

444. *Cape Arago*, (Gregory,) sea-coast of Oregon.

445. *Yaquina Bay*, Oregon.

448. *Shoalwater Bay*, Territory of Washington.

LIGHT-SHIPS.

There are no light-ships in this district.

DAY OR UNLIGHTED BEACONS.

Sand Island, mouth of Columbia River, Oregon.—An unlighted beacon, for which \$1,000 will be required, is needed at this point, as the low beach and shifting nature of the island render it somewhat dangerous in hazy or foggy weather.

— *Silvie de Grace Rock, about two miles above Astoria, Oregon, near the south shore of Columbia River.*—The channel of the Columbia is quite narrow at this point and the current rapid. Vessels must run close to this rock to keep the channel, and the position of the rock has heretofore been shown by the wreck of the *Silvie de Grace*, now nearly destroyed. The erection of a permanent unlighted beacon, at a probable expense of \$2,000, is recommended.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

Cape Flattery.—A 12-inch steam-whistle.

674

REPORT ON THE FINANCES.

BUOYS.

The buoyage of this district is in good condition.

DEPOT.

The construction of a buoy-depot at the mouth of the Columbia has been urged by the district officers. The buoys are now kept on an open wharf, at Astoria, where they are exposed to the weather and other causes of injury, and where the interruption by rain of painting is liable to detain the light-house tender. A project has been made for a depot large enough to provide for all storage and repairs under shelter.

JOSEPH HENRY,

Chairman.

REPORT OF THE LIGHT-HOUSE BOARD.

LIGHT-HOUSE BOARD OF THE UNITED STATES.

(Organized in conformity to the act of Congress approved August 31, 1852.)

LIST OF MEMBERS.

Hon. BENJAMIN H. BRISTOW, Secretary of the Treasury, *ex-officio* President.
 Prof. JOSEPH HENRY, LL. D., Secretary Smithsonian Institution.
 Commodore ALEXANDER MURRAY, United States Navy.
 Col. J. G. BARNARD, United States Engineer Corps, brevet major-general United States Army.
 CARLISLE P. PATTERSON, Esq., Superintendent of the Coast Survey.
 Capt. JOHN LEE DAVIS, United States Navy.
 Maj. ORLANDO M. POE, United States Engineer Corps, (colonel and aid-de-camp,) brevet brigadier-general United States Army.
 Commander JOHN G. WALKER, United States Navy.
 Maj. PETER C. HAINS, United States Corps of Engineers,
 brevet lieutenant-colonel United States Army.

MEMBERS OF THE BOARD EMPLOYED IN THE OFFICE.

Prof. JOSEPH HENRY, Secretary Smithsonian Institution, Chairman.
 Commander JOHN G. WALKER, United States Navy, Naval Secretary.
 Maj. PETER C. HAINS, United States Corps of Engineers, Engineer Secretary

CLERKS.

Arnold B. Johnson, Chief Clerk.

Frank Baker.	Zach B. Brooke.
Bruce Small.	Albert H. Sawyer.
Mrs. E. J. Beare.	

Paul J. Pelz, Chief Draughtsman.

CLERKS TEMPORARILY DETAILED FROM OTHER OFFICES

E. P. Rankin.	Henry Kalussowski.
E. L. Beach.	Edgar K. Whitaker.
Miss M. F. Poor.	Miss H. M. Séron.
Miss C. A. Burghardt.	

LIST OF OFFICERS IN CHARGE OF LIGHT-HOUSE DISTRICTS.

FIRST DISTRICT.—Commander W. N. Allen, United States Navy, inspector, Portland, Me.; Lieut. Col. J. C. Duane, United States Corps of Engineers, brevet brigadier-general United States Army, engineer, Portland, Me.

SECOND DISTRICT.—Commander G. H. Perkins, United States Navy, inspector, Boston, Mass.; Lieut. Col. J. C. Duane, United States Corps of Engineers, brevet brigadier-general United States Army, engineer, Portland, Me.

THIRD DISTRICT.—Commodore Stephen Decatur Trencharé, United States Navy, inspector, Tompkinsville, Staten Island, New York; Col. I. C. Woodruff, United States Corps of Engineers, brevet brigadier-general United States Army, engineer, Tompkinsville, Staten Island, New York.

FOURTH DISTRICT.—Commander G. B. White, United States Navy, inspector, Philadelphia, Pa.; Lieut. Col. William F. Reynolds, United States Corps of Engineers, brevet brigadier-general United States Army, engineer, Philadelphia, Pa.

FIFTH DISTRICT.—Commander F. H. Baker, United States Navy, inspector, Norfolk, Va.; Maj. Franklin Harwood, United States Corps of Engineers, brevet lieutenant-colonel United States Army, engineer, Baltimore, Md.

SIXTH DISTRICT.—Commander C. S. Norton, United States Navy, inspector, Charleston, S. C.; Maj. Franklin Harwood, United States Corps of Engineers, brevet lieutenant-colonel United States Army, engineer, Baltimore, Md.

SEVENTH DISTRICT.—Commander H. B. Seely, United States Navy, inspector, Key West, Fla.; Maj. Jared A. Smith, United States Corps of Engineers, United States Army, engineer, Key West, Fla.

REPORT ON THE FINANCES.

EIGHTH DISTRICT.—Commander Robert Boyd, jr., United States Navy, inspector, New Orleans, La.; Capt. Andrew N. Damrell, United States Corps of Engineers, brevet brigadier-general United States Army, engineer, Mobile, Ala.

TENTH DISTRICT.—Commander Edward E. Potter, United States Navy, inspector, Buffalo, N. Y.; Lieut. Col. C. E. Blunt, United States Corps of Engineers, brevet colonel United States Army, engineer, Buffalo, N. Y.

ELEVENTH DISTRICT.—Commander W. P. McCaun, United States Navy, inspector, Detroit, Mich.; Maj. Godfrey Weitzel, United States Corps of Engineers, brevet major-general United States Army, engineer of eleventh district, except Lake Michigan and Green Bay; Maj. Henry M. Robert, United States Corps of Engineers, engineer for that part of eleventh district embracing Lake Michigan and Green Bay.

TWELFTH DISTRICT.—Commodore J. H. Spotts, United States Navy, inspector, San Francisco, Cal.; Lieut. Col. Robert S. Williamson, United States Corps of Engineers, United States Army, engineer, San Francisco, Cal.

THIRTEENTH DISTRICT.—Commodore J. H. Spotts, United States Navy, inspector, San Francisco, Cal.; Maj. N. Michler, United States Corps of Engineers, brevet brigadier-general United States Army, engineer, Portland, Oregon.

FOURTEENTH DISTRICT.—Commander Joseph E. Fyffe, United States Navy, inspector, Cincinnati, Ohio; Maj. William E. Merrill, United States Corps of Engineers, brevet colonel United States Army, engineer, Cincinnati, Ohio.

FIFTEENTH DISTRICT.—Commander R. R. Wallace, United States Navy, inspector, Saint Louis, Mo.; Maj. Charles R. Suter, United States Corps of Engineers, United States Army, engineer, Saint Louis, Mo.

REPORT

OF

THE UNITED STATES LIGHT-HOUSE BOARD.

TREASURY DEPARTMENT,
OFFICE OF THE LIGHT-HOUSE BOARD,
Washington, September 1, 1874.

SIR: We have the honor to transmit herewith the annual report of the Light-House Board for the fiscal year ending June 30, 1874.

Very respectfully, your obedient servant,
JOSEPH HENRY,
Chairman.

J. G. WALKER,
Commander U. S. N., Naval Secretary.

PETER C. HAINS,
Major of Engineers, U. S. A., Engineer Secretary.

TREASURY DEPARTMENT,
OFFICE OF THE LIGHT-HOUSE BOARD,
Washington, September 1, 1874.

Hon. B. H. BRISTOW,
Secretary of the Treasury.

SIR: The following is the report of the operations of the Light-House Board during the year ending 30th June, 1874:

INTRODUCTION.

Before entering upon the details of these operations, it is thought advisable to give some general statements as to the organization, character, and history of the establishment, necessary to be kept in mind by Congress, and which may be interesting to the general public.

Nothing marks more distinctly the stage of civilization to which any nation has attained than the character of the aids to safety which it furnishes the mariner in approaching and leaving its shores. It is not alone in its economical aspect that a light-house system is to be regarded; it is a life-preserving establishment founded on the principles of Christian benevolence, of which none can so well appreciate the importance as he who, after having been exposed to the perils of the ocean, it may be for months, finds himself approaching in the darkness of night a lee-shore. But it is not enough to erect towers and establish other signals; they must be maintained in an efficient state with uninterrupted constancy. A failure of a single light-tower to send forth its expected ray may allure the confiding mariner to an untimely death or disastrous shipwreck. In view of these facts, our Government early resolved to establish and

maintain a light-house system which should be commensurate with the wants of our increasing commerce and the unrivaled resources of the country.

At the commencement of our Government, the principles of light-house illumination were in an undeveloped condition, and it was not until the investigations of Fresnel and Arago, in France, and the labors of Smeaton and the elder Stephenson, in Great Britain, that they were brought into a strictly scientific condition.

Wood and coal were at first used as fuel for lights. They were burned as beacon-fires on headlands, and afterward, as the necessity for increased elevation was felt, they were placed on the tops of towers. Smeaton introduced the use of wax candles in the Eddystone light-house; and the invention of the Argand lamp in 1789, consisting of a series of concentric wicks with an air-passage through the middle and between each wick, furnished the means of a more brilliant light, the effect of which was further increased by parabolic reflectors.

In the United States, the first light-houses were illuminated by tallow candles and solid-wick lamps suspended by iron chains from the dome of the lantern. The Argand burners and reflectors were adopted in 1812, and were used until the organization of the present Light-House Board, shortly after which they were superseded by the Fresnel apparatus.

Previous to the present organization of the Board, the light-houses and other aids to navigation of the United States were under the charge of one of the Auditors of the Treasury Department, and the furnishing of plans and the constructing of light-houses were intrusted to temporary agents.

In 1845, a commission was sent to Europe to inquire into the most improved light-house system; the chairman of which, Lieutenant (now Rear-Admiral) Jenkins of the United States Navy, made an exhaustive report on the subject which was the basis of the improved system afterward introduced.

In 1851, a provisional board was appointed by the Government to investigate the condition of our light-house system, and on the report of this board the organization now in use was adopted. In accordance with this organization, the whole coast of the United States is divided into districts, to each of which is assigned an officer of the Navy and an officer of Engineers; the duty of the first being to inspect, at stated periods, the condition of the lights, buoys, &c., to furnish supplies, and to give information as to the necessity for repairs; that of the second, to make repairs, to furnish information as to new sites and designs for new structures, to be submitted afterward to the Light-House Board, which has the direction of all the operations of the establishment.

The Light-House Board consists of two officers of the Navy, two engineer officers of the Army, and two scientific civilians, with the addition of an officer of the Navy and an engineer officer of the Army, who are also the secretaries.

This organization was adopted after mature deliberation. Its theory is exceedingly simple: In the several districts the engineer officer builds the light-houses under the direction of the Board, fits them up with all the necessary apparatus, and then turns them over, with the exception of subsequent repairs, to the naval officer, who is responsible for their faithful performance as aids to navigation. He furnishes the burning and other materials, visits them from time to time, instructs the keepers in their duty, and enforces the rules which have been adopted. He has charge, also, of buoys, beacons, and light-vessels. The duties of the

two classes of officers are so distinctly marked that there never need be any dispute as to the relative jurisdiction.

As to the several classes of members of the Board, as well as the officers of the districts, they are chosen with special reference to their fitness, from professional education and practical skill, to discharge the multifarious and important duties connected with the light-house service. The experience of the naval officer is required to assist in deciding upon special localities at which signals are required, to enforce the discipline to which the keepers are subjected, and by frequent inspection to insure the Board that all parts of the system are in proper working order. Engineering knowledge and skill of the highest character are required for devising means and executing plans for the construction of light-houses of the most durable character, and in exposed and dangerous positions. The services of the two civilians, one of whom is the Superintendent of the Coast-Survey, and the other the Director of the Smithsonian Institution, are important—the first in furnishing special surveys for marking channels, shoals, &c., and the other for the investigation of scientific problems connected with aids to navigation.

The law of Congress establishing this organization makes no distinction as to rank in the several classes of members of the Board; no one of them, therefore, can claim precedence over another; and furthermore, in order that they may act in harmonious equality, the whole system is placed, not under the Secretary of the Navy nor of the Army, but, as in the case of the Coast-Survey, under the Secretary of the Treasury, the head of a neutral Department. Hence, all discussions as to precedence other than those which arise from a laudable zeal in the faithful discharge of the specified duties of the several classes, are out of place in the deliberations of the Board.

Under the system we have described an amount of work has been done which will compare favorably in quality, quantity, and economy with that of any other system in existence, and toward this result each class of members of the establishment have been contributors. To the Navy belongs the credit of the report of Admiral Jenkins relative to the French system, and principally its introduction into this country through his untiring industry and great executive ability; and also to the Navy is due the planning of light-ships, the laborious inspection of lights, and the placing of buoys in tempestuous weather, frequently at the peril of life. To the Army belongs the credit of the erection of light-houses, such as that of Minot's Ledge, on a sunken rock, exposed to the full force of the Atlantic gales, and inaccessible except for a few hours during each lunation; of Spectacle Reef, in the deep water of Lake Huron, of which the foundation was laid by means of an immense coffer-dam; of Carysfort Reef, in the open ocean, six and one-half miles from land; of Alligator Reef, three and one-half miles from the shore; and of a series of others in dangerous and difficult positions which may challenge comparison with any work of a similar kind elsewhere constructed. Nor have the two civilians of the board been wanting in zeal for the service. They have each given from the first a large amount of time to the work—the one in making reports on the position of channels and shoals, and the proper points for lights, beacons, and buoys, and the other in the investigations relative to sound for fog-signals, and the examination of different materials for illumination. To the duty thus devolved upon the latter he has devoted nearly all his vacations for a number of years, with results which will appear in an appendix to this report.

The magnitude of the light-house system of the United States, and

consequently that of the duties of the board and the responsibilities connected with them, may be inferred from the following facts:

1st. The coast, from Saint Croix River, on the boundary of Maine, to the Rio Grande, on the Gulf of Mexico, includes a distance of five thousand miles.

2d. The Pacific coast has a length of about fifteen hundred miles.

3d. The great northern lakes about three thousand miles.

4th. The inland rivers of seven hundred miles; making a total of more than ten thousand miles.

The following table exhibits a synopsis of what has been accomplished in aid of navigation along these extended lines, by far the longest of those of any nation in the world:

TOTAL AIDS TO NAVIGATION FOR THE ENTIRE ESTABLISHMENT.

Light-houses and lighted beacons	608
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1874	25
Light-ships in position	21
Fog-signals, operated by steam or hot-air engines	40
Day or unlighted beacons	346
Buoys in position	2,865

It is true, some of the light-houses in the above list were erected before the present board had charge of the aids to navigation, but in every case they have been supplied with new lighting-apparatus and otherwise improved. The work, however, can never be finished; besides the constantly-recurring repairs, many of the lights destroyed by the war have to be replaced, and nearly all the towers constructed before the present century are to be rebuilt, and many other early structures, which may still serve for a time, are to be extensively repaired. On the western coast, as our commerce is extended, continued additions to the number of lights and other signals will be required; and, furthermore, the recent act of Congress to extend the light-house system in the great valley of the Mississippi will add much to the labors and responsibilities of the Board.

It must be evident, on reflection, that such responsible duties as devolve on the Light-House Board cannot be properly discharged by merely revising the operations of two executive officers. The Board is essentially one of experts, and not one of mere revisers, the several members of it being chosen for their peculiar adaptation to the discharge of special duties. These duties cannot be reduced to rules, but constantly require special investigations and decisions on points involving original conceptions. To this purpose the Board is divided into committees, to each of which special duties are assigned. These committees are on finance, engineering, floating-aids, lighting, location, and experiments.

The law of Congress directs at least four sessions of the Board annually, but from the first, and in its most active condition, the meetings have been frequent and the labor of the committees continuous. The great increase in the extension of the light-house system now demands at least one session of the Board during each week in order to a proper transaction of the business, and in this connection it is proper to remark that no person should be appointed to the Board having other duties which will in any way interfere with those pertaining to the light-house service. Another important matter, which should be mentioned in the same connection, is, that since the duties of the officers of the Board, as well as those who have charge of the districts, are of so special a character that it requires no inconsiderable time to become perfectly famil-

iar with them, few changes should take place. The experience which is gained, it may be after several years of practice, is lost when an officer connected with the service is recalled to the Army or Navy. But what is still more detrimental to the service is a frequent change of light-keepers, for no other reason, in many cases, than to give place to a political favorite. It is to be hoped that the civil-service rules will be applied to the appointment of light-keepers, since they would secure material benefit.*

Besides discharging his duty in connection with committees, each member of the Board should visit annually one or more of the districts, so that the whole extent of the coast and every part of the system may be brought under the personal supervision of the Board. Such visits not only tend to secure the watchful care of the light-keepers, but also to afford means for personal consultation with the district officers, and also to give more definite ideas to the members of the Board, which may enable them to act more intelligently in regard to the questions which are constantly coming up for decision.

The most laborious duties which devolve on any officers connected with the establishment are those of the two secretaries. They are required to attend to the daily correspondence with the officers of all the districts, to take note of all the changes which are going on, of the accidents which may happen; to keep account of the condition of the different appropriations, and to transact all ordinary business which has been reduced to rules. For the proper discharge of the duties of their office executive talents of a high order are necessary, with a conscientious regard to the best interests of the service, irrespective of personal consideration. It has sometimes happened, in the changes to which the Board has been subjected, that a large portion of the duties of the Light-House Board have devolved for a time on the two secretaries, but such a burden ought not to be imposed upon them; and now, in time of peace, when a sufficient number of officers of the Army and Navy can be detailed for light-house duty, such an occurrence ought not again to be allowed.

There is one matter connected with the improvement of the operations of the system to which the Board would call special attention, namely, the proper preservation of the records and the means of rendering them readily accessible. As the light-house system is to exist as long as our Government endures, it is highly important that the record of the experience and operations of each generation of officers should be transmitted in a legible form to their successors. The materials exist in the archives of the Office for a history of every light-station in the United States. These, however, are in reports on file in the archives, in volumes of the bound letters addressed to the board, and in pressed copies of letters sent from the Light-House Office. Of the first of these volumes there are four hundred and fifty, averaging eight hundred pages each. Of the second class, or of those of letters sent, there are two hundred and five volumes, averaging one thousand pages each. In the early days of the Board it was supposed that pressed copies of letters would be indelible, but unfortunately this has not been found to be the case; experience proves that they gradually fade, and every year become less and less legible. To be preserved they must be copied, which operation will require, from careful estimation, the labor of thirty persons for one year; and, furthermore, although these letters are indexed by the names

* At the present time the civil-service rules have, by proclamation of the President, been made applicable to the Light-House Establishment.

of the writers, there is no subject-index of letters sent or received. There is, therefore, also need of copious indices to render this mass of material—much of it relative to original investigation—available. It may be asked why this work has not been commenced before. The answer to this question is readily given: the clerical force of the Office has for many years been barely sufficient to carry on the daily routine business, it not having been increased, with the exception of a single clerk, since the organization of the board, twenty-two years ago. For this work an appropriation of \$30,000 is asked, not to be applied for the employment of additional permanent clerks, but for the payment of copyists; it may be of women, paid by the amount of labor accomplished.

It has been from the first the policy of the board to improve the condition of the light-house system by having constantly an eye to the latest discoveries and inventions pertaining to this end in our own or foreign countries, as well as to contribute its share to the existing sum of general knowledge on the subject by original investigations.

In accordance with this policy, the Light-House Board obtained the sanction of the Secretary of the Treasury to commission Maj. George H. Elliot, of the Corps of Engineers, U. S. A., and then engineer secretary of the board, to visit Europe and report upon anything which he might observe relative to light-houses, of importance to the system of the United States. This act of the Board at the time mentioned was prompted by a commission of the officers of Trinity House, England, who visited this country for the purpose of inspecting our light-house system, and invited us to send a commission on our part, for a similar purpose, to England.

Major Elliot was everywhere received with marked cordiality, and every facility was afforded him for obtaining the required information. On his return he embodied the result of his investigations in a report, which comprises 288 printed octavo pages, and is illustrated with 50 plates and 31 wood-cuts. This report, which was originally intended for the Light-House Board, contains much valuable information. It was called for, however, by the United States Senate and published as a public document, for the information of the people as well as of Congress, and was printed under Major Elliot's supervision after he had ceased to be connected with the Light-House Board. While the members of the Light-House Board fully concur in the propriety of giving all useful information directly to the public, they think that in this case the comparisons in which Major Elliot has indulged relative to the efficiency, in some particulars, of our system and those of Europe, ought either to have been omitted in a report given to the public or be accompanied with such comments as a just consideration of them would require.

The object of the Board in sending Major Elliot abroad was to obtain facts carefully collected, and to leave to the Board the consideration as to the propriety of adopting changes founded upon these facts, after a careful examination of them in relation to the conditions under which our light-house system is maintained. Furthermore, since the report contains accounts of what has been done abroad in the way of improvements, much of which was previously familiar to the Board, such accounts ought not to have been given to the world without an accompanying statement of what the Board itself has accomplished in the same line. For example, Major Elliot gives a detailed account of a late series of experiments by the Trinity-House Board on fog-signals. Now, although this account is interesting in itself to the public generally, yet, being addressed to the Light-House Board of the United States, it would tend

to convey the idea that the facts which it states were new to the Board, and that the latter had obtained no results of a similar kind; while a reference to the appendix to this report will show that the researches of our Light-House Board have been much more extensive on this subject than those of the Trinity House, and that the latter has established no facts of practical importance which had not previously been observed and used by the former. It will be seen from the same appendix that the Board has made extensive researches with regard to lighting-materials, and has sought by improved lamps to employ those which are the abundant products of our own country, and that they are fully aware of the properties of mineral oil, and have given the preference to lard as an illuminating-material on account of its excellent qualities, particularly in lights of the first order, combined with entire safety, an essential element in light-house economy.

The Board do not deem it expedient to attempt to introduce the electric light, or that of gas, on account of the complexity and cost of the apparatus. It is their intention, however, to adopt any improvements in lamps of the importance of which they are assured by the results of photometric experiment. The introduction of an improved wick since the report above mentioned, has increased the capacity of our lamps of the first order to the amount of a hundred candles. This, however, is at a proportionally increased expense, on account of the larger quantity of oil consumed.

During the last fiscal year the following changes have occurred in the board: Rear-Admiral Davis has been succeeded by Commodore Murray; Colonel Poe has relieved General Humphreys; Mr. Patterson, who succeeded Professor Peirce, as Superintendent of the Coast Survey, also relieved the Professor from duty in the Light-House Board, and Major Hains relieved Major Elliot as engineer secretary.

The other members of the Board, viz, Professor Henry, Colonel Barnard, Captain Davis, and Commander Walker, remain as at the date of the last annual report.

APPROPRIATIONS.

It will be seen, by reference to the estimates, that the amounts asked for the next fiscal year are in general greater than those requested for the year previous. In regard to the estimates for supplies, the increase in this case is principally demanded by the increased number of light-houses established by the Government and now in operation.

Secondly, as regards the repairs, the increase under this head is demanded on account of the condition of the light-houses, especially of the older stations, several of which were erected previous to the present century, for which the amount of repairs is constantly increasing, and for which a sufficient sum was not granted by the last Congress.

With reference to the estimates for buoys, this is a never-ending and constantly-increasing expenditure. In the mouths of rivers, where the buoys are required as essential aids to navigation in marking out the channel, they are in winter, at the North, constantly liable to be carried away by floating ice; and since the disappearance of a single one of these aids may be attended with a loss of life and property, its place must be immediately supplied, it may be by a succession of buoys, at whatever cost of money and labor on the part of the Light-House Board. To be ready at all times to supply the losses as soon as they occur, an adequate supply of buoys must be constantly kept on hand. Unfortunately, however, on

account of the deficiency in the appropriations of previous years, the supply which should be kept constantly on hand has fallen below the minimum, which experience has shown to be safe, especially in winters of unusual severity.

To lessen the expense occasioned by the unavoidable carrying away of buoys by the ice the Board has adopted the plan of removing during the winter the large, costly floating buoys of boiler-iron and replacing them with spars of wood, which less perfectly serve the purpose intended. So important, however, is this matter considered by the Board of Trade of New York that it has petitioned that the large iron buoys be retained in position in that harbor during the whole winter. If this request be granted a considerable addition to the appropriation will be required.

As to fog-signals, the coast of no other country is so subject to fogs as that of some parts of the United States. On this account, fog-signals in many places are almost as necessary as light-houses. But abundant experience has shown that a sound of sufficient magnitude to become an efficient aid to navigation can only be produced by a large amount of power, derived from steam or heated air, and applied by means of complex machinery, expensive in first cost and in continued maintenance.

The amount of another item has been increased, viz, the expenses of light-ships. This results—

1st. From the addition of two new light-vessels to the service.

2d. To the important repair to which three others have been subjected.

3d. To the improvement in the efficiency of these important aids to navigation which have been introduced.

It must be remembered that the light-ship serves the purpose of a light-house maintained in a position at which a light is absolutely necessary, but where one has not been erected, because of the impossibility or great difficulty of establishing such a structure. The light-ship must therefore have the same permanency and efficiency as the light-house, giving warning to the mariner by its light in clear weather, and its sound-signals during fogs.

In the construction of the two new light-ships ordered by Congress at the last session, improvements are about to be introduced in regard to the fog-signals which, while they will greatly increase the range to which the sound may be heard, will, of necessity, increase the cost of their maintenance.

A small increase in the appropriation has been asked to defray the cost of inspections of lights by the Board. We think this an important item. The members of the Board, in order to properly discharge their duties, should be practically familiar with every part of the light-house system, should have a personal knowledge, as far as possible, of each station, so as to enable them to vote intelligently on each question which may occur in their deliberations. Furthermore, nothing tends in a greater degree to keep the Light-House Establishment up to its maximum state of efficiency than frequent visits of members of the board to the light-house districts at irregular intervals and at unexpected times.

During the past year one or other members of the board has been constantly occupied in visiting the different districts, and the effect of such visits fully warrants the increased appropriation asked for on this point.

LIGHT-HOUSE BOARD.

617

CONDITION AND OPERATIONS OF THE LIGHT-HOUSE^o SYSTEM DURING THE FISCAL YEAR 1873-1874.

Light-houses, light-ships, fog-signals, day-beacons, and buoys belonging to the United States Light-House Establishment on the 1st July, 1874.

ATLANTIC COAST AND STRAIT OF FLORIDA.

Light-houses and lighted beacons.....	333
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1874	8
Light-ships in position.....	20
Fog-signals operated by steam or hot-air engines.....	21
Day or unlighted beacons.....	291
Buoys in position.....	2, 373

COAST OF THE GULF OF MEXICO.

Light-houses and lighted beacons.....	51
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1874	1
Light-ships in position.....	1
Fog-signals operated by steam or hot-air engines.....	2
Day or unlighted beacons.....	49
Buoys in position.....	171

PACIFIC COAST.

Light-houses and lighted beacons.....	29
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1874	3
Light-ships.....	0
Fog-signals operated by steam or hot-air engines.....	10
Day or unlighted beacons.....	4
Buoys in position.....	98

NORTHERN AND NORTHWESTERN LAKES.

Light-houses and lighted beacons.....	195
Light-houses and lighted beacons finished and lighted during the year ending July 1, 1874	13
Light-ships.....	0
Fog-signals operated by steam or hot-air engines.....	7
Day or unlighted beacons.....	2
Buoys in position.....	223

List of light-houses finished and lighted between July 1, 1873, and July 1, 1874.

Name of station.	Locality.	When lighted.
Muscle-Bed Shoals..	On southeast side of the channel, Bristol ferry, Rhode Island.....	August 1, 1873.
Penfield Reef.....	Long Island Sound, Connecticut, off Bridgeport Harbor.....	January 16, 1874.
Bluff Point.....	Valcour Island, west side of Lake Champlain, New York.....	Spring, 1874.
Hereford Inlet.....	On the coast of New Jersey.....	May 11, 1874.
Craighill Channel...	Range lights, (two,) entrance Patapsco River, Maryland, temporarily lighted...	November 20, 1873.
Daufuskie Island...	Range beacons, (two,) on the northeast point of Daufuskie Island.....	October 1, 1873.
Alligator Reef.....	On northeast point of Alligator Reef.....	November 25, 1873.
Horn Island.....	At east end of Horn Island, Gulf of Mexico...	June 30, 1874.
Olcott Harbor.....	Near north end of west pier, entrance to Olcott Harbor, New York.....	November 1, 1873.
Presque Isle.....	On north shore of Presque Isle, Erie, Penn	July 1, 1873.
American Channel...	On bridge between Trenton and Grosse Isle, Detroit River, (3 lights)*	July 10, 1873.

* Erected and maintained by Detroit River Railroad and Bridge Company, under direction of the United States Light-House Board.

List of light-houses finished and lighted between July 1, 1873, and July 1, 1874.—Continued.

Name of station.	Locality.	When lighted.
Au Sable	On the outer end of the north pier at the harbor of Au Sable, mouth of Sable River, Michigan.....	November 20, 1873.
St. Helena	On southeast point of St. Helena Island, in the Straits of Mackinaw, Michigan.....	September 20, 1873.
Frankfort	On the outer end of the south pier at the harbor of Frankfort, east shore of Lake Michigan.....	October 20, 1873.
Petite Pointe au Sable	South of Grand Pointe Au Sable, on eastern shore of Lake Michigan.....	Spring, 1874.
Calumet	On north side of Calumet River, west shore of Lake Michigan.....	September 7, 1873.
Grosse Pointe	On Grosse Pointe, Lake Michigan.....	Spring, 1874.
Sheboygan	Pier head-light, on the outer end of the north pier at the entrance of Sheboygan Harbor, Wisconsin.....	December 1, 1873.
Manitowoc	Pier-head, on the outer end of north pier, harbor of Manitowoc, Wisconsin.....	December 10, 1873.
Duluth	On the outer end of the south pier at the entrance to Duluth Harbor, Minnesota.....	June 1, 1874.
East Brother Island	On East Brother Island, off Point San Pablo, California.....	March 1, 1874.
Mare Island	Extreme eastern end of Mare Island, at entrance from San Pablo Bay to the Straits of Karquines, California.....	September 1, 1873.
Cape Foulweather	(Yaquina Head,) on westerly end of Cape Foulweather, Oregon.....	August 20, 1873.

NOTE.—In addition to the foregoing, light-houses have during the same period been reconstructed and lighted as follows :

On the Atlantic coast.....	1
On the Gulf.....	3
On the Lakes.....	1

Operations and condition of the Light-House Establishment during the year.

FIRST DISTRICT.

The first district extends from the northeastern boundary of the United States (Maine) to and including Hampton Harbor, N. H., and includes all aids to navigation on the coasts of Maine and New Hampshire.

Inspector.—Commander W. N. Allen, United States Navy.

Engineer.—Lieut. Col. James C. Duane, Corps Engineers, Brevet Brigadier-General, United States Army.

In this district there are :

Light-houses and light-beacons.....	51
Light-ships.....	0
Fog-signals operated by steam or hot-air engines.....	8
Day or unlighted beacons.....	55
Buoys actually in position.....	383
Spare buoys for relief.....	134
Tender (steamer) Myrtle, for construction and repairs, also used in second district; and tender Iris, (inspectors' tender).....	2
Tender (sail) schooner Wave, (for repairs,) also used in second district.....	1

The following numbers which precede the names of stations correspond with those of the light-house list of the Atlantic, Gulf, and Pacific coasts of the United States, issued January 1, 1874.

LIGHT-HOUSES AND LIGHTED BEACONS.

3. *Little River, west side of entrance to Little River Harbor, Maine.*—The stone walls of the building have been repointed, new water-conductors put on, floors and windows repaired, and all wood-work repainted.

Avery's Rock, Machias Bay, Maine.—An appropriation of \$15,000 was made at the last session of Congress for a light-house and fog-signal at or in vicinity of Avery's Rock. Plans are being prepared and steps have been taken to secure a site.

4. *Libby Island, entrance to Machias Bay, Maine.*—New sills have been placed under a part of the keeper's dwelling and the exterior clapboarded and repainted. The bell-tower foundation has been repaired.

6. *Nash's Island, off mouth of Pleasant River, Maine.*—The light-tower has been rebuilt of brick and furnished with a new cast-iron deck, parapet, and lantern. The keeper's dwelling has received some slight repairs.

8. *Petit Menan, on Petit Menan Island, Maine.*—The floors and sills of the keeper's dwelling and wood-shed have been repaired, and a new wooden cistern furnished.

Egg Rock, Frenchman's Bay, Maine.—An appropriation of \$15,000 was made by an act approved June 23, 1874, for a light-house and fog-signal at or in vicinity of Egg Rock. Plans are now being prepared and steps have been taken to secure a site. The work will then be taken in hand without delay.

18. *Saddleback Ledge, Isle au Haute Bay, Maine.*—Two sides of the boat-house have been sheathed and painted, and the boat-slip repaired with new timbers, rollers, and slides.

19. *Heron Neck, entrance Carver's Harbor, Maine.*—A cement floor has been laid in the cellar of the keeper's dwelling, a portion of the roof reshingled, slight repairs made about the house, and the exterior wood-work repainted.

26. *Owl's Head, off Rockland Harbor, Maine.*—The sills and doors of the keeper's dwelling have been repaired, the exterior of the house repainted, and a plank walk laid in the rear. A new wooden cistern and water-conductors have been furnished.

28. *Negro Island, off Camden Harbor, Maine.*—The roof of the keeper's dwelling has been reshingled, new saddle-boards put on, chimney repaired, walls repointed, six new windows put in, new gutters and water-conductors furnished, storm-porches repaired, interior plastering, floors, and doors repaired, and all wood-work repainted. The outbuildings have been repaired and painted.

34. *Monheigan, on Monheigan Island, Maine.*—An appropriation of \$5,000 was made at the last session of Congress for rebuilding a keeper's dwelling at this station, the old one being in a very dilapidated state. This work will be taken in hand without unnecessary delay.

Indian Island, at the entrance of Rockport Harbor, Maine.—A light was formerly exhibited from a tower at this point, but was discontinued. An appropriation having been made to re-establish the light, it will be done as soon as the building can be put in order for the purpose.

40. *Seguin, off the mouth of Kennebec River, Maine.*—New cast-iron decks and parapet have been furnished and placed on the light-tower.

42-43. *Cape Elizabeth, entrance to Portland Harbor, Maine.*—The ex-

terior shells of the two new iron towers, in process of construction at date of last report, have been set up at the site, and the interior brick-work and iron stairways carried up to the full height, window-frames set, and the walls plastered. It is expected that the lights will be exhibited from the new towers during the present season, and the old towers will then be taken down. The lens of the fixed light will be changed to the first order, and that of the flashing light will remain of the second order.

45. *Portland Breakwater, in Portland Harbor, Maine.*—The temporary light-house has been removed about 150 feet in a northeasterly direction to the pier at the end of the recently-completed extension. An appropriation of \$6,000 having been made at the last session of Congress for a permanent structure at this station, plans have been prepared and approved by the board, and work ordered to be commenced.

Hypocrite's, eastern entrance to Townsend Harbor, Maine.—The commerce passing these islands would be greatly benefited by the establishment of a light at the eastern end thereof, and an appropriation of \$15,000 is asked for the purpose.

Cape Neddick, (York Nubble,) coast of Maine.—The erection of a light-house at this point for the benefit of the coasting-trade is considered of importance, and an appropriation of \$15,000 is asked for that purpose.

In the first district there are a number of small light-stations, built early in the present century by contract. The walls of the houses are usually of rubble-masonry, laid in common lime; the roofs very flat, and surmounted with the lantern. In most cases the lime has entirely disappeared from the joints, the wood-work where it enters the masonry is rotten, and the rafters have settled under the weight of the lantern. A large expenditure is annually necessary to keep these buildings in even a passable condition. Economy, the efficiency of the service, and the comfort and health of their keepers require that the buildings should be replaced, as rapidly as circumstances will permit, by suitable structures.

And it is recommended that the keepers' dwellings at *Narraguagus* and *Hendrick's Head* be rebuilt, and special estimates are submitted therefor.

REPAIRS.

At each of the following-named stations there have been made repairs and renovations more or less extensive during the year :

1. *Saint Croix*, on Docket's Island, Saint Croix River, Maine.
2. *West Quoddy Head*, western entrance to Passamaquoddy Bay, Maine.
5. *Moose Peak*, on Moose Peak Head, Maine.
7. *Narraguagus*, west side of Narraguagus Bay, Maine.
9. *Prospect Harbor*, east side of entrance to the harbor.
10. *Winter Harbor*, west side of entrance to Winter Harbor, Maine.
11. *Mount Desert*, on Mount Desert Rocks, Maine.
12. *Baker's Island*, off Mount Desert Island, and south of entrance to Frenchman's Bay, Maine.
13. *Bear Island*, on one of the Cranberry Islands, Maine.
14. *Bass Harbor Head*, east side of entrance to Bass Harbor, Maine.
- 15-16. *Burnt Coat Harbor*, on south end of Swan Island, Maine.
17. *Eggemoggin*, entrance to Blue Hill Bay and Eggemoggin Reach, Maine.
20. *Deer Island Thoroughfare*, western entrance to Deer Island Thoroughfare, Maine.

21. *Eagle Island Point*, near the head of Isle au Haut Bay, Maine.
22. *Pumpkin Island*, on Pumpkin Island, Maine.
- 23-24. *Matinicus Rock*, off entrance to Penobscot Bay, Maine.
25. *White Head*, west side of entrance to Muscle Ridge Channel, Penobscot Bay, Maine.
27. *Brown's Head*, east side of west entrance to Fox Island Thoroughfare, Maine.
29. *Grindel's Point*, north side of entrance to Gilkey's Harbor, Maine.
30. *Dice's Head*, north side of entrance to Castine Harbor, Maine.
31. *Fort Point*, west side of entrance to Penobscot Bay, Maine.
32. *Tenant's Harbor*, south side of entrance to Tenant's Harbor, Maine.
34. *Monheigan Island*, on Monheigan Island, Maine.
35. *Franklin Island*, west side of entrance to George's River, Maine.
36. *Pemaquid Point*, east entrance to John's Bay, Maine.
37. *Burnt Island*, west side of entrance to Townsend Harbor, Maine.
38. *Hendrick's Head*, west side of mouth of Sheepscot River, Maine.
39. *Pond Island*, west side of entrance to Kennebec River, Maine.
41. *Halfway Rock*, in Casco Bay, Maine.
44. *Portland Head*, west side of entrance to Portland Harbor, Maine.
46. *Wood Island*, west side of entrance to Saco River, Maine.
47. *Goat Island*, east side of entrance to Cape Porpoise Harbor, Maine.
48. *Boone Island*, off York Harbor, Maine.
49. *Whale's Back*, east side of the entrance to Portsmouth Harbor, New Hampshire.
50. *Portsmouth Harbor*, west side of entrance to the harbor.
51. *Isle of Shoals*, off Portsmouth, New Hampshire.

The following-named light-stations require repairs to be made during the current and ensuing year:

4. *Libbey Island*, entrance to Mathias Bay, Maine.
5. *Moose Peak*, on Moose Peak Head, Maine.
23. *Matinicus Rock*, on Matinicus rock off entrance to Penobscot Bay, Maine.
34. *Monheigan Island*, on Monheigan Island, Maine.
36. *Pemaquid Point*, east entrance to John's Bay, Maine.

LIGHT-SHIPS.

There are no light-ships in the first district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

West Quoddy Head.—Ten-inch steam-whistle. Has been supplied with new grate-bars.

Petit Menan.—Ten-inch whistle. The fog-signal building has been lined with brick, the steam-pump repaired, and a new smoke-pipe supplied.

Matinicus Rock.—Twelve-inch steam-whistle.

White Head.—Ten-inch steam-whistle. The boiler has received new tubes. The well has been enlarged and deepened. A duplicate machine has been provided.

Monheigan.—Six-inch steam-whistle. The steam-pump has been repaired and the boiler has received new tubes.

Cape Elizabeth.—Ten-inch whistle. The steam-pump has been repaired.

Portland Head.—Second class Daboll trumpet.

These fog-signals are in good condition.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the first district:

Jerry's Point, Portsmouth Harbor, New Hampshire.—Iron shaft, six braces, top lozenge-shaped, with letters L. H.

South Beacon, Portsmouth Harbor.—Square stone pier with mast and lozenge-shaped top.

North Beacon, Portsmouth Harbor, New Hampshire.—Wooden mast with four faces and lozenge-shaped top.

Willey's Ledge, Portsmouth Harbor, New Hampshire.—Iron spindle with copper cylinder and ball on top.

York Ledge.—Iron spindle with cage at top.

Stage Island Monument, entrance to Saco River, Maine.—Conical stone tower, 40 feet high.

Cow Island Ledge, entrance Saco River.—Iron spindle.

Ram Island Ledge, entrance Portland Harbor.—Wooden tripod.

Back Cove Beacon, Portland Harbor.—Wooden pile-beacon.

White Head Ledge, Portland Harbor, Maine.—Iron spindle, with cage at top.

Trott's Rock, Portsmouth Harbor, Maine.—Iron spindle, with ring and pendants at top.

Mark Island Monument, Casco Bay, Maine.—Pyramidal stone tower, 50 feet high.

Black Jack Rock, entrance to Kennebec River, Maine.—Wrought-iron spindle with cage at top.

Seal Rock, Kennebec River, Maine.—Iron spindle, copper cylinder.

Ram Island Ledge, Kennebec River, Maine.—Iron socket, wooden spindle, cask at top.

Ames' Ledge, Kennebec River, Maine.—Iron socket, wooden spindle, cask at top.

Beef Rock, Kennebec River, Maine.—Iron socket, wooden spindle, cask at top.

Lime Rock, Back River, Maine.—Iron socket, wooden spindle, cask at top.

Carleton's Ledge, Back River, Maine.—Iron socket, wooden spindle, cask at top.

Clough's Rock, Sheepscot River, Maine.—Iron socket, wooden spindle, cask at top.

Merrill's Ledge, Sheepscot River, Maine.—Iron socket, wooden spindle, cask at top.

"The Cuckolds," western side of entrance to Townsend Harbor, Maine.—A wooden tripod 57 feet high, covered in one-half of the way from the top, and painted black, has been erected on this place at a point 12 feet above high-water mark.

Eastern Egg Rock, Muscongus Bay, Maine.—A wooden tripod 54 feet high, covered in one-half of the way from the top, and painted red, has been erected at this place at a point 6 feet above high-water mark.

Duck Rock, near Monhegan Island, Maine.—A wooden tripod 57 feet high, covered in one-half of the way from the top, and painted red, has been erected at this place at a point 12 feet above high-water mark.

Yellow Ledges, Penobscot Bay, Maine.—Iron shaft, copper cylinder at top.

Garden Island Ledge, Penobscot Bay, Maine.—Iron shaft, copper cylinder at top.

Otter Island Ledge, Penobscot Bay, Maine.—Iron shaft, copper cylinder with ball on top.

Ash Isle Point, Penobscot Bay, Maine.—A wooden tripod, (in place of the spindle,) 57 feet high, covered in one-half way from the top, and painted brown, has been erected at this place at a point at half-tide mark.

Dodge's Point Ledge, Penobscot Bay, Maine.—Wooden shaft attached to stump of iron spindle.

Potterfield Ledge, Penobscot Bay, Maine.—Square stone beacon with mast and cask at top.

Lowell's Rock, Penobscot Bay, Maine.—Iron spindle, cage and ball at top.

Seal's Rock, Penobscot Bay, Maine.—Iron spindle with cage at top.

Harbor Ledge, Penobscot Bay, Maine.—Square stone beacon with mast and cask at top.

Fiddler's Ledge, Penobscot Bay, Maine.—Square stone beacon, mast and cask at top.

Northeast Ledge, Camden Harbor, Maine.—Iron spindle with copper cylinder at top.

Morse's Point Ledge, Camden Harbor, Maine.—Iron spindle, with copper cylinder and ball at top.

Hosmer's Ledge, Castine Harbor, Maine.—Square stone monument.

Steel's Ledge, Belfast Harbor, Maine.—Square stone beacon, mast and cask at top.

Fort Point Ledge, Penobscot River, Maine.—Square stone beacon.

Odom's Ledge, Penobscot River, Maine.—Square stone beacon.

Buck's Ledge, Penobscot River, Maine.—Iron spindle, cylinder at top.

Centre Harbor Ledge, Eggemoggin Reach, Maine.—Iron socket, wooden spindle with cask at top.

Ship and Barges, Blue Hill Bay, Maine.—Iron socket, wooden spindle with cask at top.

Fullerton's Point, Blue Hill Bay, Maine.—Iron spindle.

Bunker's Ledge, Mount Desert, Maine.—Square stone beacon.

Half-tide Ledge, Sullivan Harbor, Maine.—Iron spindle.

Low-water Rock, Sullivan Harbor, Maine.—Iron spindle.

Half-tide Ledge, Narraguagus Harbor, Maine.—Iron socket, wooden spindle with cask at top.

Half-tide Rock, Narraguagus River, Maine.—Iron spindle.

Norton's Reef, Pleasant River, Maine.—Iron tripod and shaft with ball at top.

Snow's Rock, Moosepeak Reach, Maine.—Iron socket, wooden spindle and cask at top.

Gilchrist's Rock, Moosepeak Reach, Maine.—Iron shaft, ball at top.

Moose Rock, Moosepeak Reach, Maine.—Iron tripod, cage at top.

Western Bar, Lubec Narrows, Maine.—Wooden crib, pyramid at top.

The Ledge Saint Croix River, Maine.—Wooden crib.

Under the appropriation for "Day-beacons in Maine and Massachusetts, 1873-'74," operations have been carried on during the past year at the following named places:

Western Bar, Lubec Narrows, Maine. Completed.

Stone's Island Ledge, Machias Bay, Maine.

Fessenden Ledge, Moosepeak Reach, Maine.

Trafton's Island Ledge, Narraguagus Bay, Maine.

Jordan's Delight Ledge, Narraguagus Bay, Maine.

Winter Harbor Ledge, Winter Harbor, Maine.

South Bunker's Ledge, Mount Desert, Maine.

Pumpkin Island Ledge, Eggemoggin Reach, Maine.

Scrag Island Ledge, Penobscot Bay, Maine.
Colby's Ledge, Penobscot Bay, Maine.
Inner Ledge, Penobscot Bay, Maine.
Goose Rock, Penobscot Bay, Maine.
Iron Point Ledge, Penobscot Bay, Maine.
Drunkard's Ledge, Penobscot Bay, Maine.
West Mark Isle Point, Penobscot Bay, Maine.
Ash Island Point, Penobscot Bay, Maine. *Completed.*
South Breaker, Penobscot Bay, Maine.
Duck Rock, Monheigan, Maine. *Completed.*
Egg Rock, Muscongus Bay, Maine. *Completed.*
Hypocrite Ledge, off Townsend Harbor, Maine.
The Cuckolds, off Cape Newagen, Maine. *Completed.*
Black Jack, Kennebec River, Maine.
Trott's Rock, Portland Harbor, Maine. *Completed.*
Ram Island Ledge, off Portland Harbor, Maine.
Stone's Rock, off York Harbor, Maine.

BUOYS.

The buoyage of the district is in good order.

New spar-buoys have been placed to mark the following dangers, viz:

Spruce Point Ledge, Townsend Harbor, Boothbay, Maine.
Pemaquid Ledge, Townsend Harbor, Boothbay, Maine.
Outer Heron Ledge, Townsend Harbor, Boothbay, Maine.
Tumbler Island Ledge, Townsend Harbor, Boothbay, Maine.
Squirrel Island Ledge, Townsend Harbor, Boothbay, Maine.
Haddock Island Ledge, Round Pond Harbor, Maine.
Poland's Head Ledge, Round Pond Harbor, Maine.
Mark's Island Ledge, Round Pond Harbor, Maine.
Harbor Ledge, Round Pond, Maine.
Green Island Ledge, Vinal Haven, Maine.
Laury's Island Ledge, Vinal Haven, Maine.
Fox's Ears, Vinal Haven, Maine.
Calderwood's Ledge, Vinal Haven, Maine.
Diamond Rock, Vinal Haven, Maine.
Smith's Island Ledge, Vinal Haven, Maine.
Marsh Point Ledge, Vinal Haven, Maine.
Saddleback Ledge, Vinal Haven, Maine.
Myrtle Ledge, Some's Sound, Maine.
Hooper Island Ledge, Herring Gut Harbor, Maine.
Hog Island Ledge, Casco Bay, Maine.

Sixty-eight new buoys have been used to supply losses during the year

DEPOT.

A buoy-depot is at present located upon House Island, near Fort Scammel, Portland Harbor, upon land belonging to the War Department, which is now needed by the engineer in charge of the construction of fortifications at that point.

Notice has been given that the depot must be removed, and a site has been secured on Little Hog Island, Portland Harbor, to which the depot will be removed as soon as practicable.

SECOND DISTRICT.

The second light-house district extends from Hampton Harbor, New Hampshire, to include Gooseberry Point, entrance to Buzzard Bay, and embraces all the aids to navigation on the coast of Massachusetts.

Inspector.—Commander George H. Perkins, United States Navy.

Engineer.—Lieut. Col. James C. Duane, Corps of Engineers, Brevet Brigadier-General, United States Army.

In this district there are :

Light-houses and lighted beacons.....	61
Day or unlighted beacons.....	52
Light-ships, (in position).....	8
Light-ships, (for relief).....	2
Fog-signals, operated by steam or hot-air engines.....	4
Buoys actually in position.....	511
Spare buoys, for relief and to repair losses.....	184
Tender steamer Verbena, and Daisy, inspector's tender.....	2

The following numbers, which precede the names of stations, correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1874.

LIGHT-HOUSES AND LIGHTED BEACONS.

54, 55. *Newburyport Harbor, on Plum Island, entrance Merrimack River, Massachusetts.*—Owing to the encroachment of the sea, both towers have been moved to the southward about 75 feet.

56, 57. *Ipswich, entrance Ipswich Harbor, Massachusetts.*—The roof of the keeper's dwelling has been partially reshingled, new saddle-boards put on, cellar bulk-head rebuilt, and barn partially reboarded.

78. *Race Point, on Cape Cod, Massachusetts.*—A one and a half story frame dwelling for the assistant keeper has been erected.

80. *Long Point, entrance Provincetown Harbor, Massachusetts.*—An appropriation of \$13,000 was made by act approved June 23, 1874, for rebuilding the tower and dwelling, and erecting a fog-signal at this station. Plans have been already prepared, and work ordered to be commenced.

91. *Monomoy Point, southern end of Cape Cod, Massachusetts.*—The two last annual reports contain the following remarks, which are respectfully annexed :

Monomoy Point.—The light at this station, which is of the fourth order, on a tower about 40 feet high, was originally intended as a guide to *Old Stage Harbor*. The harbor has been filled with sand, and cannot now be entered, and the light is therefore of no further use for that purpose. But, inasmuch as nearly all vessels (both steamers and sailing) plying between New York and the eastern ports pass this point, and have no other guide than the light-ships, which cannot be seen a sufficient distance, it is considered a matter of the greatest importance that this light should be replaced by one of sufficient power to guide vessels safely through this intricate passage. For this purpose there is recommended a second-order fixed light, varied by red flashes, for which an estimate is submitted.

Nauset Beach, Cape Cod, Massachusetts.—The lights at this station having been increased in power, an additional keeper became necessary, for whom additional quarters are required. An appropriation of \$5,000 is asked therefor.

95. *Sankaty Head, on east side of Nantucket, Mass.*—The interior plastering of the keeper's dwelling has been repaired, a new floor laid in the addition, sinks repaired, cellar-stairs renewed, roof repaired and new saddle-boards put on, the exterior walls of the brick and the trimmings and window-sash of the wooden buildings repainted, and the fences about the premises rebuilt. These repairs were paid for from the general appropriation for repairs.

East Chop, Martha's Vineyard, east entrance to Holmes Hole Harbor, Massachusetts.—A light has been maintained for several years at this point by the subscription of the owners of the steamships and by other private individuals. As there is no doubt as to the utility of the light,

it is recommended that an appropriation for erecting a small light be made.

97. *Gay Head, on southwest point of Martha's Vineyard, Mass.*—The exterior of the light-tower has been repainted and the barn new silled, shingled, and whitewashed. On the 15th of May, 1874, the light at this station was changed from flashing-white by making every fourth flash red.

103. *Bishop and Clerk's, on Bishop and Clerk's Shoal, Vineyard Sound, Massachusetts.*—The timber foundation of the tower, which had become exposed by the action of the sea, has been covered with concrete masonry. The interior of the tower has received some slight repairs.

112. *Sow and Pigs, entrance to Vineyard Sound and Buzzard's Bay, Massachusetts.*—It is very important that a permanent structure should be built on this shoal, to take the place of the light-vessel now moored in the vicinity, which is liable to be driven from her station by stress of weather. A permanent structure would not only furnish a better guide to vessels entering the sound, but would be a saving of expense by enabling both the light-ship and the Cuttyhunk light to be dispensed with. An appropriation of \$50,000, to commence the work, is therefore earnestly recommended.

REPAIRS.

At each of the following-named light-stations there have been made repairs and renovations more or less extensive during the year:

58. *Annisquam, entrance to Annisquam Harbor, Massachusetts.*

59. *Straitsmouth, north side of Cape Ann, Massachusetts.*

60 and 61. *Cape Ann, on Thatcher's Island, near Cape Ann, Massachusetts.*

62. *Eastern Point, east side of entrance to Gloucester Harbor, Massachusetts.*

63. *Ten-Pound Island, east side of entrance inner harbor, Gloucester, Mass.*

64 and 65. *Baker's Island, northeast entrance to Salem Harbor, Massachusetts.*

66. *Hospital Point, north side of Salem Harbor, Massachusetts.*

67. *Fort Pickering, north side of Salem Harbor, Massachusetts.*

68. *Derby's Wharf, east end Derby's Wharf, upper Salem Harbor, Massachusetts.*

70. *Egg Rock, off Nahant, entrance to Broad Sound, Massachusetts.*

71. *Minor's Ledge, on Cohasset Rocks, entrance to Boston Bay, Massachusetts.*

72. *Boston, on Little Brewster Island, entrance to Boston Bay, Massachusetts.*

73. *Narrows, north side channel, entrance to Boston Bay, Massachusetts.*

74. *Long Island Head, south side channel, entrance to Boston Bay, Massachusetts.*

75 and 76. *Plymouth, entrance to Plymouth Harbor, Massachusetts.*

77. *Duxbury Pier, near Duxbury Pier, Plymouth, Massachusetts.*

79. *Wood End, on beach on Wood End, Cape Cod, Massachusetts.*

80. *Long Point, on Long Point Shoal, entrance to Princeton Harbor, Massachusetts.*

81. *Mayo's Beach, at head of Wellfleet Bay, Massachusetts.*

82. *Billingsgate Island, southeast side of Sandy Neck Point, Massachusetts.*

83. *Sandy Neck*, west side entrance to Barnstable Harbor, Massachusetts.

84. *Cape Cod*, seaward side of Cape Cod, (Highlands Truro,) Massachusetts.

85, 86, and 87. *Nauset Beach*, at Eastham, east side of Cape Cod, Massachusetts.

88 and 89. *Chatham*, west side of Chatham Harbor, Massachusetts.

91. *Monomoy Point*, on Monomoy Beach, extremity of Cape Cod, Massachusetts.

94. *Nantucket*, on Sandy or Great Point, Nantucket Island, Massachusetts.

98. *Brant Point*, west side of entrance to Nantucket Harbor, Massachusetts.

99. *Nantucket Range Beacon*, one mile in rear of Brant Point light-house, Massachusetts.

100 and 101. *Nantucket Cliff*, range-beacons, front and rear, northwest of Nantucket Harbor, Massachusetts.

102. *Bass River*, east side entrance to Bass River, Massachusetts.

104. *Hyannis*, east side entrance to Hyannis Harbor, Massachusetts.

106. *Cape Poge*, on an island, northeast point Martha's Vineyard, Massachusetts.

108. *Edgartown*, northeast side Edgartown Harbor, Massachusetts.

109. *Holmes Hole*, on west wharf Holmes Hole Harbor, Massachusetts.

110. *Nobsque Point*, east-southeast side Wood's Hole Harbor, Massachusetts.

111. *Tarpaulin Cove*, on Naushon Island, Massachusetts.

114. *Cuttyhunk*, entrance to Buzzard's Bay, Massachusetts.

115. *Dumpling Rock*, northwest side Buzzard's Bay, Massachusetts.

116. *Clark's Point*, entrance to New Bedford Harbor, Massachusetts.

117. *Palmer's Island*, entrance to New Bedford inner harbor, Massachusetts.

118. *Ned's Point*, east side of Mattapoisett Harbor, Massachusetts.

119. *Bird Island*, entrance to Sippican Harbor, Massachusetts.

120. *Wing's Neck*, entrance to Sandwich Harbor, Massachusetts.

The following-named light-stations require repairs to be made during the current and ensuing years :

60 and 61. *Cape Ann*, on Thatcher's Island, near Cape Ann, Massachusetts.

80. *Long Point*, on Long Point Shoal, entrance to Provincetown Harbor, Massachusetts.

81. *Mayo's Beach*, at the head of Wellfleet Bay, Massachusetts.

88 and 89. *Chatham*, west side of Chatham Harbor, Massachusetts.

91. *Monomoy Beach*, extremity of Cape Cod, Massachusetts.

110. *Nobsque Point*, east-southeast side of Wood's Hole Harbor, Massachusetts.

118. *Ned's Point*, east side of Mattapoisett Harbor, Massachusetts.

120. *Wing's Neck*, entrance to Sandwich Harbor, Massachusetts.

LIGHT-SHIPS.

During the past year three of the light-ships in this district have been run into by passing vessels, and have sustained more or less injury; and one, on the evening of November 17, 1873, was driven from her moorings by a gale, losing an anchor and cable.

90. *Pollock Rip*, off Chatham, Mass., was run into by an unknown vessel about the middle of September, 1873, and so much damaged as to

render it necessary to take her to New Bedford for repairs, which were completed at a cost of \$3,000.

92. *Shovelful, on Shovelful Shoal, off Chatham, Mass.*—This vessel is in good order, has met no disaster during the year, and has required no repairs.

93. *Handkerchief, on Handkerchief Shoal, in Nantucket Sound, Massachusetts.*—This vessel was run into on September 6, 1873, and damaged to a considerable extent, requiring repairs to the amount of \$1,200. On the night of November 17, 1873, she parted her chain in a heavy gale, losing an anchor and cable. Sail was made upon her, and she succeeded in reaching Hyannis Harbor in safety the following afternoon.

96. *Nantucket New South Shoals, twenty-one miles south-southeast from the island of Nantucket.*—Has required no repairs during the year, and is in good condition.

105. *Cross Rip, off Cross Rip Shoal, Nantucket Sound, Massachusetts.*—This light-ship was run into by a passing vessel, but the injuries sustained were so slight as to make it unnecessary for her to leave her station for repairs. She is now in good condition.

107. *Succonnesett, between Succonnesett and Eldridge Shoals, Nantucket Sound, Massachusetts.*—She has needed no repairs during the year, and is in good condition.

112. *Vineyard Sound, off Sow and Pigs Rocks, western entrance to Vineyard Sound, Massachusetts.*—This vessel has been extensively repaired during the year, at a cost of \$5,000, and is now in good condition.

113. *Hen and Chickens, western side of entrance to Buzzard's Bay, Massachusetts.*—No repairs have been necessary, and the vessel is in good order.

Reliefs Nos. 9 and 24.—Necessary repairs to these vessels have been made during the year, at cost of some \$2,000. They are ready for service.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

Cape Ann.—Twelve-inch steam-whistle.

Boston.—First-class Daboll air-trumpet.

Race Point.—Twelve-inch steam-whistle.

Cape Cod.—First-class Daboll air-trumpet.

Repairs more or less extensive have been made at each of the stations, and a duplicate signal furnished at Race Point.

An appropriation of \$10,000 was made at the last session of Congress for the purpose of placing fog-signals in the light-ships that mark the entrances to Vineyard Sound, Massachusetts. Plans are now being prepared, and the signals will be put in place as soon as possible.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the second district :

Old Cock, Buzzard's Bay, Massachusetts.—Iron spindle 36 feet high, cage at top.

Egg Island, Buzzard's Bay, Massachusetts.—Granite cone with iron spindle and vane.

Range Beacon, Fairhaven, Mass.—Iron triangular pyramid, 40 feet high.

Cormorant Rocks, entrance to Mattapoisett Harbor, Buzzard's Bay, Massachusetts.

Lone Rocks, entrance to Wood's Hole, Massachusetts.—Iron spindle, cage at top.

Collier's Ledge, Centreville Harbor, Vineyard Sound, Massachusetts.—Granite base, iron spindle, ball and vane.

Great Rock, west of Point Gammon, Vineyard Sound, Massachusetts.—Iron spindle, cage at top.

Hyannis breakwater, Massachusetts.—Wooden spindle, four arms, cask on top.

Sunken pier, Bass River Bar, Massachusetts.—Wooden spindle, cask at top.

Spindle Rock, entrance to Edgartown Harbor, Massachusetts.—Iron spindle 12 feet high, cask at top surmounted by a spindle and vane.

Billingsgate Shoal, Massachusetts.—Old-site timber beacon with masts and slats.

Egg Island Rock, entrance to Wellfleet Harbor, Massachusetts.—Wooden spindle, cast at top.

Duxbury beacon, Massachusetts.—Square granite, and granite post at top.

Breakwater beacon, Plymouth Harbor, Massachusetts.—Square granite, with wooden spindle and cage.

Hogshead beacon, Plymouth Harbor, Massachusetts.—Iron spindle, with arm, cask, and cage at top.

North beacon, entrance to Scituate Harbor, Massachusetts.—Iron spindle, with two rounds.

South beacon, entrance Scituate Harbor, Massachusetts.—Iron spindle, with two lozenges.

Harding's Ledge, Boston Bay, Massachusetts.—A wrought-iron shaft 35 feet in length, 15 inches diameter at one end, and tapering to 5 inches at the other, has been erected on this ledge, at a point of 3 feet above low-water mark. The top of the shaft is 31½ feet above the ledge, and bears a cast-iron ring 4 feet in diameter, set horizontally with 12 wooden pendants 5 feet in length attached to the rim. The whole structure is painted black.

Point Alderton, Boston Bay, Massachusetts.—Square granite pyramid with cone at top. For the protection of this beacon a quantity of heavy stones have been placed around its base.

False Spit, Boston Bay, Massachusetts.—Granite base with iron spindle and cage at top.

Spit beacon, Boston Bay, Massachusetts.—Square granite pyramid.

North Point of Deer Island, Boston Harbor, Massachusetts.—Wooden spar with board at top.

Nix's Mate, Boston Harbor, Massachusetts.—Square granite base, with octagonal wooden pyramid, black.

Great Fawn Bar, Boston Bay, Massachusetts.—Square granite base and granite cone, with iron spindle and cage at top.

Deer Island Point, Boston Bay, Massachusetts.—Square granite pyramid.

Bird Island, Boston Bay, Massachusetts.—Iron spindle, cage at top.

Sunken Island, Boston Bay, Massachusetts.—Granite base, with wooden spindle and cage at top.

Pig Rocks, Boston Bay, Massachusetts.—Granite pyramid, with wooden spindle and cage at top.

Half-tide Rock, entrance to Swampscot Harbor, Massachusetts.—Iron spindle, cask at top

Cat Island, entrance to Salem Harbor, Massachusetts.—Wooden spindle, cask at top.

Marblehead Rock, entrance to Marblehead Harbor, Massachusetts.—Granite cone, wooden spindle.

Little Aquavitæ, entrance to Salem Harbor, Massachusetts.—Granite, wooden spindle, and cage at top.

Great Aquavitæ, entrance to Salem Harbor, Massachusetts.—Granite, wooden spindle, and cage at top.

Hardy's Rock, entrance to Salem Harbor, Massachusetts.—Wooden spindle, with two triangles at top.

Bowditch Beacon, entrance to Salem Harbor, Massachusetts.—Granite triangular pyramid, wooden spindle, and cage.

Halfway Rock, off Marblehead, Massachusetts.—Granite beacon, broken down.

Little Haste, entrance to Salem Harbor, Massachusetts.—Wooden mast, cask at top.

Abbott's Monument, entrance to Salem Harbor, Massachusetts.—Square granite, wooden spindle, and cask at top.

Monument Bar, entrance to Beverly Harbor, Massachusetts.—Square granite, wooden mast, cage at top.

Ram's Horn beacon, entrance to Beverly Harbor, Massachusetts.—Square granite, wooden mast.

Lobster Rock, Beverly Harbor, Massachusetts.—Stone, with wooden spindle.

Black Rock, Gloucester Harbor, Massachusetts.—Iron spindle; with cage at top.

Harbor Rock beacon, Gloucester Harbor, Massachusetts.—Iron spindle, with ball and cage at top.

Five-Pound Island beacon, Gloucester Harbor, Massachusetts.—Granite base, with iron spindle and ball at top.

Londoner, off Thatcher's Island, Cape Ann, Massachusetts.—Iron spindle, with cage at top.

Dry Salvages, off Cape Ann, Massachusetts.—A wooden tripod 55 feet high, and covered in one-third of the way from the top, has been erected on this place at a point 10 feet above high-water mark. It is painted red.

Lobster Rock, Annisquam Harbor, Massachusetts.—Square granite beacon.

Lane's Point, Annisquam Harbor, Massachusetts.—Square wooden beacon.

Point Neck Rocks, entrance to Essex Harbor, Massachusetts.—Iron spindle, with ball at top.

Black Rocks, Newburyport Harbor, Massachusetts.—Granite pier 15 feet square and 15 feet high, a wooden pyramid 15 feet square at the base, 35 feet high and painted red, has been erected on this pier.

North Pier, Newburyport Harbor, Massachusetts.—Wooden crib filled with stones.

South Pier, Newburyport Harbor, Massachusetts.—Wooden crib filled with stones.

Under the appropriation for "Day beacons in Maine and Massachusetts, 1873-'74," operations have been carried on during the past year at the following-named places:

Black Rocks, Newburyport Harbor, Massachusetts; completed.

Dry Salvages, off Cape Ann, Massachusetts; completed.

Harding's Ledge, Boston Bay, Massachusetts; completed.

Point Alderton, Boston Bay, Massachusetts; completed.

BUOYS.

Another small tender was last fall sent to this district, and the buoys which it had been found impossible to care for as well as desired, are now in their proper places and in good condition.

Fifty spar buoys, six iron buoys, and one spindle have been lost during the year.

DEPOTS.

Lovell's Island, Boston Harbor, Massachusetts.—It having been found necessary to abandon the depot at Cohasset, authority was granted by the War Department to use land on Lovell's Island belonging to the Government for depot purposes. Buoys and material will be moved from the former place as soon as the necessary preparations can be made. A one and a half story frame house, blacksmith-shop, and coal-shed have been erected, the wharf repaired, and railway and cars for landing coal furnished.

Wood's Hole, Massachusetts.—Only slight repairs have been made at this place.

THIRD DISTRICT.

The third district extends from Gooseberry Point, Massachusetts, to include Squam Inlet, New Jersey, and embraces all the aids to navigation on the sea and sound coasts of Rhode Island, Connecticut, and New York, Narragansett and New York Bays, Providence and Hudson Rivers, Whitehall Narrows, and Lake Champlain.

Inspector.—Commodore Stephen D. Trenchard, United States Navy.

Engineer.—Col. I. C. Woodruff, Corps of Engineers, brevet brigadier-general, United States Army.

In this district there are—

Light-houses and lighted beacons.....	117
Day or unlighted beacons.....	39
Light-ships in position.....	6
Light-ships for relief.....	3
Fog-signals operated by steam or hot-air engines.....	9
Buoys actually in position.....	445
Buoys for relief and to supply losses.....	583
Steam-tenders for supply and for inspection, Putnam and Cactus.....	2
Steam-tender for engineer purposes, Mistletoe.....	1
Supply-steamer for supplying the light-houses of the Atlantic and Gulf coasts, Fern.....	1

The numbers preceding the names of stations correspond with the "Light-house list of the Atlantic, Gulf, and Pacific coasts and the northern and northwestern lakes of the United States," issued January 1, 1874.

122. *Beaver Tail light station, Rhode Island.*—Additional quarters are required at this station for the better accommodation of the assistant keepers. It is therefore recommended that an appropriation of \$8,000 for the purpose be made.

124. *Newport Harbor, Goat Island, Rhode Island.*—The fog-bell machine of this station has been changed in some material parts by improved machinery for striking the bell.

132. *Conimicut, Providence River, Rhode Island.*—The keeper's dwelling authorized to be built on the pier of the light, under the act of March 3, 1873, has been completed. The site of the old dwelling-house on Nayat Point has been placed under the charge of a custodian. The fog-bell, striking apparatus has been furnished with new and improved parts for its greater efficacy.

133. *Bullock's Point, Providence River, Rhode Island.*—The keeper's dwelling, &c., authorized by act of June 23, 1874, will be commenced as soon as the detailed working-plans are prepared and approved.

137. *Sassafras Point, Providence River, Rhode Island.*—The building for the use of the keeper of these lights, authorized by act of June, 23, will be placed under construction as soon as detailed working-plans are prepared and approved.

138. *Point Judith, Rhode Island.*—The building of additional quarters at this station for the accommodation of the assistant keepers is rendered necessary by the recent establishment of a steam fog-signal. With this view the sum of \$8,000 has been estimated for the work, and it is recommended that amount be appropriated.

140. *Block Island, (southeasterly,) Rhode Island.*—The purchase for the site for this light-house was finally concluded, and a steam fog-signal (siren) in duplicate, except the boiler, erected under proper housing; a keeper and assistant-keeper were appointed to take charge of and operate the same. The signal is in operation. A cistern was built for furnishing water for the signals, and pipes laid for water-supply from an adjacent pond on the land of the Government. The pond, it is found by experience of the past year, must be revetted by a wall in order that it may collect and reserve a larger supply of water in anticipation of a season of drought. Contracts have been made for the dwelling and tower, and already the work has advanced to part of the first stories of these structures. The metal-work of the buildings and stairs has also been placed under contract, and the portion of the first story delivered on the island. The lantern, made under contract, has been completed, and is now in store ready to be delivered at the station when needed.

The expenses attending the purchase of the land at this site, district attorney's fees, and the connections with the water-supply, were somewhat greater than was anticipated. This, and the exorbitant cost of hauling the machinery of fog-signal, lumber, labor, &c., have drawn heavily on the appropriation for this station. The metal-work and lantern have to be delivered to the contractors for the dwelling and tower at the site, and the appropriation being all covered by the contracts, no funds remain available for the completion of the reservoir. The sum of \$4,500 is asked to meet expenses attending the same.

Montauk Point, New York.—The repairs authorized at this station by the appropriation act of June 10, 1872, have been completed.

143. *Stonington Harbor, Connecticut.*—The general repairs authorized by the act of June 23, 1874, will be undertaken at an early day.

147. *New London Harbor, Connecticut.*—The second class fog-signal authorized at this station under the act of March 3, 1873, has been completed and is now in operation.

149. *Race Rock, Long Island Sound, New York.*—The work at this station continued until the month of September, 1873, when all active operation ceased. The contractor reported the foundation so far completed as to be ready for the placing of the iron band to be filled with concrete, and at the same time submitted a statement of the amount of riprap stone removed from the centre of the island. This statement the engineer of the district considered in excess of what he had computed as necessary or possible to be removed. After some correspondence upon the subject, the committee on engineering of the board, the contractor, and the engineer of the district, proceeded, to the station, when a survey of the work was made, the amount removed determined, and the matter adjusted. Since the settlement of the above question the work has proceeded with the view of preparing the bed for laying the concrete.

The necessary removal of remaining stones that interfered with the placing of the iron band, 69 feet in diameter, has been completed, and the band placed. Material of the various kinds for the manufacture of the concrete in large quantities on the island has been assembled, and tests have been made of all to insure a compliance with the terms of contract. The contractor has erected a shanty on the work for the accommodation of his workmen, &c., and it is hoped he may now push his work forward with more energy and means and equipments than he has heretofore employed.

150. *Little Gull Island, Long Island Sound, New York.*—The completion of the landing at this station, for which Congress made an appropriation in the act of June 23, 1874, will be undertaken without delay.

155. *Saybrook, Lynde Point, Connecticut.*—The repairs and rebuilding of the fog-bell frame, &c., at this station, authorized by the act of June 23, 1874, will be undertaken at once.

161. *Faulkner's Island, Long Island Sound, Connecticut.*—In the last two annual reports an appropriation has been asked for this station of \$2,500, for protection of the bank, which is gradually wearing away from the effects of the sea. A special report, submitting petitions from various steamship companies and others interested in the navigation of the Sound, was received by the board during last spring, asking that a powerful fog-signal be established at this station, where many vessels have been wrecked; reference is made to a recommendation in the annual report for the year ending June 30, 1871, for the erection of a signal at this station. The recommendation is now submitted, and an appropriation of \$5,000 asked for the purpose, which sum, with the \$2,500 for the protection of the bank, is embraced in the estimates, or \$7,500 in the aggregate.

164. *Southwest Ledge, New Haven Harbor, Connecticut.*—Owing to a severe storm last winter, during which the work on the tubular foundation was greatly damaged, the operations were abandoned, except the continuing of the delivery of stone for the riprap which is to protect the foundation. Seven thousand tons of stone have so far been delivered. The stones which were rolled into the ring during the storm, and interfere with the laying of the stone ring on which the iron tube is to rest, have been removed and the stone laid. The placing of the tube will shortly be resumed.

165. *Stratford Point, Connecticut.*—It is stated in the last two annual reports that "the buildings of this station are very old, and unfit for occupation." They should be rebuilt, and an estimate for a suitable dwelling is submitted. It is recommended that the amount of \$15,000 be appropriated, as the work is urgently needed.

167. *Stratford Shoal, Middle Ground, Long Island Sound, New York.*—The riprap ring within which the foundation for this light-house is to be placed has been completed, and plans for the pier have been approved. The work will be commenced as soon as working-plans are prepared. The plan now approved consists of a granite pier, backed with concrete. The sum of \$50,000 is asked for the completion of the work on the plan modified as above.

169. *Bridgeport Harbor, Connecticut.*—The fog-bell apparatus at this station has been improved by the addition of a new part to the machine of improved pattern.

171. *Penfield Reef, Connecticut.*—The dwelling and tower of this station have been satisfactorily completed, and the light was exhibited the first time on January 16, 1874. A fog-bell, struck by machinery, has been established at this station.

173. *Eaton's Neck, New York.*—Various improvements in the station, and better facilities for securing a sufficient supply of water for operating the steam fog-signal at this important station have been made during the year. An appropriation of \$8,000 is asked for additional accommodations for an assistant keeper, made necessary by the establishment of the steam fog-signal.

174. *Lloyd's Harbor, New York.*—The work of protecting the site from the abrasion of the sea under the appropriation of June 23, 1874, will be undertaken at the earliest possible time.

— *Cold Spring Harbor, Long Island, New York.*—A petition having been made to Congress for erection of a light in Cold Spring Harbor, Oyster Bay, Long Island, the matter was referred for examination and report to the inspector and engineer of the district. A personal examination was made of the locality, and a special joint report submitted, recommending two range-lights on the mainland, for which an appropriation of \$20,000 is asked.

177. *Sand's Point, New York.*—The repairs authorized by act of June 10, 1872, for this station have been completed.

178. *Hart Island, New York.*—It having been ascertained that no patent to the site selected for this light could be granted to the United States by the State, it was decided to change the location of the light to the "Stepping Stones," distant about one mile, and which would subserve the purpose required of the light fully as well as the first location. The latter site involving no question of riparian ownership, no difficulty will be experienced in erecting the structure. Cession of jurisdiction from the State of New York having been obtained over the site of the "Stepping Stones," and Congress having authorized the change of location of the light, the erection of this much-needed aid to navigation will be commenced at an early day.

179. *Throgg's Neck, New York.*—The keeper's dwelling is greatly in need of repairs, the sills of the house entirely decayed, causing unequal settling, the doors and windows are all out of position, the plastering of the house broken down, &c. The repairs will be quite extensive, and doubt is felt as to the propriety of the expenditure of a large sum for repairs of so old a building. It would seem to be more judicious to build a new dwelling, the estimate for which is submitted—\$8,000.

182. *Great West Bay, New York.*—The repairs authorized at this station under the appropriation of June 10, 1872, have been completed.

183. *Fire Island, New York.*—The repairs at this station, authorized under the act of June 10, 1872, have been completed, and the station placed in good condition.

185 and 186. *Highlands of Navesink, New Jersey.*—The fencing, grading of grounds, and some repairs, needed at this station, will be undertaken at once, under the authority of the act appropriating funds therefor of June 23, 1874.

188. *East beacon, Sandy Hook, New Jersey.*—The several brush jetties built for protecting this station from the encroachment of the sea, which at one time threatened its destruction, have proved very beneficial in arresting and collecting the sand.

189. *West beacon, Sandy Hook, New Jersey.*—The recommendation contained in last year's report for an appropriation of \$6,000 for rebuilding the crib-work at this station is renewed, and the estimate submitted.

190. *Conover beacon, south shore, Sandy Hook Bay, New Jersey.*—The recommendation for rebuilding the wooden tower at this station, which is very much decayed, is urgently renewed, and an estimate of \$4,000

submitted. Upon a request from the board of pilots' commissioners, there were erected at this station and at Chapel Hill Beacon day-marks or screens, composed of large plank frames, painted black, for use in distinguishing these stations in winter when the ground is covered with snow. These were erected at each station, flanking the dwelling on either side.

194. *Elm Tree beacon and range lights, Staten Island, New York.*—This station needs essential repairs and renovations, and an estimate is accordingly made of \$4,500.

196. *Princess Bay, Staten Island, New York.*—The protection sea-wall at this station has been entirely completed, including the jetties, &c.

198. *Fort Tompkins, Staten Island, New York.*—The new dwelling and tower at this station have been completed, and was lighted for the first time on December 20, 1873. The old tower and keeper's dwelling have been removed.

203. *Passaic light, Newark Bay, New Jersey.*—The fog-bell at this station is at present struck by hand, which precludes efficient service during fogs. A Stevens striking-apparatus of improved pattern has therefore been purchased, and will be placed at the station at an early day.

210. *Hudson City, Hudson River, New York.*—The pile foundation and granite pier for this light house have been completed, and the contractor for the dwelling-house and tower has carried his work forward to the completion of the first story and assembling of the material for the remainder of the work. The lantern has been made under contract, and delivered at the station.

214-225. *Hudson River Beacons, on the Upper Hudson, New York.*—The portable beacons were removed toward the close of navigation and stored, stake lights being substituted for them till the close of navigation on the Hudson. The repairs required, more or less extensive at all the sites, were attended to, and on the opening of navigation in May the beacons were replaced.

467-483. *Whitehall Narrows, Lake Champlain.*

469, 470. *Beacons Nos. 3 and 4, in Whitehall Narrows.*—The piers of these two beacons are built, and the lights are shown from stakes. It is recommended that portable beacons be erected on the piers similar to others in the Narrows, and that the sum of \$1,600 be appropriated for the purpose.

485. *Split Rock, Lake Champlain, New York.*—The dwelling at this station is in a state of decay, and needs rebuilding. It is of poor construction, and unfit for the climate of this latitude, where the severe and long winters demand houses substantially built. To repair the present dwelling would cost as much as the building is worth. It is, therefore, recommended that an appropriation of \$5,000 be made to rebuild it.

486. *Juniper Island, Lake Champlain, Vermont.*—The work on the bell-frame and repairs of this station authorized by the act of June 23, 1874, will be undertaken without delay.

487 & 488. *Burlington breakwater beacons, Vermont.*—The dwelling-house for the keeper provided for in the appropriation of March 3, 1871, has not been built in consequence of the continual work in extending breakwaters. The breakwater, it is understood, will not be further extended for the present, and a plan has been submitted for placing the dwelling-house somewhere between the two beacons. This plan has been approved, and Congress having re-appropriated the funds, the work will be commenced this season. The beacons will be moved at the earliest day to the ends of the breakwater.

489. *Colchester Reef, Lake Champlain, Vermont.*—The protection of the

foundation of this structure by an enrockment of stone will be commenced at once under the authority of the act of Congress of June 23, 1874, appropriating \$5,000 therefor.

490. *Bluff Point, Valcour Island, Lake Champlain, New York.*—This light has been completed, and was lighted for the first time on the opening of navigation in the spring of 1874. The building is of blue limestone, identical in construction to that at Barber's Point. The work throughout has been well done, and the station is one of the best on Lake Champlain. The site of the light is a high bluff, and the supplies, &c., must be landed in a little bay to the eastward, which right is secured to the Government in the deed. A roadway to this bay is very much needed, as it is almost impossible to get supplies from the landing to the station. To meet this want, an estimate of \$1,000 is submitted.

REPAIRS.

At each of the following stations in the third district, repairs, more or less extensive, have been made during the year:

122. *Beaver Tail, Rhode Island.*
124. *Newport Harbor, Rhode Island.*
127. *Poplar Point, Rhode Island.*
127. *Muscle Bed, Rhode Island.*
131. *Warwick, Rhode Island.*
133. *Bullock's Point, Rhode Island.*
134. *Sabins Point, Rhode Island.*
135. *Pumham Rock, Rhode Island.*
138. *Point Judith, Rhode Island.*
142. *Montauk Point, New York.*
147. *New London, Connecticut.*
150. *Little Gull Island, New York.*
151. *Gardiner's Island, New York.*
152. *Plum Island, New York.*
153. *Long Beach Bar, New York.*
155. *Saybrook, Connecticut.*
156. *Calves' Island, Connecticut.*
157. *Brockway's Reach, Connecticut.*
158. *Devil's Wharf, Connecticut.*
160. *Horton's Point, Connecticut.*
161. *Faullmer's Island, Connecticut.*
162. *New Haven, Connecticut.*
165. *Stratford Point, Connecticut.*
168. *Old Field Point, New York.*
169. *Bridgeport, Connecticut.*
170. *Black Rock, Connecticut.*
172. *Norwalk Island, Connecticut.*
173. *Eaton's Neck, New York.*
174. *Lloyd's Harbor, New York.*
175. *Great Captain's Island, New York.*
176. *Execution Rock, New York.*
177. *Sand's Point, New York.*
179. *Throgg's Neck, New York.*
182. *Great West Bay, New York.*
183. *Fire Island, New York.*
- 185 & 186. *Highlands of Navesink, New Jersey.*
187. *Sandy Hook, New Jersey.*
188. *East Beacon, Sandy Hook, New Jersey.*
189. *West Beacon, Sandy Hook, New Jersey.*
190. *Conover Beacon, New Jersey.*

- 191. *Chapel Hill*, New Jersey.
- 193. *Waackaack*, New Jersey.
- 194. *Elm Tree Beacon*, New York.
- 196. *Princess Bay*, New York.
- 199. *Robbins' Reef*, New York.
- 200. *Fort Columbus*, New York Harbor.
- 201. *Bergen Point*, New Jersey.
- 205. *Stony Point*, New York.
- 208. *Rondout*, New York.
- 209. *Saugerties*, New York.
- 211. *Four Mile Point*, New York.
- 213. *Stuyvesant*, New York.
- 214-225. *Hudson River beacons*, New York.
- 467-482. *Whitehall Narrows*, New York and Vermont.
- 483. *Crown Point*, New York.
- 484. *Barber's Point*, New York.
- 485. *Split Rock*, New York.
- 486. *Juniper Island*, Vermont.
- 489. *Colchester Reef*, Vermont.
- 491 & 492. *Plattsburgh beacons*, New York.
- 494. *Pointe au Roche*, New York.
- 495. *Isle la Motte*, Vermont.
- 496. *Windmill Point*, New York.

The following-named stations in the district require repairs or renovations to be made during the current or ensuing year:

- 122. *Beaver Tail*, Rhode Island.
- 138. *Point Judith*, Rhode Island.
- 143. *Stonington*, Connecticut.
- 146. *North Dumpling*, Connecticut.
- 150. *Little Gull Island*, New York.
- 155. *Saybrook*, Connecticut.
- 162. *New Haven*, Connecticut.
- 169. *Bridgeport*, Connecticut.
- 172. *Norwalk Island*, Connecticut.
- 173. *Eaton's Neck*, New York.
- 174. *Lloyd's Harbor*, New York.
- 176. *Execution Rocks*, New York.
- 185 & 186. *Highlands of Navesink*, New Jersey.
- 187. *Sandy Hook*, New Jersey.
- 189. *West Beacon*, Sandy Hook, New Jersey.
- 190. *Conover Beacon*, New Jersey.
- 194. *Elm Tree*, New York.
- 196. *Princess Bay*, New York.
- 203. *Passaic*, New Jersey.
- 207. *Esopus Meadows*, New York.
- 484. *Barber's Point*, New York.
- 485. *Split Rock*, New York.
- 486. *Juniper Island*, Vermont.
- 487 & 488. *Burlington Beacons*, Vermont.
- 489. *Colchester Reef*, Vermont.
- 494. *Pointe au Roche*, New York.
- 496. *Windmill Point*, New York.

LIGHT SHIPS.

121. *Brenton's Reef*, No. 11, off *Brenton's Reef*, entrance to *Newport Harbor*, Rhode Island.—Two years ago this vessel was temporarily repaired in New London, the intention being to thoroughly repair her this

year. As frame and plank are quite decayed, a thorough overhauling is necessary, and to put her in a condition of complete repair the sum of \$15,000 will be required.

144. *Eel Grass Shoal, off Mystic, Connecticut, in Fisher's Island Sound.*—This vessel was slightly damaged by collision. This and other defects have been repaired.

148. *Bartlett's Reef, off New London, Connecticut, in Long Island Sound.*—This vessel has been repaired with a new rail, white-pine deck, fenders, caulking, painting, &c., at a cost of \$3,556.23, and is now in good condition.

159. *Cornfield Point, Long Island Sound, off the mouth of the Connecticut River.*—This vessel was brought in for repairs, and is now lying at New London. She will require extensive repairs, at an estimated cost of \$8,000.

166. *Stratford Shoal, off Stratford Point, on Middle Ground, Long Island Sound.*—This vessel during the winter was dragged from her moorings by the ice, and her metal cut through. The damage has been repaired, and other defects attended to, at a cost of \$449.30.

181. *Sandy Hook No. 16, off entrance to New York Bay, six miles from Sandy Hook and Highlands of Navesink lights.*—This vessel has just been repaired with a new deck, top-sides thoroughly re-caulked, a new bowsprit, and several lesser matters of renovation, at a cost of \$2,500. She is now in good condition for service and will soon be returned to her station. Five hundred dollars of the cost of repair will be paid by the New York and Charleston Steamship Company, the steamer Charleston having collided with the light-ship and damaged her to that amount.

Relief Light-vessel No. 17.—This vessel is at present stationed at Cornfield Point. During the year she has had very extensive repairs. New rail, stanchions, bilge-keels, wire-rigging, hawse-pipes, &c., at a cost of \$2,472.19. She is in good condition for service as a relief.

Relief Light-vessel No. 20.—This vessel during the year has had her deck and top-sides caulked, and repairs of rail and deck, at a cost of \$1,067.16. At present she is doing duty on the Sandy Hook station, and is in fine condition.

Relief Light-vessel No. 23.—Since last report this vessel has been caulked, sparred, rigged, altered, and repaired generally, at a cost of \$5,347.10. She is now in fine condition for service, and will be put on the "Wreck of the Scotland Station" on or about the 10th of September, 1874.

An appropriation of \$40,000 was made at the last session of Congress for placing a light-ship upon the station known as the wreck of the Scotland, entrance to New York Bay. Plans will be prepared and the necessary steps taken without needless delay, for building a light-vessel for the permanent occupancy of the station.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

122. *Beaver Tail, Rhode Island.*—A first-class Daboll trumpet, operated by 24 inch Ericsson hot-air engine, (duplicate.)

138. *Point Judith, Rhode Island.*—First-class steam siren, (duplicate.)

140. *Block Island, (southeasterly,) Rhode Island.*—First-class steam siren, (duplicate.)

142. *Montauk Point, Long Island, New York.*—First-class Daboll trumpet, operated by 24 inch Ericsson hot-air engine, (duplicate.)

147. *New London, Connecticut.*—Second-class Daboll trumpet, operated by 18 inch Ericsson hot-air engine, (duplicate.)

150. *Little Gull Island, New York.*—Second-class steam siren, (duplicate.)

173. *Eaton's Neck, New York*.—Second-class steam siren, (duplicate.)

176. *Execution Rocks, New York*.—Third-class Daboll trumpet, operated by 18-inch Ericsson hot-air engine, (duplicate.)

188. *Sandy Hook, entrance to New York Harbor*.—First-class steam siren, (duplicate.)

The repairs required at those signals which were operating at the beginning of the year have been slight. The only steam-signal which has within this period been established is that at Block Island, which was put in operation upon the 1st of January last and has performed perfectly.

A scheme for applying the steam-whistle to light-ships has nearly been completed. An appropriation having been made at last session of Congress for a steam-signal on a light-ship in Long Island Sound, the work will be undertaken at an early day.

DAY OR UNLIGHTED BEACONS.

1. *East Lime Rock, near Newport, Rhode Island*.—A granite structure, surmounted by a spindle and a cage in the shape of a keg.

2. *South Point, Rose Island, Narragansett Bay, Rhode Island*.—A granite structure, surmounted by a spindle and a cage, keg-shaped.

3. *Half-way Rock, three-fourths of a mile southward of Prudence Island, Narragansett Bay, Rhode Island*.—A spindle and square cage.

4. *Pawtucket, Narragansett Bay, Rhode Island*.—A stone tower, surmounted by a black ball.

5. *Pumham, Providence River, Rhode Island*.—A stone tower, surmounted by a vane and black ball.

6. *Borden's Flats, opposite Fall River, Massachusetts*.—A granite structure, surmounted by an iron spindle and cage.

7. *Castle Island, near north end of Hog Island, Bristol Harbor, Rhode Island*.—A stone tower surmounted by a red ball.

8. *Allen's Rock, Warren River, Massachusetts*.—A stone tower surmounted by an iron pointer.

9. *Warwick, entrance to Greenwich Harbor, between Warwick Neck and Pojack Point, Rhode Island*.—An iron spindle with square wooden cage.

10. *White Rock, entrance to Wickford Harbor, Rhode Island*.—A granite structure, with iron spindle and square cage.

11. *Watch Hill, Rhode Island, entrance to Fisher's Island Sound, southwest by south from Watch Hill light-house, and distant three-fourths of a mile*.—An iron spindle, upon a rock which is bare at low water, marked by square cage.

12. *Sugar Reef, Connecticut, entrance to Fisher's Island Sound*.—An iron spindle with a cage in the form of a cone.

13. *East or Catumb Reef, Connecticut, entrance to Fisher's Island Sound, by Lord's Channel, one and one-fourth mile east of east point of Fisher's Island*.—An iron spindle with square cage.

14. *West or Wicopesset Rock, Connecticut, entrance to Fisher's Island Sound, by Lord's Channel, northwest of East or Catumb Reef, two-thirds of a mile*.—An iron spindle with square cage.

15. *Latimer's Reef, Fisher's Island Sound, Connecticut, one mile northwest of east point of Fisher's Island, and three-fourths of a mile southeast of Eel-Grass Shoal light-ship*.—An iron spindle with square cage.

16. *Ellis Reef, Fisher's Island Sound, Connecticut, three-fourths of a mile northwest of Eel-Grass light-ship*.—An iron spindle with square cage.

17. *Ram Island, Fisher's Island Sound, Connecticut, one-half mile southeast of Ram Island*.—An iron spindle with square cage.

18. *Crook, Mystic River, Connecticut.*—A granite structure surmounted by a spindle and a keg.

19. *Whale Rock, (spindle on the Whale,) entrance to Mystic River, Connecticut.*—An iron spindle with square cage.

20. *Groton Long Point, Connecticut, Fisher's Island Sound.*—An iron spindle with a cage in the form of an inverted cone.

21. *Sea Flower, Fisher's Island Sound, Connecticut.*—A granite structure, surmounted by an iron spindle and cage.

22. *Black Ledge, entrance to New London Harbor, Connecticut.*—A granite structure surmounted by a spindle and a cage in the shape of two cones, connected at the vertices.

23. *Saybrook, Connecticut, entrance to Connecticut River.*—A granite structure surmounted by a globe.

24. *Hen and Chickens, Long Island Sound, Connecticut, southwest of Cornfield Point one mile.*—An iron spindle with a square cage.

25. *Branford Reef, Long Island Sound, Connecticut.*—A granite tower with iron shaft and ball.

26. *Quixie's Ledge, entrance to New Haven Harbor, Connecticut.*—An iron spindle with a cask. It stands on a rock which is bare at half-tide.

27. *Stratford, Connecticut, entrance to Stratford River.*—A granite structure with shaft and ball.

28. *Bridgeport, outer entrance to harbor of Bridgeport, Connecticut.*—A wooden pyramid with a spar and cask.

29. *Bridgeport, inner entrance to harbor of Bridgeport, Connecticut.*—A wooden pyramid.

30. *Black Rock, or Huncher, west side of entrance to Black Rock Harbor, Connecticut.*—An iron pile-structure with a large cage.

31. *Southport, Connecticut.*—A granite structure with iron shaft and ball.

32. *Southport breakwater, Connecticut.*—A granite structure with iron shaft and ball.

33. *Norwalk, Connecticut, entrance to the harbor of Norwalk.*—A granite structure with iron shaft and cage.

34. *Great Reef, off Norwalk Island, Connecticut.*—An iron socket, wooden shaft, with a cage.

35. *Success Rock, near Sand's Point, New York.*—An iron shaft with conical cage.

36. *Sand's Spit, Sag Harbor, New York.*—A granite structure.

37. *Oyster Pond Point, Plum Gut, entrance to Gardiner's Bay, New York.*—A granite structure with iron shaft and square cage.

38. *Romer Shoal, Swash Channel, New York Bay.*—A granite structure, in the form of a frustum of a cone, with a mast and square cage.

39. *Mill Reef, Killbuck, opposite New Brighton Landing, New York.*—A sheet-iron beacon filled with concrete, secured to granite base. It bears an iron shaft and cage.

BUOYS.

The buoyage of the district is in good order, the buoys having been changed twice during the year. Forty-six buoys of all kinds were lost during the year.

LIGHT-HOUSE DEPOT, STATEN ISLAND, NEW YORK.

The grading of the grounds and general repairs of buildings, &c., have been continued. Some necessary drainage has also been attended to.

Hose-carriage and suitable hose-pipe, in lengths sufficient to reach from the docks to any of the buildings of the depot, have been provided in case of fire.

An elevator of approved pattern has been introduced into the lamp-shop building, saving labor, time, and expense in the taking in and out of the building cases of lenses and illuminating apparatus, &c. An emery-wheel grinder has been erected in the lamp-shop for finishing work, which, under the old system of doing it by hand, consumed much time. The plan originally contemplated for the introduction of a foundry in the lamp-shop building for the necessary brass castings required in the manufactures at this depot, has been carried out, and a good furnace is now provided for the purpose.

During the year the lands adjoining the depot on the south have been sold to parties who have now nearly completed a system of improvement along the water-front, consisting of extensive bulk-heads and docks, where from fifty to sixty ships may be accommodated with wharfage. Buildings for the public stores have been commenced. In making these improvements, the land has been graded down to 7 or 8 feet below the former level, where it joins the depot lands. This involved heavy grading and change of the line of roadway in the depot lands, particularly in the south and southeast portions, and changes will yet have to be made depending in extent upon the completion of the improvements on the lands adjoining. To meet expenses of these changes an estimate is submitted of \$10,000, while the recommendations submitted in the annual report of last year for \$30,000 for commencing the enlargement of the basin and renovating wharves, &c., and for brick addition to oil-shed, &c., \$20,000, are urgently renewed, and estimates included. Total amount therefor required is \$60,000.

DEPOT, NEW LONDON, CONN.

During the year there has been purchased a water-lot at New London, Conn., adjoining the present Government wharf at that place, which will afford increased facilities to the vessels of the Light-House Establishment for coaling, taking on supplies, &c.

Lens apparatus received from France, and delivered from light-house depot, Staten Island; also number of cases containing the same, from July 1, 1873, to June 30, 1874.

	First order.	Second order.	Third order.	Three and one-half order.	Fourth order.	Fifth order.	Sixth order.	Steamer lenses.	Pressed lenses.	Canal lenses.	Lamps.	Total.
Received	2	2	1	1	2	1	1	.....	.....	.....	4	13
Delivered	3	1	2	2	6	5	6	.....	.....	.....	2	27
Total	5	3	3	3	8	5	7	.....	.....	.....	6	40
Cases received	54	43	16	10	28	12	12	.....	.....	.....	7	170
Cases delivered	108	28	41	28	30	13	26	.....	.....	.....	12	286
Total cases	162	71	57	38	58	13	38	.....	.....	.....	19	456

List of boxes, barrels, bundles, packages, pans, cases, &c., received at, and shipped from, light-house depot, Staten Island, from July 1, 1873, to June 30, 1874.

	Boxes.	Barrels.	Packages.	Total.
Received	2, 475	3, 603	4, 893	10, 971
Delivered	2, 751	3, 474	6, 813	13, 038
Total	5, 226	7, 077	11, 706	24, 009

Buoys and appendages received at and shipped from light-house depot, Staten Island, from July 1, 1873, to June 30, 1874.

	Can-buoys.			Nun-buoys.				Sundries.				Ballast and balls.		
	First class.	Second class.	Third class.	First class.	Second class.	Third class.		First class.	Second class.	Third class.	Stone.	First class.	Second class.	Third class.
Received	41	40	....	41	40	....	114	60	60	60	180	....	....	....
Delivered .....	....	15	....	....	5	....	....	....	....	....	105	....	2	17
Total	41	55	....	41	45	....	114	60	60	60	285	....	2	17

List of articles manufactured and repaired in the lamp-shop at light-house depot, Staten Island, from July 1, 1873, to June 30, 1874.

	Lenses.	Lamps.	Lamp-burners.	Miscellaneous articles.	Total.
Manufactured	1	213	223	1, 262	1, 699
Repaired	20	118	99	425	662
Total	21	331	322	1, 687	2, 361

FOURTH DISTRICT.

The fourth light-house district extends from Squam Inlet, New Jersey, to and including Metomkin Inlet, Virginia. It includes the sea-coast of New Jersey below the highlands of Navesink, the bay coasts of New Jersey and Delaware, the sea-coasts of Delaware and Maryland, and part of the sea-coast of Virginia.

Inspector.—Capt. Thomas G. Corbin, United States Navy, until January 10, 1874; Commander George B. White, United States Navy, present inspector.

Engineer.—Lieut. Col. W. F. Reynolds, Corps of Engineers, brevet brigadier-general, United States Army.

In this district there are:

Light-houses and lighted beacons.....	20
Light-ships, (in position).....	2
Light-ships, (for relief).....	1
Fog-signals operated by steam or hot-air engines.....	0
Day or unlighted beacons.....	0
Buoys actually in position.....	111
Spare buoys for relief and to supply losses.....	94
Tenders (steam) for inspection, Violet.....	1
Tenders (steam) for construction and repairs, Rose.....	1

The numbers preceding the names of stations correspond with those of the "Light-house list of the Atlantic, Gulf, and Pacific coasts of the United States," issued January 1, 1874.

LIGHT-HOUSES AND LIGHTED BEACONS.

226. *Barnegat, sea-coast of New Jersey.*—The semi-monthly measurements along the beach near the light-house have been continued, and no important changes of the water-lines are apparent, the works for protecting the beach having effected the object of their construction. The changes of the position of the sand-hill, north of the dwelling, are very marked. The store-house is covered by drifting sand and needs removing; the plank platform between the tower and dwelling must be renewed. The dwelling outside and in should be painted, and a porch roof should be placed over the back doors, and call-bells provided. Estimated cost of repairs \$1,200.

227. *Tucker's Beach light-station, New Jersey.*—This station has two keepers. The dwelling is a one-story brick building; outside dimensions, 35 by 20 feet, containing but two rooms, beside the attic; there is a small, detached frame kitchen. The accommodations for the keepers are entirely inadequate; the house should be remodeled entirely and enlarged, or a new one built. This station needs a new boat-house, and the buoy-shed, now some eight miles off, and often inaccessible, should be removed to the light-house site. For rebuilding keeper's dwelling and erecting buoy-shed and boat-house, an appropriation of \$10,000 is asked.

228. *Absecon light-station.*—The semi-monthly measurements of the beach near this station have been continued throughout the year. They show no important changes. New storm-doors have been placed on the dwelling, which have proved of great service; the lot has been graded and put in order; a Driven force-pump has been placed in the grounds, which furnishes an abundant supply of water.

229. *Hereford Inlet light-station.*—A new structure, which was finished on the 16th of April last. The light was first exhibited, in accordance with "Notice to Mariners," on the 11th of May. A boat-house has been built, and boat furnished. The grounds around the building cleared up and graded.

232. *Cape Henlopen light-station, Delaware.*—The tower needs repointing, the dwelling should be painted outside and in, the pavement around the dwelling should be repaired, and call-bells or speaking-tubes, for calling relief, should be provided. Estimated cost of repairs, \$500.

233. *Cape Henlopen beacon light-station.*—The water-tank and floor in one room need repairs, and eastern side of the house, which leaks during storms, should be shingled; the house, outside and in, needs painting. Estimated cost of repairs, \$600.

234. *Delaware breakwater light-station.*—A special appropriation of

\$600, made at the last session of Congress, will make all repairs needed at this station.

235. *Mispillion Creek light-station*.—A special appropriation of \$5,000 was made at the last session of Congress "for the erection of keeper's dwelling" at this station. Designs have been prepared for additions to the present structure, and the work will be commenced at once.

236. *Brandycwine Shoal light-station*.—The plank platform over the iron-pile ice-fender at this station having been exposed to the weather for seventeen years, was found too much decayed to be safe or to be repaired. It has been entirely renewed. A new cedar water-tank has been placed in the building, instead of the one of iron, entirely destroyed by rust after twenty-four years' service. The shelter over the fog-signal has been renewed; new boat-davits and a small store-house have been built on platform, and some minor repairs made to the dwelling, which has been painted inside and out.

237. *Maurice River light-station*.—All the windows in dwelling need overhauling, and a new oil-room should be built, the oil now being kept in the kitchen. The wooden water-tank in cellar, after twenty-five years' service, is decayed, and should be replaced by one of brick. Estimated cost of repairs, \$700.

239. *Cross Ledge light-station*.—Bids for the erection of foundation pier for this work were invited by advertisement on the 13th of June. Owing to informality in the two lowest bids all were rejected by the board, and bids for the work were again invited June 30. Before the contract was made the question of title and jurisdiction were raised and all operations have been suspended until they can be settled; should this be done in season the foundation will be laid in the fall.

240. *Mahon's River light-station*.—The monthly measurements of marsh show that the abrasion is less rapid than formerly, though still going on. The building will probably stand during the coming winter. A special appropriation of \$15,000 was made during the last session of Congress for a new structure on a more secure site. A design for the new structure has been prepared, and the work will be taken in hand without unnecessary delay.

241. *Ship John Shoal light-station*.—Bids for the iron for cylindrical foundation of this structure were received on the 8th of June, after public advertisement. The iron is nearly ready for delivery. Arrangements were in progress for putting down pile foundation and building a temporary platform to aid in construction, when the questions of title and jurisdiction were raised and all work suspended. It is hoped that these difficulties can be overcome in time to put down the foundation and exhibit a temporary light from it the present season.

242. *Cohansey light-station*.—A special appropriation of \$400 was made during the last session of Congress for a new boat-house at this station, which will be built. The building needs thorough overhauling and renovating to the extent of leaving little of the present building but the walls, which are passably good; for this purpose an appropriation of \$8,000 is asked.

244. *Reedy Island light-station*.—A special appropriation of \$20,000 was made during the last session of Congress for rebuilding the structure at this station. The work will be commenced at an early day.

245. *Pea Patch light-station*.—The erection of this structure has been suspended, as it is believed that the range-lights proposed for guiding vessels past Bulkhead Shoal will render a light at this point unnecessary.

246. *Bulkhead Shoal light-station*.—An appropriation of \$25,000 was made at the last session of Congress for range-lights to guide past Bulk-

head Shoal, and the previous appropriation of \$50,000 for a light on Bulkhead Shoal made available for the same purpose. A survey has been made, and the location of the range-lights fixed. The necessary steps to secure title to the site and cession of jurisdiction have been taken.

247. *Christiana light-station*.—A platform 50 by 150 feet has been built for buoys. It is placed on the stone piers, which rest on grillage below water on the top of piles. The dock between the wharves has been dredged out to the depth of 6 feet of low water, and the soil deposited inside of the river-bank.

REPAIRS.

At each of the following-named light-stations there have been repairs and renovations more or less extensive since the last annual report.

- 226. *Barnegat*, New Jersey, Barnegat Inlet.
- 227. *Tucker's Beach*, New Jersey, Little Egg Harbor Inlet.
- 228. *Absecom*, New Jersey, Absecom Inlet.
- 231. *Cape May*, New Jersey, entrance to Delaware Bay.
- 234. *Delaware Breakwater*, entrance to Delaware Bay, Delaware.
- 235. *Mispillion Creek*, Delaware, entrance to Mispillion Creek.
- 236. *Brandywine Shoal*, Delaware Bay.
- 244. *Reedy Island*, Delaware, Delaware Bay.
- 247. *Christiana*, Delaware, entrance to Christiana River.
- 249. *Fenwick's Island*, Delaware, coast of Delaware.

The following-named light-stations require repairs more or less extensive during the ensuing year:

- 226. *Barnegat*, New Jersey, Barnegat Inlet.
- 227. *Tucker's Beach*, New Jersey, Little Egg Harbor Inlet.
- 231. *Cape May*, New Jersey, entrance to Delaware Bay.
- 232. *Cape Henlopen*, Delaware, entrance to Delaware Bay.
- 233. *Cape Henlopen beacon*, Delaware, entrance to Delaware Bay.
- 235. *Mispillion Creek*, Delaware, mouth of Mispillion Creek.
- 237. *Maurice River*, New Jersey, mouth of Maurice River.
- 238. *Egg Island*, New Jersey, Delaware Bay.
- 242. *Cohansey*, New Jersey, Delaware Bay.
- 243. *Bombay Hook*, Delaware, Delaware Bay.
- 247. *Christiana*, Delaware, Delaware River.
- 248. *Fort Mifflin*, Pennsylvania, Delaware River.
- 249. *Fenwick's Island*, Delaware, coast of Delaware.
- 250. *Assateague*, coast of Virginia.

LIGHT-SHIPS.

227. *Five-Fathom Bank*, on *Five-Fathom Bank off the Capes of Delaware*.—On the 16th of January, 1874, during a heavy blow, this vessel parted her cable, losing 75 fathoms of 1½ inch chain, and a mushroom anchor of about 4,000 pounds. After parting the chain the vessel drifted from her station about three-fourths of a mile east by south, when the spare anchor was let go and the vessel brought up. As she had drifted off shore, the lights were exhibited regularly at night. March 2, 1874, the revenue steamer W. H. Crawford took the vessel in tow, and replaced her on the station. The deck and hull require recaulking, and the vessel will be thoroughly overhauled and refitted. On the 22d of April, while one of the boats belonging to this vessel was crossing Cold Spring bar with the keeper and four men, she was capsized, the four men losing their lives, the keeper being the only one saved. The boat was completely broken up and everything in her lost.

239. *Upper Middle or Cross-Ledge light-vessel No. 19.*—This vessel has had no repairs made to her since the last annual report. On February 8, the ice coming down the bay in large quantities, the vessel was forced from her station and proceeded under sail to the Breakwater, where she remained until February 16, when she was returned to the station by the tender Violet. At 7 a. m., on the 29th of October, one of the boats, containing the mate and two men belonging to the vessel, left Little Creek Landing, Delaware, for the station. On the evening of the same day the schooner Marshall Perin found the boat bottom up, recovered it, and delivered it to the keeper of Delaware Breakwater light-house, since which time no tidings of the men have been received, and the impression is that the boat capsized, and they were all drowned.

Relief light-ship No. 18.—This vessel is in good condition, and ready for service.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

There are no day or unlighted beacons in this district.

BUOYS.

The buoyage of the fourth district is in good order. A new buoy, painted with red and black horizontal stripes, has been placed to mark a small shoal near the breakwater; also buoys to mark the entrance into Broadkill River, Delaware. The south channel of Absecom Inlet, having become so shallow as not to be safe for vessels to enter, the buoys were removed.

DEPOT.

Christiana, Delaware.—In good order, needing no repairs of consequence.

FIFTH DISTRICT.

The fifth light-house district extends from Metomkin Inlet, Virginia, to include New River, North Carolina, and embraces part of the sea-coast of Virginia and North Carolina, Chesapeake Bay, sounds of North Carolina, and the James and Potomac Rivers.

Inspector.—Commodore Fabius Stanley, United States Navy, until January 1, 1874; Commander F. H. Baker, United States Navy, present inspector.

Engineer.—Maj. Peter C. Hains, Corps of Engineers, brevet lieutenant-colonel United States Army, until July 1, 1874. Major Franklin Harwood, Corps of Engineers, brevet lieutenant-colonel United States Army, the present engineer.

In this district there are:

Light-houses and lighted beacons	70
Day and unlighted beacons	78
Light-ships in position	0
Light-ships for relief	0
Fog-signals operated by steam or hot-air engines	0
Buoys actually in position	652
Spare buoys, for relief and supply losses	739
Tenders (steam) Heliotrope, (buoy tender,) and Tulip, (for engineer's construction and repairs)	2
Tenders (sail) Maggie, (buoy tender,) and Spray, (engineer's tender for construction, and repairs)	2

The numbers preceding the names of stations correspond with the light-house list of the Atlantic, Gulf, and Pacific coasts of the United States issued January 1, 1874.

252. *Cape Charles, on Smith's Island, Cape Charles, Virginia.*—Information having been received of the existence of a crack in the tower, immediately under the lantern-gallery, supposed to have been caused by a heavy gale of wind, a party was sent to repair damage. This was done by fastening the lantern-gallery, which is iron, to the stone brackets of the tower by bolts on the outside. The repairs were completed in the early part of October. At the same time other minor repairs were made at the station.

253. *Cape Henry, on south side of the main entrance to Chesapeake Bay, Virginia.*—This tower is a frustum of an octagonal pyramid, built on a raised foundation of loose stone, some thirty feet above the level of the sea. The masonry of the outside is a soft sandstone, with an inside brick cylinder, the latter having been built in 1857, at which time the station was last refitted. Of the eight faces of the tower, six of them show on the outside large cracks, or openings, extending from the base upward. Four of them are apparently less dangerous than the other two, and, alone, would not warrant any great apprehension of danger; but the latter, viz, those on the north and south faces, where the strength of the masonry is lessened by openings for windows, are much worse, and extend from the base almost to the top of the tower. At present, the tower is in an unsafe condition, and there is no way of repairing the damage satisfactorily. This old tower has done good service, having been built in 1791, and is now the oldest tower on the coast south of Cape Henlopen. It is undoubtedly one of the first lights, in point of importance, on the coast. A new tower should be built at this station without delay. A good site can be had near the present location on Government land, and the materials for building purposes can be landed without difficulty. The keeper's dwelling is in a dilapidated condition, and at too great distance from the tower to insure proper attendance. It is a frame building, and is now more than thirty years old. It is too small for the number of keepers at this station, and should be enlarged. At present, it affords very poor protection to the keepers from the inclemency of the weather in winter. A new dwelling is an absolute necessity for this station. It is recommended that an appropriation of \$50,000 be made to commence this work.

254. *Thimble Shoal, at the entrance to Hampton Roads, Virginia.*—Complaints having been made that the light from this structure is not strong enough for navigation purposes, a moderator lamp, with two wicks, has been made, (which will give a much stronger light,) and will be sent to the station during the year. Other minor repairs have been made.

256. *Craney Island, on the west side of the channel, near the mouth of Elizabeth River, Virginia.*—The house has been painted inside and out, the fog-bell and apparatus moved from the north end of the house to the center of the roof on east side, and a new weight-box made. At the same time, other minor repairs were made and the place put in good condition.

262. *Jordan's Point, James River, Virginia.*—The beach on the upper side of this point is rapidly washing away, and already endangers the structure. To prevent further action of the waves the shore at this point should be protected by loose stones. The fog-bell is now rung by hand; it should be rung by machinery. This will require a change in the bell-tower, to do which and protect the site will require an appropriation of \$2,000, for which an estimate is submitted.

Dutch-Gap Canal beacons and dwellings, James River, Virginia.—At the date of the last annual report the plans and specifications for the structures had been prepared and the site secured. Bids for construction were then requested by public advertising, and opened at the date specified. The proposals received, however, were judged exorbitant, and it was determined to build the structures by day's work instead of by contract. Everything was in readiness to commence, when work was ordered to be suspended to await the action of Congress. Congress did not, however, take the action anticipated, and the appropriation is still available.

265. *York Spit, on easterly end of York Spit, entrance to York River, Chesapeake Bay, Virginia.*—The lens at this station is of the fifth order, fixed red. The shoal on which the structure stands is some distance, however, from the main channel, and the light is not strong enough for the purpose required. It is proposed to substitute a lens of the fourth order, with the double-wick lamp.

Too's Marshes, south side of the entrance to York River, Virginia.—Congress having made an appropriation of \$15,000 for a light-house at this point, plans have been prepared, site selected, and the necessary steps will be taken to commence the work at an early day.

268. *Stingray Point, south side of mouth of Rappahanock River, Virginia.*—This station has been supplied with a fog-bell machine to strike at alternate intervals of five and thirty seconds. Extensive repairs were made at the same time, and the station placed in good order.

Solomon's Lump, in Kedge's Strait, between Tangier Sound and Chesapeake Bay, Virginia.—An appropriation of \$15,000 was made at the last session of Congress, for a light-house off Solomon's Lump, to take the place of that at Fog Point. The light-house will be a square structure, resting on five wrought-iron piles, in five feet water. Its construction will be undertaken without unnecessary delay.

Thomas Point Shoal, north side, mouth of South River, Chesapeake Bay, Maryland.—An appropriation of \$20,000 was made March 3, 1873, for a screw-pile light-house, to be built on the shoal that makes off from Thomas Point, Maryland, to take the place of the old light-house on land, which is in need of extensive repairs, and which, on account of its distance from the track of vessels navigating the bay, is of comparatively little use at any time, and perfectly useless in foggy and thick weather, as the light cannot be seen and the distance is too great for a fog-bell to be heard. The location on the extreme point of the shoal is one of great exposure, and will require a costly structure, and perhaps necessitate a change in the plans. In consequence of the action of the House of Representatives at the last session of Congress, in calling upon the Executive Departments to revise their estimates, work on this structure was suspended and no additional appropriation made. To enable the board to resume operations and complete the structure, an additional appropriation is asked of \$15,000.

283. *Sandy Point, on the west side of Chesapeake Bay, Maryland.*—Sandy Point light is located on the main-land, from which place continuous shoals make out into the bay, a distance of about one mile, and vessels drawing more than ten feet of water cannot approach within that distance of the light-house. A fog-bell is established at this station, but, on account of its distance from the channel, can seldom be heard. The defects of its location are especially felt during stormy weather in winter. Nearly all the passenger-steamers running into the port of Baltimore from below, of which there are many, change their course at this point, and this becomes a hazardous undertaking to boats crowded

with passengers and running on time, when neither the light can be seen nor the fog-bell heard. A change in the location of the light to the outer edge of the shoal and the establishment of an efficient fog-signal are recommended, and an appropriation of \$40,000 asked for this purpose.

284. *Love Point Shoal, mouth of Chester River, Maryland.*—An additional appropriation of \$5,000 by Congress for the further protection of this light-house by riprap stone, was made by act approved June 23, 1874, the amount previously appropriated having been insufficient to thoroughly protect the light-house, which occupies a position of great exposure. It is expected to complete this work during the fall of this year.

285. *Craighill Channel range-beacons, mouth of Patapsco River, Maryland, upper and rear light.*—At the date of the last annual report the coffer-dam had been pumped out, the piles driven and cut off, and the granite piers put down. The cast-iron corner columns, manufactured in Baltimore, were then set up and anchored to the piers, and the erection of the frame-work was commenced. The appropriation was insufficient to finish the work; however, owing to unforeseen difficulties encountered, and expenses necessarily incurred thereby, in getting a secure foundation for the structure. To give commerce the benefit of this important light, temporary arrangements were effected by which the light was exhibited on the 20th of November. Temporary accommodations for the keepers were prepared on shore by making use of the quarters used by workmen while the structure was being built. At the last session of Congress an additional appropriation was made for the completion of this structure, and the work will be at once taken in hand.

286. *Craighill Channel range-beacons, mouth of Patapsco River, Maryland, lower or front light.*—A portion of the foundation-piles of this structure had been driven at the date of the last annual report. The driving of these piles was completed on the 23d of August, 1873, and the operation of cutting off the heads to a level bearing 24 feet below low-tide commenced. This was done in the following manner: A circular saw, 3 feet in diameter, was made fast to a hollow wrought-iron shaft, the latter being held in vertical position in a frame, in the guides of a pile-driver. Rotary motion was given to it by means of a belt and pulleys connecting with a steam-engine. The upper end of the shaft was suspended by means of a ring-bolt, which allowed the shaft to revolve freely. The saw was set at the proper depth, by means of marks on the shaft and fixed marks on some wharf-piles. After the saw was set in motion the pile was fed to it by drawing the pile-driver toward it. This plan of cutting off piles at this depth below water-line is objectionable, in exposed places like the site of this light-house, as sufficient accuracy in keeping them all on the same level is not attainable. It was found in testing them that there was some difference in the heights of the tops of the piles, in consequence of which they had to be leveled by means of blocks of hard wood spiked on their heads where necessary. This was done by a submarine diver. The piles were prepared to receive the caisson on the 25th of October. While this work was going on at the site of the light-house, the grillage forming the bottom of the caisson was made at Havre de Grace, Maryland, and the first section of tubing bolted to it. It was launched on the 13th of September, and towed to the site on the 3d of October. Owing to the difficulty of managing it in a gale of wind, and to the fact that in such a gale it came near parting its moorings and going ashore, it was determined to remove it to a safer place, bolt on several more sections, and then take advantage of calm

weather to tow it back and sink it quickly on the foundation-piles. It was accordingly towed to Curtis's Creek, about ten miles distant, where it had a good harbor, and where plenty of material could be obtained for making concrete. Two more sections were then bolted on, the joints calked, and 3 feet of concrete laid in and rammed in layers of 6 inches. The caisson was then 30 feet high from the bottom of the flooring to the top of the uppermost section of tubing, drew 15 feet water, and floated in a perfectly vertical position. It was then towed out to the site and carefully moored over the foundation-piles. It only required 50 to 65 tons weight to place the caisson on the bottom, depending on the stage of the water. About 100 tons additional, however, were deemed essential to secure it in place after it was there. Three more feet of concrete would do this, but the work of making and ramming 3 feet of concrete required too much time, with the limited space available. At the same time, if it was found (after the caisson reached the foundation) that its position was not exact, the load would have to be removed and the caisson floated, to be sunk again in its proper place. As the removal of concrete would have been a slow and tedious operation, it was determined to sink it by loading it with gravel, which could be done quickly, and in case of necessity it could easily be removed again so that the caisson would float. Accordingly a box 12 feet square and about 22 feet high was built in the center of the caisson for this purpose. This box would hold about 160 tons. Everything being in readiness, on the 31st of October, and the day being calm, the loading of the caisson was commenced early in the morning, and at 9 a. m. it rested on the piles. Its position was accurate, and consequently more gravel was added until the box was filled. The work of laying concrete was then commenced outside the box and carried up to near the top. The gravel was then taken out, the box removed, and the space occupied by it filled in with concrete. As soon as the caisson was on the foundation the deposit of stone around it was commenced and continued until the stone reached the surface of the water at low-tide; 5,000 tons of broken stone were thus thrown in around the caisson during the month of November. A temporary square-frame house was built on the tube and surmounted by a fourth-order lantern, in order to exhibit a light until the structure could be finished as designed. An appropriation has since been made by Congress to complete the work, and the temporary frame will be removed and its place supplied by a structure of iron resting on the caisson.

287. *Seven-Foot Knoll, mouth of Patapsco River, Maryland.*—On the establishment of the Craighill Channel beacons, the light at Seven-Foot Knoll was changed to fixed red.

288, 289. *North Point range-lights, north side of entrance to Patapsco River, Maryland.*—These lights were discontinued (1873) when the Craighill Channel range had been established and mariners had become accustomed to them, as their use was no longer necessary. The lens, supplies, &c., were removed and sent to the general depot. The old towers on North Point will be retained as day-marks.

Mathias Point, Virginia, or Port Tobacco Flats, Maryland., Potomac River.—An appropriation of \$40,000 for "light-house and day-beacon at or in the vicinity of Mathias Point or Port Tobacco Flats, in the discretion of the Light-House Board," was made by act of Congress approved June 23, 1874, with the proviso that the appropriation for a light-house at Shipping Point revert to the Treasury, it having been decided that there is no necessity for a light at the latter place. The character and position of the light-house and beacon provided for by the above

appropriation will be determined, and their construction commenced, at the earliest practicable day.

306. *Currituck Beach, on the coast of North Carolina, about midway between Cape Henry and Bodys Island light-houses.*—The site for this light-house was purchased and jurisdiction over the same ceded by the State of North Carolina to the United States in November, 1873. Borings to test the character of the soil on which the new structure is to rest were made by the engineer of the district in January. The upper stratum was found to consist of fine sand of light color, about 3 feet in depth; below this the sand became darker and apparently more compact, but with no other material change until at about 9 feet depth, where a stratum of soft mud was found about 4 feet thick; making the depth of its lower surface 13 feet below the surface of the ground. The test-pile that was driven penetrated this mud nearly a foot with a blow from a 1,600-pound hammer falling 18 feet. Below the mud the boring showed fine sand all the way to a depth of 30 feet, no material change in its appearance being observed. Plans for a pile and grillage foundation were accordingly made, the piles to be driven to a depth of from 22 to 24 feet, so as to allow them to penetrate several feet into the hard sand, and at distances apart of 2 feet 10 inches. They are then to be sawed off, at a depth of $3\frac{1}{2}$ feet below the level of the water, then capped by 12 by 12 inch timbers, which will be treenailed to the tops of the piles. At right angles to these pieces another set of 12 by 12 inch timbers will be laid, each set of timber being notched into the other 3 inches. The grillage will thus be 18 inches thick. The spaces are to be filled in with concrete to the level of the top of the grillage on which the masonry of the tower will rest. The driving of the piles for the foundation was commenced on the 19th of June, a steam-pile-driver and appurtenances having been first set up. At the present date about half the piles have been driven. Meanwhile the temporary quarters for the workmen, the carpenter's shop, blacksmith's shop, cement-shed, &c., have been put up, the wharf connecting the shore with the landing in Currituck Sound (about 500 yards in length) built, and a railway extending from its outer end to near the site of the tower laid. A pier has also been constructed near Church's Island, distant about twelve miles, in 6 feet water, to enable vessels to land material for the light-house. From this pier the material is lightered to the wharf, whence it is conveyed to the site by cars. The tower is to be 150 feet high, and show a light of the first order, which can be seen at sea a distance of eighteen nautical miles. The base of the tower is an octagonal pyramid, surmounted by a conical shaft. The establishment of this light will supply a want long felt by the commerce of the country, as will be attested by the numbers of wrecks that have struck this beach in the course of the last 22 years. The additional appropriation made by Congress June 23, 1874, will insure a steady continuance of operations; but, owing to the difficulties in getting materials to this station, and in securing a good foundation, an additional appropriation of \$20,000 is asked.

List of vessels that have gone ashore on Currituck Beach, N. C., within the last twenty-two years.

Name.	Class.	Cargo.	Where from.	Where bound.	Date of going ashore.
Samuel L. Mitchell*	Schooner.	Corn.	New Berne, N. C.	New York, N. Y.	1852
Mary Cratch*	do	do	do	do	1852
Martha Ann*	do	Corn and wheat.	Elizabeth City, N. C.	do	1852
Middleton*	do	Merchandise.	New York, N. Y.	New Berne, N. C.	1852
do	do	do	do	do	1852
George Henry*	do	Naval stores.	Washington, N. C.	New York, N. Y.	1852
do	do	White pine.	North Carolina	do	1852
Lee*	do	Naval stores.	Washington, N. C.	do	1852
Rebecca*	Brig.	Ballast.	do	do	1852
Gestitia*	do	Coffee.	do	Baltimore, Md.	1852
Roanoke	do	Merchandise.	New York, N. Y.	Savannah, Ga.	1853
Rattler	Ship.	Guano	do	Baltimore, Md.	1853
James P. Ross	Schooner.	Ballast.	New York, N. Y.	Plymouth, N. C.	1853
Marrell	Brig.	Molasses.	Demarara.	Baltimore, Md.	1855
Vermont	do	Ballast	do	do	1855
N. L. Montague	Schooner.	do	Porto Rico.	Baltimore, Md.	1856
Union	do	Shingles	Plymouth, N. C.	New York, N. Y.	1856
Louisa	do	Coal	Philadelphia, Pa.	Plymouth, N. C.	1857
Jos. P. Ramsey	do	Lime	New York, N. Y.	do	1857
do	do	Fruit	do	Baltimore, Md.	1857
Spirit of the Sea.	Bark.	do	Italy	do	1857
Venezuela.	do	Hides and coffee.	do	do	1857
Star of Empire	Ship.	Guano	Callao	Hampton Roads	1858
Independence	Schooner.	Raisins	Malaga	Richmond, Va.	1858
Agamemnon	do	Merchandise	New York, N. Y.	Edenton, N. C.	1859
Elizabeth Daniels	Ship	Crockery	Europe	Baltimore, Md.	1859
Jane	Brig.	Irish potatoes.	Nova Scotia.	Philadelphia, Pa.	1859
do	do	Sugar	West Indies	Baltimore, Md.	1859
Robert Treat	Bark.	Salt.	Liverpool	do	1860
Jane and Henry.	do	Crockery	do	do	1860
American Belle	Schooner.	Yellow pine.	Wilmington, N. C.	New York, N. Y.	1860
Emma Eliza.	Bark.	Salt.	do	Baltimore, Md.	1861
Glory	do	Coffee.	Rio	do	1861
do	do	Ballast.	Prussia	do	1861
Cherubim	Brig.	Coffee.	do	do	1861
Forbes, (gun boat).	Steamer.	do	do	do	1862
Nashua	Brig.	Coal	Philadelphia, Pa.	Charleston, S. C.	1863
Andrew Jackson	Steamer	do	New Orleans, La.	do	1865
Leonora	do	Merchandise	do	do	1867
Martha	Brig.	Guano	West Indies	New York, N. Y.	1867
Jennie Sheppard	do	Sugar	Porto Rico	Norfolk, Va.	1867
Sarah	Schooner.	Ballast.	New York, N. Y.	Richmond, Va.	1868
Savanna	do	Yellow pine.	Florida	New York, N. Y.	1869
Ferr Clorrett.	do	Ballast	New York, N. Y.	Savannah, Ga.	1869
M. A. Forbes	Bark.	Crockery	Europe	Baltimore, Md.	1870
William Muir	do	do	Liverpool	do	1871
Marion	Brig.	Sugar	Demarara	do	1872
Mary McFarland	Schooner.	Ballast.	Boston, Mass.	Norfolk, Va.	1872
Faugh-a-Ballah.	Brig.	Scrap-iron	London	Baltimore, Md.	1873
Furioso	do	Sugar	Trinidad	do	1873
Volunteer	Bark.	Ballast.	Genoa	do	1874
Arletie	Steamer	do	New York, N. Y.	Wilmington, N. C.	1874
Anna Maria.	Schooner.	Bricks	do	Savannah	1874
do	do	Corn	Wilmington, N. C.	New York, N. Y.	1874
do	do	Mackerel	Boston, Mass.	Baltimore, Md.	1874

* These vessels went ashore the same evening.

310. *Hatteras Inlet, Pamlico Sound, North Carolina.*—After some delay, the title to, and jurisdiction over, the site of this light-house were obtained from the State of North Carolina. Borings to determine the character of the soil on which the light-house will rest were made in January, and it was found that the shoal was clean, hard sand to a considerable depth. Plans and specifications were prepared, and proposals invited for the construction of the metal-work. The contract was awarded in March, and the work completed and delivered in May. The construction of the frame-work of the light-house was carried on and completed at the Lazaretto depot, Baltimore, Md. The light-house

material will be transported to the site in July, and it is expected to complete the work and exhibit the light in the course of two or three months; the light will be of the fifth order.

319. *Roanoke Marshes on the east side of the narrow channel connecting Pamlico and Croatan Sounds, North Carolina.*—The remarks made in the last annual report in regard to rebuilding this light-house are as follows:

It was built in 1860, on what was at that time a marsh, which was dry, or nearly so, at low water. The foundation consists of seven wooden piles covered with cast iron, the latter, when the structure was built, being screwed into the ground several feet. Since then the marsh has been washed away, so that there are now 10 feet water at the light-house. The piles being of wood, as soon as they were exposed by the washing away of the shoal below the depth covered by the cast-iron sleeve, were attacked by worms. In order to save the light-house from falling three coppered piles were driven at each angle of the structure, capped by heavy square timber. A short time ago a raft drifted against the light-house, and carried away three of the copper piles above referred to. The house has settled some inches on the west side, and though the damage sustained by the striking of the raft has been repaired, it is not considered in a safe condition, nor can it be made so, except at great expense, for which an appropriation would be necessary. It will be cheaper in the end to build a new structure, and an appropriation for this purpose is recommended. The estimated cost of a light-house near the present site, but in about 6 feet water, is \$15,000.

And the recommendation is renewed.

REPAIRS.

At each of the following-named light stations in the fifth district, there have been repairs and renovations more or less extensive made during the year.

- 254. *Thimble Shoal*, entrance to Hampton Roads, Virginia.
- 255. *Old Point Comfort*, entrance to Hampton Roads, Virginia.
- 256. *Craney Island*, near mouth Elizabeth River, Virginia.
- 257. *Lambert's Point*, Elizabeth River, Virginia.
- 262. *Jordan's Point*, James River, Virginia.
- 263. *Cherrystone*, entrance Cherrystone Inlet, Virginia.
- 264. *Back River*, entrance to Back River, Virginia.
- 265. *York Spit*, entrance to York River, Virginia.
- 268. *Stingray Point*, mouth of Rappahanuock River, Virginia.
- 278. *Cove Point*, north of entrance Patuxent River, Maryland.
- 279. *Sharp's Island*, entrance to Choptank River, Maryland.
- 280. *Choptank River*, opposite entrances to Choptank and Treadheaven Rivers, Maryland.
- 282. *Greenbury Point*, entrance to Severn River, Maryland.
- 283. *Sandy Point*, west side of Chesapeake Bay, Maryland.
- 284. *Love Point*, upper end of Kent Island, Chesapeake Bay, Maryland.
- 287. *Seven-Foot Knoll*, mouth of Patapsco River, Maryland.
- 295. *Pool's Island*, off mouth of Gun Powder River, Maryland.
- 307. *Body's Island*, north of Cape Hatteras, North Carolina.
- 308. *Cape Hatteras*, southern extremity of Cape Hatteras, North Carolina.
- 311. *Ocracoke*, entrance to Ocracoke Inlet, North Carolina.
- 312. *Southwest Point Royal Shoal*, on southwest point of Royal Shoal, North Carolina.
- 313. *Northwest Point Royal Shoal*, on northwest point of Royal Shoal, North Carolina.
- 314. *Harbor Island*, between Pamlico and Cove Sounds, North Carolina.

315. *Brant Island Shoal*, southern part of Pamlico Sound, North Carolina.

316. *Neuse River*, entrance to Neuse River, North Carolina.

317. *Pamlico Point*, entrance to Pamlico River, North Carolina.

318. *Long Shoal*, on east point of Long Shoal, Pamlico Sound, North Carolina.

319. *Roanoke Marshes*, in channel connecting Pamlico and Croatan Sounds, North Carolina.

320. *Croatan*, between Croatan and Albemarle Sounds, North Carolina.

321. *North River*, entrance to North River, North Carolina.

322. *Wade's Point*, west side of Pasquotank River, Albemarle Sound, North Carolina.

323. *Roanoke River*, near mouth of Roanoke River, North Carolina.

LIGHT-SHIPS.

There are at present no light-ships in this district. At the last session of Congress an appropriation of \$50,000 was made for building a light-ship for Winter Quarter Shoals, coast of Virginia. Plans have been perfected, and the vessel will be built at an early day.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

Names and positions of the day or unlighted beacons in the fifth district:

North Point, north side of entrance to Patapsco River; two towers colored white, Maryland.

Smith's Point, south side of the mouth of Potomac River, old tower colored white, Virginia.

Bodkin Point, south side of the mouth of Patapsco River; old tower colored white, Maryland.

Day's Point, half a mile from Day's Point, James River, Virginia; an iron shaft with cage on top.

Woodstock, entrance to Bell's Bay, &c., North Carolina; spar with barrel.

Hunting Quarter, Core Sound, North Carolina, in mid-channel; spar with barrel.

Wilson's Bay, in Core Sound, North Carolina, mid-channel; spar with barrel.

Piney Point, Core Sound, North Carolina, mid-channel; two spars with barrels.

Yellow Shoal, Core Sound, North Carolina, mid-channel; spar with barrel.

Bush's Bluff Shoal, north side of entrance to Elizabeth River, Virginia; an iron pile with cage on top.

There are, besides the above beacons, sixty-seven stake-beacons planted to mark channels in Core Sound and other places.

An appropriation was made during the session of Congress 1872-1873, of \$15,000 for three day-beacons for the *Potomac River*. Owing to the action of the House of Representatives at the last session in calling upon the Executive Departments to reduce their estimates, work on

these structures was suspended. Congress having failed to take further action in the matter, the appropriation continues available and work on the beacons will be resumed.

BUOYS.

Nineteen new buoys have been placed. During the year there have been carried away by ice and the sea, or run down by vessels, twenty-one iron and thirty-three spar buoys; of these five iron buoys and one spar have been recovered, leaving a loss of sixteen iron and thirty-two spar buoys. All the buoys in the district have been examined and exchanged once or twice, and are properly placed in good condition. It should be further added in regard to the fifth district that there is a very large number of buoys to be cared for, and in the northern parts of the district there is always much complaint when they are shifted by the ice, in consequence of the delay in replacing them, which cannot be prevented so long as the Light-House Establishment has but one steam-tender for the purpose. It is therefore recommended that an appropriation of \$50,000 be made at the next session of Congress for a new steam-tender for buoy-service in this district.

DEPOTS.

Lazaretto Point, Patuxent River, Maryland.—At this depot a number of buoys, sinkers, &c., are kept for use as reliefs, and to supply losses in the channels leading to Baltimore, and the upper part of the Chesapeake and tributaries. The recommendation in the following extract from the last annual report is renewed:

The wharf at this depot is in need of considerable repairs, which should be made without unnecessary delay. It is too small for the purpose, and should be extended so that a supply of coal can be kept there. The depot is much in need of a blacksmith's shop, which should be separate from the store-house, and in which small forging could be executed. The estimated cost of repairs to the wharf, and building a blacksmith's shop, is \$4,000, for which an appropriation is asked.

Portsmouth, Elizabeth River, Virginia.—At this depot are kept the principal supply of spare buoys and appurtenances, coal for the use of steam-tenders and for light-house stations; also supplies to meet cases of emergency. Most of the spar-buoys used in the district are made here. This depot is in good condition excepting the wharf, which requires extensive repairs.

Washington, Pamlico River, North Carolina, and their tributaries.—The wharf requires filling in and grading between the wharf-logs and the lot, and several fender-piles in front to make it secure and prevent the tenders from overriding it during freshets. Belaying-posts are also required to be placed on the wharf.

SIXTH DISTRICT.

The sixth district extends from New River Inlet, North Carolina, to and including Cape Canaveral light-house, Florida, and embraces part of the coast of North Carolina, the coasts of South Carolina and Georgia, and part of the coast of Florida.

Inspector.—Commander Charles S. Norton, United States Navy.

Engineer.—Maj. Peter C. Hains, United States Engineer, Brevet Lieutenant-Colonel United States Army, until July 1, 1874; Maj. Franklin Harwood, United States Engineers, Brevet Lieutenant-Colonel United States Army, present engineer.

In this district there are :

Light-houses and lighted beacons	35
Day or unlighted beacons	44
Light-ships, in position	4
Light-ships, for relief	1
Fog-signals operated by steam or hot-air engines	0
Buoys actually in position	235
Spare buoys, for relief and to supply losses	21
Tender (steam) Alanthus, buoy-tender	1
Tender (sail) Mignonette, used in engineer's constructions and repairs	1
Steam-launch Crocus	1

The numbers preceding the names of the stations correspond with those given in the "List of light-houses, lighted beacons, and floating lights of the Atlantic, Gulf, and Pacific coasts of the United States," published January 1, 1874.

— *Campbell's Island, Cape Fear River, North Carolina.*—The following remark and recommendation contained in the last annual report are repeated :

The re-establishment of this light, which was extinguished during the war, would render the navigation of this river at night comparatively safe. It is one of the most difficult places to pass at night that can be found on the river below Wilmington. The channel is narrow, the river wide; the shoals from the east and west banks approaching close to each other at the point where the course is changed. The establishment of a screw-pile light-house at this point is practically the re-establishment of the light at Campbell's Island, and it is deemed of more importance at the present time than any other light on the Cape Fear River. Nothing remains of the old light-house. An appropriation of \$15,000 is therefore asked for a light-house at or near Campbell's Island.

327. *Oak Island beacons, at the main entrance to Cape Fear River, North Carolina.*—An appropriation of \$4,000 was made at the last session of Congress for building two new frame beacons to take the place of the present ones, and to secure better range. The work will be commenced at an early day.

330. *Cape Romain, on Raccoon Key, South Carolina.*—Recent measurements made show the deviation of the tower from the perpendicular to be $27\frac{1}{4}$ inches, the points measured being from the base to the main gallery. The deviation found by similar measurements in July, 1873, was $23\frac{1}{2}$ inches, showing an increased deflection of $3\frac{3}{4}$ inches in twelve months. This matter will be examined by the committee on engineering.

— *Charleston main light, on the south end of Morris Island, South Carolina.*—A site for this light-house was selected at a point 1,700 feet north, 60° east, from the present rear beacon of the Pumpkin-Hill Channel range. This location will, by alignment of the front beacon, enable a range to be made through the Northwest or Old Ship Channel, which the Coast Survey charts show to have the deepest water. A wharf for landing material, store-house, and quarters for workmen have been erected and a portable railway laid from the landing to the site to transport material of construction. Careful examinations were made early in the year by means of borings with an artesian-well apparatus, and by driving test-piles to determine the character of the soil on which the light-house will rest. It was found that to a depth of 5 feet there was sand, from 5 to 16 feet very soft black mud, from 16 to 28 feet various strata of shells, sand, and clay, from 28 to 49 feet soft clay, from 49 to 56 feet coarse sand. As the tower will necessarily be a heavy one it was decided to form a pile and grillage foundation. The piles to be driven 3 feet apart from center to center, then cut off below the level of the water. On top of the piles a grillage composed of two thicknesses of 12-inch square

timbers, to be laid at right angles to each other. The space between the grillage timbers, and for three feet below, to be filled in with concrete and to extend 2 feet outside the piles. The two outer rows of piles to be driven 50 feet, the interior ones to a depth of from 25 to 35 feet if sufficient bearing-capacity is found. The base of the tower below the surface of the ground will be concrete or rubble masonry, on which will rest the brick shaft 150 feet in height. The work of driving the foundation-piles has necessarily been a slow operation, owing to the depth to which they are driven. A pile-driver, 60 feet in height, had to be built and a good hoisting-engine provided; about one-half of the foundation-piles have been driven and the others purchased. A lot of building-sand and part of the material for concrete have been purchased and stored at the site. A contract was made after due public notice calling for bids for the metal-work used in the construction of the tower, and is now nearly ready for delivery. The lens, which is to be of the first order, showing a flashing light, has been purchased. On account of the unhealthiness of the locality, work cannot be carried on during the summer-months. An additional appropriation of \$30,000 is asked for this work.

— *Castle Pickney, on Castle Pickney, Charleston Harbor, South Carolina.*—This is a wood framed pyramidal beacon, 36 feet high to the focal plane, was built in 1866, and last repaired in 1872. It is now in a dilapidated state and in need of extensive repairs, the wood-work being mostly rotten. It will be better to rebuild the structure entire, which can be done for \$2,000, and an appropriation of this amount is asked.

341. *Hunting Island light, on the north end of Hunting Island, South Carolina.*—Operations were commenced in the spring, and were continued until the end of June, when, on account of unhealthiness of the climate, the work was suspended. The tower is of iron, lined with brick, resting upon a concrete foundation 8 feet in thickness. The tower section of the iron is secured to the foundation by 36 anchor-bolts built into the concrete. The concrete foundation has been laid, and the three lower sections of the iron-work have been set up. The material for thirteen sections of the tower have been received at the station. Operations will be resumed about the 1st of November. The north point of the island is still washing away under the abrasive action of the sea. About 400 feet of the point of the island, and 25 feet of the easterly side opposite the light-house site, has disappeared within a year. It is proposed to build two or three brush or log jetties on the beach opposite the site, which it is thought will arrest the abrasive action of the sea. The station is so unhealthy that work can be carried on only about six months in the year. An appropriation of \$10,000 is asked to build a keeper's dwelling for this station.

343. *Daufuskie Island range-beacons, on the northeast point of Daufuskie Island, South Carolina.*—These beacons, which at the last report were nearly completed, have been finished. The lights were first exhibited October 1, 1873. The lens of the rear beacon is dioptric, of the fifth order of Fresnel, and illuminates an arc of 270° of the horizon. The front beacon has a steamer lens, illuminating an arc of 90° . The beacons are 750 yards apart. They mark the channel into Calibogue Sound from Tybee Roads, Georgia.

345. *Tybee entrance to Savannah River, Georgia.*—The following statement and recommendations for an appropriation of \$50,000 for the commencement of a new tower at this station made in two preceding annual reports are renewed. As then stated, "the tower is not in a safe condition, owing to the damage it sustained in the cyclone of 1871. This

tower is very old, having been built in 1793. It is a frustum of an octagonal pyramid built of Savannah brick. Two of its faces show dangerous cracks. As stated in previous report, its great age and neglect during the war render it impracticable to properly repair it. An appropriation of \$50,000 is therefore asked to commence the building of a new structure. This can be done without delay on Government land, near the site of the present tower."

— *Tybee Knoll, Savannah River, Georgia.*—The work of constructing a screw-pile light-house to take the place of the present light-vessel on the knoll has been suspended to await completion of a channel now being dredged out in this vicinity, under the direction of the War Department. The light-vessel will therefore be retained for the present.

350. *Oyster-Beds beacon, on the oyster-beds in Savannah River, Georgia, to mark the south channel.*—The beacon is a substantial brick structure, resting on a foundation of piles. The keeper's dwelling, built in 1855, is a small one-story frame structure resting on piles. The building and piles are so thoroughly rotten that further repairs would be a waste of money. An appropriation of \$10,000 is therefore recommended to rebuild the structure.

354. *Sapelo beacon, on the south end of Sapelo Island, Georgia.*—A frame beacon, old and infected with dry-rot. It has been frequently repaired, and the sills have been once renewed. It would be cheaper to rebuild it. An appropriation is recommended of \$2,500 for this purpose.

357. *Saint Simons, on the south end of Saint Simon's Island, entrance to Saint Simon's Sound, Georgia.*—This station is very unhealthy, and it is attributed to the stagnant water in several ponds in the vicinity which have no outlet. It is proposed to drain these ponds during the coming winter, the only time the work can be done.

361. *Amelia Island main light, entrance to Fernandina Harbor, Florida.*—The front beacon has been moved about 150 feet to the south, to conform to the changes of the channel. The beacon is old and decayed, and has been injured by several removals. An appropriation of \$1,200 is recommended for the re-establishment of the beacon and tramway. An earthen causeway has been built (to replace the worn-out plank-walk) between the lights.

365. *Saint Augustine, Florida, (new.)*—The tower has been essentially completed and the lens apparatus set up. The works yet remaining to be done are the fittings of the oil and work rooms, casing the windows and doors, giving the outside of the tower another coat of color, and grading and paving around the tower. The light will be exhibited for the benefit of navigation on or about November 1. Congress at the last session having appropriated \$20,000 for building jetties to protect site of light-house and erect a keeper's dwelling, the work will be commenced without delay.

— *Mosquito Inlet, east coast of Florida.*—The following statement in the last two annual reports in regard to the establishment of a light at this place is renewed:

In common with all the inlets and harbors on the east coast of Florida, this bar shifts constantly, so that no soundings can be relied upon. The general effect of westerly winds is to reduce the depth of water, and that of the northeasterly gales to increase. The wrecks lying on or near the bar give a practical illustration of the uncertainty of the channel. For all practical purposes of construction as a light-house, it may, however, be safely assumed that the material can be delivered without any serious difficulty or delay, although additional expense would be incurred by reason of the remoteness of the station and the small-sized vessels that would be required for transporting material. As regards the necessity of a light at this point, it is manifest that the commerce passing through the inlet would not justify an expenditure by the United States for a light for merely local purposes, or at least there are other points

that may justly take precedence of it. But a light-house between Saint Augustine and Cape Canaveral lights is necessary as one of a system of coast lights, and Mosquito Inlet is undoubtedly the proper site; as, in the first place, the light there would answer the double purpose of a harbor and coast guide, and, in the second place, for a landing-place both for the original construction and subsequent supply and inspection, which could be made with more safety and certainty there than at any other point along the open sea-beach. A tower, 150 feet high, lighted by a first-order Fresnel lens, is recommended for this position, and for the commencement of its construction an estimate of \$60,000 is submitted. The distance from Saint Augustine to Cape Canaveral is ninety-five miles, of which there is an unlighted space of sixty miles.

REPAIRS.

At each of the following stations in the sixth district repairs more or less extensive have been made during the year:

- 330. *Cape Romain*, South Carolina.
- 333. *Morris Island Beacons*, South Carolina.
- 361. *Amelia Island main light*, Florida.
- 365. *Saint John's River light*, Florida.

The following stations in the sixth district require repairs and renovations during the current and ensuing years:

- 325. *Federal Point*, North Carolina.
- 327. *Oak Island*, North Carolina.
- 329. *Georgetown*, South Carolina.
- 330. *Cape Romain*, South Carolina.
- 331. *Bull's Bay*, South Carolina.
- 334. *Morris Island Beacons*, South Carolina.
- 336. *Sullivan's Island Beacons*, South Carolina.
- 338. *Fort Sumter*, South Carolina.
- 339. *Castle Pinckney*, South Carolina.
- 340. *Combahee Bank*, South Carolina.
- 343. *Daufuskie Island*, South Carolina.
- 345. *Tybee main light*, Georgia.
- 349. *Cockspur Island*, Georgia.
- 352. *Fig Island*, Georgia.
- 354. *Sapelo Beacon*, Georgia.
- 358. *Little Cumberland*, Georgia.
- 359. *North Range Beacons*.
- 362. *Amelia Island main light*, Florida.
- 363. *Saint John's River*, Florida.

LIGHT-SHIPS.

326. *Frying-Pan Shoals light-ship*, off Cape Fear, North Carolina.—This vessel was placed in her present position June 23, 1873. She was thoroughly repaired October, 1872. Her general condition is good.

332. *Rattlesnake Shoal light-ship*, off Charleston, South Carolina.—This vessel was placed on her present station September 11, 1871. She is a new ship, and has never been repaired. She is in good order.

342. *Martin's Industry light-ship*, off Port Royal, South Carolina.—This vessel was placed on her present station September 1, 1871, immediately after being thoroughly repaired at Charleston, S. C. She is in good condition.

348. *Tybee Knoll light-ship*, on Tybee Knoll, Savannah River, Georgia.—This vessel was placed on this station September 6, 1872. Her riding-bits, windlass, and rudder-head need repairs, which can be done at the station.

Relief light-ship No. 32, at Charleston, South Carolina.—This vessel is in good order and ready for service.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINE.

There are none in this district.

DAY OR UNLIGHTED BEACONS.

The following is a list of the unlighted beacons in the sixth district:

Bald Head, mouth of Cape Fear River, North Carolina.—Old tower discontinued on the establishment of the Frying-Pan Shoals light-ship.

Price's Creek, Cape Fear River, North Carolina.—Light discontinued during the rebellion.

Orton's Point, Cape Fear River, North Carolina.—Light discontinued during the rebellion.

Fort Point, Georgetown, South Carolina.—Light discontinued during the rebellion.

Cape Romain, South Carolina.—Old tower near the present light-house.

Fort Ripley.—Iron screw-pile with cage, since inclosed with a wood pyramidal beacon and cage, placed in Fort Ripley, Charleston Harbor.

Battery light, White Point Garden, Charleston, South Carolina.—Iron spindle; light discontinued during the rebellion.

Oyster Rocks, Savannah River, Georgia, near Cockspur Island.—Two iron pile-beacons.

Savannah River day-marks.—Two wood beacons on Long Island; two on Jones Island; two on Elba Island.

Savannah City, Georgia.—Iron spindle. Light discontinued during the rebellion.

St. John's River, Florida.—Old tower at south side of entrance to Saint John's River. Twenty-five wooden piles planted along the Saint John's River, between its mouth and Jacksonville, in good condition. Thirty-two groups and four single pile-beacons are being driven by contract between Jacksonville and Pilatka, not yet completed, and not included in the number of day and unlighted beacons given in this report.

BUOYAGE.

The buoyage in this district is in very good condition.

DEPOTS.

Mount Pleasant, Charleston Harbor, South Carolina.—The site for a light-house depot has been secured at Mount Pleasant, by purchase.

Fort Johnson, Charleston Harbor, South Carolina.—Sufficient repairs have been made to keep the wharf in a condition to enable the tenders to use it.

SEVENTH DISTRICT.

The seventh light-house district extends from Cape Canaveral, on the eastern coast of Florida, to the Perdido River, on the Gulf coast, and embraces all the aids to navigation within those limits. That part of the coast included between Cedar Keys and the Perdido River was on the 19th of March, 1874, taken from the 8th and added to the 7th light-house district.

Inspector.—Commander Albert Kautz, United States Navy, until

October 1, 1873; present inspector, Commander H. B. Seely, United States Navy.

Engineer.—Lieut. Col. Charles E. Blunt, Corps of Engineer, until January 29, 1874; present engineer, Maj. Jared A. Smith, Corps of Engineers, United States Army.

In this district there are:

Light-houses and lighted beacons	17
Day or unlighted beacons	60
Light-ships, (in position)	0
Light-ships, (for relief)	0
Fog-signals operated by steam or hot-air engines	4
Buoys actually in position	136
Spare buoys for relief and to supply losses	102
Tenders, (steam,) Geranium, (buoy tender,) Arbutus, (used in engineer's constructions and repairs)	2

The numbers preceding the names of the stations correspond with those of the "List of light-houses, lighted-beacons, and floating lights of the Atlantic, Gulf, and Pacific coasts of the United States," issued January, 1874.

— *Fowey Rocks, Florida Reef, east coast of Florida.*—An appropriation of \$100,000 was made during the last session of Congress for commencing the erection of a light-house upon Fowey Rocks, near the extreme northeastern point of the Florida Reef. This is by far the most important point of this dangerous line of reefs now remaining unlighted. Plans will be prepared and the work commenced as soon as practicable. Upon the completion of this light that at Cape Florida will be discontinued. An appropriation of \$100,000 is respectfully asked for continuing this work.

369. *Carysfort Reef, on the reef of that name, sea-coast of Florida.*—This iron structure has suffered considerably from oxidation. Extensive repairs have become necessary. The tension-braces of the tower-section are very much eaten by rust, and will have to be renewed.

370. *Alligator Reef, sea-coast of Florida.*—At the date of the last annual report, the work on this important structure had been carried up to the base of the lantern. The work was completed, and the light exhibited, November 25, 1873.

371. *Sombrero Key, near Coffin's Patches, and Sombrero Key, Florida Reef.*—A new hoisting-apparatus for a boat has been made for this station. The iron is badly rusted, the tower tension-rods need replacing, and the station considerable repairs.

Loo Key, Florida Reef.—The navigation of this portion of the Gulf is always dangerous, particularly to vessels bound to the southward and westward, because of the strong and variable current near the reef, causing many wrecks and much loss of property. A light on or in the vicinity of Loo Key, illuminating the now unlighted space between Sombrero and Sand Key lights, would be most useful to mariners, and is strongly recommended. For this purpose, an appropriation of \$100,000 is respectfully asked.

372. *Sand Key, sea-coast of Florida.*—Repairs for this station, which were greatly needed, were commenced last March, but had to be suspended for want of funds. An appropriation of \$20,000 having been made, at the last session of Congress, for a new iron stair-tower and keeper's dwelling, the work will be taken in hand at an early day.

374. *Northwest Passage, entrance to Key West Harbor.*—An iron screw-pile light-house. The metal above water has been carefully scaled and painted throughout; the lower braces need renewing, and other repairs of an extensive nature are required.

375. *Dry Tortugas, Loggerhead Key, sea-coast of Florida.*—The buildings and tower of this station, which were seriously damaged in the hurricane of October, 1873, have been temporarily repaired. The tower is considered to be in a dangerous condition and should be rebuilt. It will probably cost \$150,000. An appropriation of \$100,000 is asked to commence the work.

376. *Tortugas Harbor, Garden Key, sea-coast of Florida.*—Portions of the dwelling and outbuildings were unroofed and otherwise injured in the hurricane of October, 1873. These have been repaired to render them habitable. A new lantern has been sent to this station from the general depot; but as no funds were available for placing it, it was stored in a convenient and secure location in Fort Jefferson. It will be placed in position during the winter. Authority has been obtained for transferring the light to an adjacent stair-tower of the fort in order that the old, inconvenient, and unsightly structure may be removed from the parade. It is recommended that an appropriation of \$5,000 be made for removing the light.

379. *Saint Mark's, entrance to Saint Mark's River, Florida.*—This station was visited by a hurricane of unusual severity on the 18th and 19th of September, 1873, during which the water rose so high above the general level of the sea as to inundate the interior of the dwelling, causing the keepers, together with several women and children, to seek refuge in the tower. The damage to the windows, doors, and interior of the dwelling was repaired, but expensive repairs are still needed to the concrete filling around the foundation of the tower to protect it from the action of the water.

380. *Dog Island, Saint George Sound, Florida.*—Owing to the washing away of the south beach, endangering the safety of the old brick tower built in 1838, the lantern and lens were removed in the latter part of 1872, and placed on the keeper's dwelling, a screw-pile structure, which stood farther inland. This was done to prevent, if possible, the extinguishment of the light until funds should be available for the construction of a light-house in a more protected position. It, however, failed, as the station was visited on the 18th and 19th of September, 1873, by a hurricane, during which the old brick tower and the keeper's dwelling were completely destroyed. An appropriation of \$20,000 having been made at the last session of Congress for re-establishing this station, the work will be taken in hand at an early day. At this station, the keepers lost their personal property at the time of the destruction of the station by hurricane of September, 1873. It is recommended that an appropriation of \$970.50 be appropriated for their re-imbursement.

— *Saint Andrew's Bay.*—A former appropriation of \$22,000 for a light-house at this place still remains available. It is not, however, considered of so great importance as some other works in the district, and its progress is therefore likely to be further delayed.

383. *Pensacola Harbor.*—This station was repaired during the year and left in good condition; but, owing to damages by lightning on the 6th of July, 1874, further repairs are necessary, which will be made.

REPAIRS.

Repairs of more or less importance have been made during the year at each of the following-named stations:

373. *Key West, southern coast of Florida.*

378. *Cedar Keys, on Sea-Horse Key, Florida.*

381. *Cape Saint George, on the cape of that name, Gulf coast of Florida.*

During the coming year considerable repairs will be required at certain iron-pile light-houses on the Florida coast, made necessary by the deterioration of the iron, which is very rapid in this climate. Some of the braces and ties of the most important light-house structures on this coast must be renewed at an early day. The expense attending this work is much greater than ordinary repairs, and it is deemed expedient that a special appropriation for such work be made. It is therefore recommended that an appropriation of \$25,000 be made to be applied exclusively to the iron light-houses on the Florida coast, which is included in the estimates.

LIGHT-SHIPS.

There are no light-ships in the seventh district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

The line of iron day-beacons on the shoaler portion of the great Florida Reefs, and marking out its general outline along the Gulf, is in two series, one on points heretofore occupied, and where beacons have been renewed, and a second in new positions. The first series is distinguished by letters, from A to P, and the second by numbers, from 1 to 8. No work has been done upon these beacons during the past year. Beacon 1, on *Rebecca Shoal*, has been carried away by the sea, and will be replaced at an early day. To replace this beacon, put up others which are needed, and make necessary repairs to those now in position, an appropriation of \$10,000 is respectfully asked.

BUOYS.

The buoyage of this district is in good condition.

TENDERS.

The *Arbutus*, a small steamer used in construction and repairs, has been for some months in such condition that it has been difficult to keep her afloat, as she is not worth repairing. It is extremely desirable that another steamer suitable for the service, which is of no easy kind in this district, should be obtained. In view of the fact that the structure to be built on Fowey Rocks, and other work in the district, will require the constant service of a steamer, an appropriation of \$50,000 for one is asked.

DEPOTS.

There are in this district three buoy and coal depots: one at *Key West*, one at *Egmont Key*, and one at *Pensacola*. They are small and of little consequence, but will serve the purpose for a time.

EIGHTH DISTRICT.

The eighth light-house district extends from the Perdido River, Florida, to the Rio Grande, Texas, and embraces the coasts of Alabama, Mississippi, Louisiana, and Texas. That part of the coast of Florida,

from the Perdido River to Cedar Keys, formerly belonging to this district, was on the 19th of March, 1874, transferred to the seventh district.

Inspector.—Commander Robert Boyd, jr., U. S. N.

Engineer.—A. N. Damrell, captain of engineers, brevet major U. S. A.

In this district there are—

Light-houses and lighted beacons	44
Day or unlighted beacons	8
Light-ships, (in position)	1
Light-ships, (for relief)	0
Fog-signals operated by steam or hot-air engines	2
Buoys actually in position	71
Spare buoys, for relief and to supply losses	83
Tenders, (steam:) Dandelion, (buoy-tender;) Ivy, used in engineer's constructions and repairs	2
Tenders, (sail:) Magnolia and Pharos, used in engineer's construction and repairs	2

The numbers preceding the names of stations correspond with those of the list of "Light-houses, light-beacons, and floating lights on the Atlantic, Gulf, and Pacific coasts of the United States," issued January, 1874.

LIGHT-HOUSES AND LIGHTED BEACONS.

385. *Sand Island, at entrance to Mobile Bay, Alabama.*—On the 31st day of July, 1873, the tower was built up to a height of 113 feet above the grade line; during the months of August and September following, the brick-work of the tower, oil and work room was completed, the iron-work of the parapet and lantern put in place, and the entire structure finished. The light was exhibited from this tower for the first time on the evening of September 1, 1873. The focal plane is 132 feet above the sea-level. A substantial double two-story wooden dwelling was built for the accommodation of the keepers. All work at this station was completed during the month of September, 1873.

389. *Horn Island Pass, Mississippi Sound, Mississippi.*—The iron-work of the foundation and lantern of this light-house was prepared and delivered on board a vessel during the month of October, 1873. On its arrival at Fort Morgan, Ala., it was stored until the framing of the wood-work of the dwelling was completed. In the month of January, 1874, the entire structure was sent to the station in the light-house tender Pharos, and preparations were immediately made for putting down the foundation-piles. The breaking of all the foundation-screws caused considerable delay. They were replaced by an entirely new set. While awaiting the casting of the new screws, the working-party were employed in making repairs in another portion of the district. In the latter part of March, operations were resumed, and the five foundation-piles at last successfully planted. The work was then vigorously prosecuted, and the building completely finished in the early part of the month of June, 1874. The light was exhibited for the first time on the evening of the last day of the same month. The structure consists of five iron screw-piles, upon which is placed a square wooden dwelling, surmounted by a lantern with iron parapet. The lens-apparatus is of the fourth order, showing a fixed white light, varied by red flashes.

398. *Rigolets, (Pleasanton's Island,) Louisiana.*—On the 25th of May, 1874, the fourth-order light at this station was discontinued, it being no longer required for purposes of navigation.

401. *Pointe aux Herbes, Lake Ponchartrain, Louisiana.*—Considerable delay has been experienced in procuring the land necessary for the site of this light-house. This has at last been accomplished. Plans have been prepared, and the work will be undertaken at an early day.

405. *Tchefuncti River, Lake Ponchartrain, Louisiana.*—The breakwater in front of the tower and dwelling at this station having been considerably damaged during a late gale, and being constructed in such a manner and of such slight material as to afford no protection to the light-house and buildings during the prevalence of strong southerly and easterly winds, requires to be rebuilt; and an appropriation of \$3,500 is respectfully recommended for this purpose.

408. *Pass a l'Outre, Mississippi River, Louisiana.*—Repairs were made to the tower, keeper's dwelling, and fog-signal house, but were not fully completed, owing to want of funds available for such work. The old landing, built some years ago at this station, being in a very dilapidated condition, and having recently fallen into the river from the washing away of the ground around the supporting piles, needs rebuilding. It is not deemed advisable to make repairs to the old wharf, as the timbers of which it is composed are rotten. An appropriation of \$2,500 is recommended for the purpose of building a new substantial landing and walk to the tower, for the safe and convenient landing of supplies for the station, coal for the supply of the steam fog-signal, and to make the required repairs to the light-house and buildings connected therewith.

410. *Head of the Passes, Mississippi River, Louisiana.*—In the early part of 1872, this light-house was removed from its original foundation to a point 200 feet farther inland, to avoid its destruction by the washing away of the river-bank; the breakwater which formerly protected the site being carried away during a violent gale in October, 1872. As the river is still encroaching on the light-house site to such an extent that it will be necessary to shortly build some protective works, or again remove the light, an appropriation of \$3,500 is respectfully recommended for the purpose of building a breakwater.

411. *Southwest Pass, Mississippi River, Louisiana.*—The light from the new first-order iron tower was exhibited for the first time on the morning of July 1, 1873; the entire work on the structure being completed during the same month. The tower is an iron frame-work, in the form of a truncated pyramid, having the keeper's dwelling in the lower part and an inclosed stairway from the dwelling to the lantern. The focal plane is 128 feet above the sea-level.

412. *Barrataria Bay, Louisiana.*—This station not having been repaired for some years, the dwelling-house was in a dilapidated condition. The entire roof of the dwelling-house was renewed, a new kitchen was built, and the station put in order.

413. *Timbalier, entrance to Timbalier Bay, Louisiana.*—The lumber and material required for the construction of the platform, to aid in the work of erecting this light-house, was sent to the station early in the month of July, 1873, and work was immediately commenced. The platform was not fully completed until the month of December, 1873; operations being considerably delayed by the loss of portions of the piles and heavy timbers, which were washed away during the frequent occurrences of high water. On the completion of the platform and quarters for the working-party the light-house tender *Magnolia* was sent to station from Southwest Pass with iron-work of the foundation and first series of the light-house. On her arrival, preparations were made for putting down the foundation-piles; this was successfully done during the month of January, 1874, and the erection of the light-house was rapidly carried on until the 19th day of February, at which date the main column and braces of the second series had been placed in position. The funds for the further prosecution of the work being exhausted, work was sus-

pended on the above date, and the working-party discharged, a watchman being left at the station to take care of the public property. An additional appropriation of \$15,000 for the completion of the light-house being made available by act of June 23, 1874, a working-party will be organized and dispatched to the station to resume operations. It is proposed to push the work forward to completion as rapidly as possible.

414. *Ship Shoal, Gulf of Mexico, off the coast of Louisiana.*—Information was received during the month of December, 1873, that the concrete and ballast put around the foundation of this light-house some five years ago was being displaced by the action of water. An examination was made of the site, and from the soundings taken underneath and outside the foundation it was found that a large portion of the concrete and ballast-stones have been moved from the original bed, and carried to a considerable distance west of the light-house. The water in that direction has shoaled, and has deepened immediately under and around the structure. A deep gully seems to be cutting into the shoal toward the foundation from the northeast. The tower was found to lean considerably in a northeast direction; but the inclination has not increased much, if any, during the last five years. It is sufficient, however, to cause irregularities in proper and accurate working of the machinery of the lens-apparatus, lessening somewhat the efficiency of this important light. The urgency of the case required immediate measures, the cost of which had to be paid from the general appropriation for repairs and incidental expenses of light-houses, &c. As this appropriation is not sufficiently great to meet such large drafts upon it without detriment to the interests of other stations, the sum of \$14,000, estimated as the cost of these remedial measures, should be returned to the general appropriation, and an appropriation is asked for this purpose, to be made available at once.

415. *Southwest Reef, entrance to Atchafalaya Bay, Louisiana.*—An appropriation of \$5,000 having been made to complete the improvements at this station, which consist of the establishment of steam fog-signal and the raising of the tower from its present foundation, the work will be commenced at once.

416. *Trinity Shoal, Gulf of Mexico, off the coast of Louisiana.*—The construction of the working-platform 100 feet square, on wooden piles, in 14 feet of water, to aid in the erection of the second-order iron screw-pile structure to mark this dangerous shoal, was commenced in the month of June, 1873, and finished in the month of October following, the work being seriously retarded by the unfavorable weather prevailing during the continuance of operations. The trestles used for driving the platform-piles were washed away at the very commencement of the work, causing the almost total destruction of the pile-driver frame and the loss of a portion of the tools used by the workmen. The vessels stationed at the works for accommodation of the working-party were compelled on several occasions to put to sea for safety. On the completion of the platform and the arrival at the work of the light-house tenders Pharos and Guthrie, in the month of November, with the iron-work of the foundation and first series, preparations were made for putting down the foundation-piles. Before this could be accomplished, the station was visited by a severe storm, which commenced on the 15th of November, causing a very heavy sea. During the night of the 16th, the tender Guthrie, having struck heavily on the shoal, put to sea, her master hoping to keep her clear with the pumps, but without success. Filling rapidly, she was headed for the shoal, on which she sunk in 11 feet water, becoming a total wreck, her crew being picked up by light-house tender

Pharos. The wind moderated in the afternoon of the 17th, but commenced blowing hard again during the night, shifting to northwest and north-northwest, and again making a heavy sea which broke on nearly every part of the shoal; this continued during the 18th. At about 1.30 p. m. of that day, when the storm was at its height, the waves nearly reaching the top of the platform, which was about 15 feet above mean low water, the entire platform was swept away, carrying with it all the iron-work of the structure on it at the time, the quarters of the working party, and the entire working-force, consisting of some sixteen persons. Through the exertions of the master of the Pharos, all the persons on the platform, at the time of the disaster, were rescued, the superintendent of the works and the master of the lost schooner Guthrie being carried out to sea. They were in the water some three hours, clinging to the floating timber, before they were picked up, in an almost exhausted condition. This misfortune was a most discouraging one, as in one more week of fair weather all the iron foundation-piles would have been planted and braced. On the Guthrie, besides the complete outfit, a large amount of material belonging to the structure was lost. On the platform, together with a complete outfit of blocks, ropes, tackles, and tools, were nine wrought-iron foundation-piles, eight chord-links, five periphery-sockets, one center-socket, nine foundation-screws, one pile-inserting apparatus, one pile-driver, two pile-hammers, and one fourth-order lens-apparatus. Immediately on the receipt of the news of the above disaster, a steam cotton-lighter was chartered and sent to the shoal, to recover as much as possible of the iron-work, &c. The vessel arrived there on the 29th of November, and commenced operations. She continued on this work until the 14th of December, being forced by the weather on four different occasions to suspend work and seek a harbor on the Louisiana coast. She succeeded, however, in recovering nine wrought-iron foundation-piles, eight chord-links, five periphery-sockets, one center-socket, and one sleeve for pile-inserting apparatus. No endeavors were made to raise the schooner Guthrie, as she was found to have settled in the sand, with about 18 feet water on her decks, and so torn to pieces that any attempts to raise her would have proved useless. From the examination made by the officer in charge of the operations of the steamer Allison, it was found that the water over the site on which the platform stood had deepened from 14 feet, the original depth when the platform was commenced, July 5, 1873, to 18 and 24 feet on the 30th of November following, and that the piles of the platform broke off at and below the surface of the shoal, being unable to withstand the accumulated force of the waves advancing from the coast some twenty-five miles distant. Before asking further appropriations for this work, it is proposed to further consider the plans and the practicability of constructing and maintaining a light-house at this point.

A supplementary estimate of \$2,000 was made last year for the reimbursement of the working-party for personal property that was lost by them at the time of the loss of the station and the wreck of the vessel. This appropriation is again recommended.

417. *Calcasieu, entrance to River and Lake Calcasieu, Louisiana.*—The appropriation made available by act of March 3, 1871, for the erection of this light-house, having reverted to the Treasury, the iron-work of the structure has, since its delivery, been stored at the depot at the Head of the Passes, where it now is. A new appropriation of \$14,000, for the purchase of the land for a site and the erection of the light-house, was made available by act of June 23, 1874. Proceedings have been instituted by the United States district attorney, district of Louisiana, for the pur-

pose of condemnation, under the laws of the State, of the lands selected and required for light-house purposes. As soon as the title to the land is acquired, the erection of this light will be commenced.

424. *Matagorda, entrance to Matagorda Bay, Texas.*—The erection of the iron tower mentioned as in progress at the date of the last annual report was completed during the month of September, 1873, and the new light was exhibited for the first time on the evening of the first day of the same month. The light is of the third order, flashing every ninety seconds; the focal plane is at an elevation of 91 feet above sea-level. A wooden dwelling for the keepers was erected near the light-house.

429. *Brazos Island beacon, entrance to Brazos, Santiago, Texas.*—The recommendations made in the annual reports for the years 1872 and 1873 for an appropriation of \$25,000 for rebuilding this light-house are respectfully renewed. The following remarks, made in the last annual report, are herewith repeated :

The present tower is one of several hastily built to serve temporary purposes in place of those destroyed during the war. Those at Sand Island, Alabama, Bolivar Point, and Matagorda, Texas, have been replaced by suitable structures, and it is now desirable that this, the last of the kind, should give way to a more durable building. It has already been used a much longer time than was anticipated when it was erected, and, in view of its condition, (the foundation of the tower being decayed and the building not worth the cost of repairing,) something should be speedily done to render the light more surely permanent.

REPAIRS.

At each of the following-named stations in the eighth district there have been repairs made, more or less extensive, during the past year :

- 379. *Saint Mark's, entrance to Saint Mark's River, Florida.*
- 380. *Dog Island, Saint George's Sound, Florida.*
- 381. *Cape Saint George, Florida.*
- 383. *Pensacola, entrance to Pensacola Bay, Florida.*
- 402. *Port Ponchartrain, Louisiana.*
- 404. *New Canal, Lake Ponchartrain, Louisiana.*
- 407. *Chandeleur, Chandeleur Island, Louisiana.*
- 408. *Pass à l'Outre, Mississippi River, Louisiana.*
- 412. *Barrataria Bay, Louisiana.*
- 421. *Half Moon Shoal, Galveston Bay, Texas.*
- 422. *Red Fish Bar, Galveston Bay, Texas.*
- 423. *Clopper's Bar, Galveston Bay, Texas.*
- 427. *Half Moon Reef, Matagorda Bay, Texas.*

LIGHT-SHIPS.

419. *Galveston light-ship inside of Galveston Bar, Texas.*—Condition good.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

408. *Pass à l'Outre, mouth of the Mississippi River, Louisiana.*—A 12-inch steam-whistle. Repairs are required at this station, referred to previously under head of this light-station.

411. *Southwest Pass, mouth of Mississippi River, Louisiana.*—A 12-inch steam-whistle.

DAY OR UNLIGHTED BEACONS.

Range-beacon, Pass à l'Outre, Mississippi River.—Iron-pile beacon.
Stake Island, Southwest Pass, Mississippi River.—Iron-pile beacon.

Five iron-pile beacons.—Marking channel into Atchafalaya Bay, Louisiana.

North breaker-beacon, entrance to Galveston Bay, Texas.—Iron-pile beacon.

BUOYS.

The buoyage in this district is in a satisfactory condition.

DEPOTS.

Coal-depot, Mobile Point, entrance to Mobile Bay.—The coal-platform at this station is in good condition.

Southwest Pass, Louisiana.—An appropriation of \$15,000 having been made for a light-house and buoy-depot at Southwest Pass, Louisiana, the work will be commenced without unnecessary delay.

TENTH DISTRICT.

The tenth district extends from the mouth of Saint Regis River, New York, to include Grassy Island light-house, Detroit River, Michigan; and embraces all the aids to navigation on the American shores of Lakes Erie and Ontario and Saint Lawrence River.

Inspector.—Commodore Napoleon Collins, U. S. N., until July 1, 1874; Commander Edward E. Potter, U. S. N., present inspector.

Engineer.—Maj. Franklin Harwood, Corps of Engineers, and brevet lieutenant-colonel U. S. A., until June 30, 1874; Lieut. Col. C. E. Blunt, Corps of Engineers, U. S. A., present engineer.

In this district there are—

Light-houses and lighted beacons.....	59
Day or unlighted beacons.....	1
Light-ships, in position.....	0
Light-ships, for relief.....	0
Fog-signals, operated by steam or hot-air engines.....	0
Buoys actually in position.....	84
Spare buoys, for relief to supply losses.....	42
Tenders, (steam, buoy-tender,) and supply-vessel.....	1

The numbers preceding the names of stations correspond with the "Light-house list of the northern and northwestern lakes," issued January 1, 1874.

LIGHT-HOUSES AND LIGHTED BEACONS.

498. *Cross-over Island, Saint Lawrence River, New York.*—Both the tower and the dwelling are in a very dilapidated condition. The appropriation asked for last year not having been granted, extensive repairs will be needed to make premises serviceable for the ensuing year. It will be an economy to rebuild the structure at this station, and an appropriation of \$14,000 is required for this purpose.

499. *Sister Island, Saint Lawrence River, New York.*—To protect the lower island from the action of the water, a retaining wall is needed along the northwest side of the dwelling and tower, for which an appropriation of \$700 is asked.

501. *Rock Island, Saint Lawrence River, New York.*—The recommendation contained in last year's report is renewed:

The tower and dwelling are in a similar condition to that of Cross-over Island. A new tower is imperatively necessary. The dwelling might be repaired, but it is not considered economical in the end to do so, as it would only be postponing the building of a new one a few years, and it would probably cost less to build tower and dwelling together now.

An appropriation of \$14,000 is required for a new tower and dwelling, and is recommended.

508. *Fair Haven, Little Sodus Bay, Lake Ontario, New York.*—The dwelling built under contract was completed and accepted in July, 1873, and occupied in August.

— *Thirty-Mile Point, Lake Ontario, New York.*—The site for this light-house has been purchased and cession of jurisdiction obtained. Plans are being prepared, and it is proposed to commence the work without unnecessary delay. An additional appropriation of \$5,000 is asked.

515. *Olcott, Lake Ontario, New York.*—A frame-beacon, with a focal plane of 32 feet above the lake-level, was established on the end of west pier; a fixed white light, sixth order, was shown on and after November 1, 1873.

521. *Dunkirk, Lake Erie, New York.*—The old tower is in a very precarious condition; large sections of the outer shell may fall off at any moment, thereby endangering not only the whole tower with the apparatus, but also the dwelling and its tenants. It is urgently recommended to rebuild the tower at the earliest possible time. An appropriation of \$15,000 is required.

524. *Presque Isle beacon-range No. 1, Lake Erie, Pennsylvania.*—An appropriation of \$8,000 was made at the last session of Congress, for establishing at this station a lumber-depot, which will be acted upon at an early day.

529. *Presque Isle, Lake Erie, Pennsylvania.*—The new light-house was completed on July 1, 1873, and a fixed white light of the fourth order, varied by red flashes, was exhibited on July 12, 1873.

530. *Conneaut, Lake Erie, Ohio.*—An appropriation of \$4,000 was made at the last session of Congress, to renew the beacon, erecting it on the head of the west pier of the harbor. It is expected to exhibit the light of the new beacon on the opening of navigation in the spring of 1875.

531. *Ashtabula, Lake Erie, Ohio.*—An appropriation was made March 3, 1873, for building a new pier-head beacon. The lantern was made, but the contemplated extension of the west pier was not completed, nor will it be this season; when completed, the new beacon will be established.

533. *Grand River (Fairport) beacon, Lake Erie, Ohio.*—An appropriation of \$4,000 was made at the last session of Congress to renew the beacon, erecting it on the head of the east pier of the harbor. The beacon will be erected as soon as the extension of the pier shall have been completed.

535. *Cleveland beacon No. 1, Lake Erie, Ohio.*—An appropriation of \$5,000 was made at the last session of Congress for renewing this beacon. It will be erected shortly, on the head of the west pier to entrance of Cleveland Harbor, and it is hoped that the light can be exhibited before the close of navigation, 1874.

536. *Cleveland beacon No. 2, Lake Erie, Ohio.*—A substantial frame-beacon is to be built at the head of east pier, provided with two sixth-order lenses in lieu of the present mast-head double light.

537. *Black River, Lake Erie, Ohio.*—This station has no keeper's dwelling. An appropriation of \$5,000 was asked for last year for the construction of a frame-dwelling similar to the one at Ashtabula, Ohio. The recommendation is renewed.

— *Sandusky Bay day-beacons, Sandusky Bay, Lake Erie, Ohio.*—An appropriation of \$12,000 was made at the last session of Congress for

two day-beacons in Sandusky Bay. Plans and location are now being considered.

— *Maumee Bay day-beacons, Maumee Bay, Lake Erie, Ohio.*—An appropriation of \$14,000 was made at the last session of Congress for two day-beacons in Maumee Bay. Plans and location are now being considered.

546. *Maumee outer range, (front,) Maumee Bay, Lake Erie, Ohio.*—The slight protection to the slope has been washed away, and the water encroaches at such a rate that the front tower is endangered. A bulkhead of protection is necessary, and for this purpose the sum of \$2,000 is required.

— *Bar Point Shoals, Lake Erie, Michigan, near the mouth of Detroit River.*—These shoals are well defined as to extent and contour by the lake-survey chart published since last annual report. They are almost entirely in Canadian waters, and the attention of the Dominion government has been called to the necessity for and asked to establish a light-ship at that point.

REPAIRS.

At each of the following-named stations in the tenth district, there have been made repairs and improvements, more or less, during the year :

497. *Ogdensburgh, Saint Lawrence River, New York.*
498. *Crossover Island, Saint Lawrence River, New York.*
499. *Sister Island, Saint Lawrence River, New York.*
500. *Sunken Rock, Saint Lawrence River, New York.*
501. *Rock Island, Saint Lawrence River, New York.*
502. *Tibetts Point, Lake Ontario, New York.*
503. *Galloo Island, Lake Ontario, New York.*
504. *Sackett's Harbor, Lake Ontario, New York.*
505. *Stony Point, Lake Ontario, New York.*
506. *Oswego, Lake Ontario, New York.*
507. *Oswego pier-head, Lake Ontario, New York.*
508. *Fair Haven, Lake Ontario, New York.*
509. *Big Sodus beacon, (outer,) Lake Ontario, New York.*
511. *Big Sodus Bay, Lake Ontario, New York.*
513. *Genesee beacon, Lake Ontario, New York.*
514. *Oak Orchard, Lake Ontario, New York.*
515. *Olcott, Lake Ontario, New York.*
516. *Niagara Fort, mouth of Niagara River, New York.*
517. *Horseshoe Reef, Buffalo, New York.*
518. *Buffalo breakwater, (north end,) Lake Erie, New York.*
520. *Buffalo light station and depot, Lake Erie.*
521. *Dunkirk, Lake Erie, New York.*
522. *Dunkirk beacon, Lake Erie, New York.*
523. *Erie Harbor, Lake Erie, Pennsylvania.*
524. *Presque Isle beacon-ranges, Erie, Pennsylvania.*
528. *Peninsular ranges, 1 and 2, Erie, Pennsylvania.*
529. *Presque Isle, Lake Erie, Pennsylvania.*
530. *Conneaut, Lake Erie, Ohio.*
531. *Ashtabula, Lake Erie, Ohio.*
532. *Grand River, Lake Erie, Ohio.*
533. *Grand River beacon, Lake Erie, Ohio.*
534. *Cleveland, Lake Erie, Ohio.*
535. *Cleveland beacon, Lake Erie, Ohio.*
538. *Vermillion, Lake Erie, Ohio.*

- 539. *Huron*, Lake Erie, Ohio.
- 540. *Cedar Point*, Lake Erie, Ohio.
- 541. *Cedar Point beacon*, Lake Erie, Ohio.
- 542. *Marblehead*, Lake Erie, Ohio.
- 543. *Green Island*, Lake Erie, Ohio.
- 544. *West Sister Island*, Lake Erie, Ohio.
- 545. *Turtle Island*, Lake Erie, Ohio.
- 546-51. *Maumee ranges*, Lake Erie, Ohio.
- 552. *Monroe*, Lake Erie, Michigan.
- 555. *Mamajuda*, Detroit River, Michigan.
- 556. *Grassy Island*, Detroit River, Michigan.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

There are no fog-signals operated by steam or hot-air engines in this district.

DAY OR UNLIGHTED BEACONS.

Dunkirk Harbor, New York.—In good condition.

BUOYAGE.

During this season an iron can-buoy has been placed off Bar Point, Lake Erie, to mark a shoal nearly in mid-channel for vessels entering or leaving Detroit River. No other changes have been made in the buoyage of this district since the last report.

DEPOT.

The district depot is in good repair and meets all present requirements.

ELEVENTH DISTRICT.

The eleventh district embraces all aids to navigation on the northern and northwestern lakes above Grassy Island light-station, Detroit River, and includes Lakes Saint Clair, Huron, Michigan, and Superior, and the straits connecting them.

Inspector.—Commodore Alexander Murray, United States Navy, until October 1, 1873; Commander William P. McCann, United States Navy, present inspector.

Engineer.—Major Godfrey Weitzel, Corps of Engineers, brevet major-general United States Army, for the entire district, excepting Lake Michigan; Maj. Henry M. Robert, Corps of Engineers, for Lake Michigan.

There are in this district:

Light-houses and lighted beacons.....	105
Day or unlighted beacons.....	1
Light-ships in position.....	0
Light-ships for relief.....	0
Fog-signal operated by steam or hot-air engines.....	7
Buoys actually in position.....	139
Spare buoys for relief and to supply losses.....	75
Tender, (steam,) <i>Dahlia</i> , buoy-tender and supply-vessel.....	1
Tender, (steamer,) <i>Warrington</i> , (used in engineers' construction and repairs).....	1

The numbers preceding the names of stations correspond with the "Light-house list of the northern and northwestern lakes," issued January 1, 1874.

LIGHT-HOUSES AND LIGHT-BEACONS.

557. *Windmill Point, Michigan, entrance to Lake Saint Clair.*—This station was built in 1838, and refitted in 1867. It is a very important station, as it is a guide for the whole commerce of the lakes, to Lake Saint Clair, and the Detroit River. An entirely new station is imperatively demanded here. Both tower and house are old and in poor condition, and not worth repairing, and it is therefore again recommended that this station be rebuilt at a cost of \$18,000.

559. *Saint Clair Flats Beacon, Lake Saint Clair, Michigan.*—An appropriation of \$10,000 was made at the last session of Congress for rebuilding this beacon and the crib which surrounds it. This will be done as soon as possible.

562. *Fort Gratiot light-station, Lake Huron.*—An appropriation of \$10,000 was made at the last session of Congress, for building a new keeper's dwelling at this place. Plans and estimates for the same will be prepared as soon as possible, and it is hoped the house will be finished this year.

— *Light house between Fort Gratiot and Point aux Barques, Lake Huron.*—The recommendation which has been made in several annual reports to build a coast-light, to divide the long distance of seventy-five miles, between Point aux Barques and Fort Gratiot, is respectfully renewed. This light-house would be of the coast-lights of the general system, and it is not intended to serve any local interest. No argument seems to be necessary to show the necessity of this light, and an appropriation of \$40,000 is recommended for this purpose.

— *Port Austin, Saginaw Bay, Michigan.*—Thus far the Government has not succeeded in obtaining the requisite site for this station, for which an appropriation is available. As soon as it is secured the work will be prosecuted.

564. *Saginaw Bay, at the head of Saginaw Bay and mouth of Saginaw River, Michigan.*—The dwelling-house at this station is very old. It was originally built of rubble masonry. It is dilapidated and not worth repairing. A new dwelling is urgently demanded, the estimated cost of which is \$8,000.

566. *Tawas (Ottawa,) Lake Huron, Michigan.*—The remarks contained in the last annual report are herewith repeated:

This station was originally built on the end of Tawas Point, on the north shore of Saginaw Bay, Michigan. Since that time the point has steadily made to the southward and westward, and the extremity of it is now more than a mile from the light. No extensive repairs or improvements have been made, as the necessity for removal of the light has long been foreseen. It is intended to guide into the harbor of Tawas, which from its situation, so near the mouth of the much-dreaded Saginaw Bay, is of great value and much resorted to for refuge. The construction of a light on the extremity of the present point, if possible, would be quite expensive, and it is an open question whether some other disposition should not be made to meet the requirements of navigation. An estimate of \$30,000 is submitted for a light or lights to guide into Tawas Bay, Michigan, leaving the proper arrangements for future discussion.

567. *Au Sable, mouth of Au Sable River, Lake Huron, Michigan.*—This pier-head light was completed and lighted for the first time on the night of the 20th November, 1873.

573. *Spectacle Reef, Lake Huron, Michigan.*—Operations on this important work were continued. At the end of the fiscal year, June 30, 1873, the cutting and fitting of the stone at the harbor had been com-

pleted to the sixteenth course, inclusive, and at the reef the sixth, seventh, and greater part of the eighth courses were set. At the end of July, of 1873, the tower had been carried up to the sixteenth course, inclusive, and at the harbor the stones had been cut to include twelve stones of the twenty-third course. At the end of August, 1873, the twenty-second course of stone had been set, four-fifths of the iron-steps, including doors at top and bottom, were in place, and at the harbor the stone-cutting was completed and stone-cutters discharged. At the end of September, 1873, all the stone was set up to and including the main deck, (course C,) and the interior brick-work was completed with the exception of the arches between the beams of the three upper floors. At the end of October, 1873, when all the parties were called in, on account of the unusually bad weather during the months of September and October, the station was completed, with the exception of placing the chimney on the outside of the lantern, the stairway leading to the watch-room, (which was found a little short,) painting the tower on the inside, and setting up the lens. The working-parties could not be started, on account of bad weather, until the 14th of May of this year. At the end of that month everything was completed, and the light was exhibited for the first time on the night of June 1, 1874.

578. *Saint Helena, Lake Michigan, Michigan.*—This station was finished in August, and lighted for the first time on the night of September 20, 1873.

580. *Skulligallee, Lake Michigan, Michigan.*—Nothing has been done at this station. The island was seriously damaged by a storm on December 4, 1873, two-thirds of it being reported as washed away. It needs protection, for which an appropriation of \$5,000 is required.

586. *South Manitou, Lake Michigan, Michigan.*—The tower at this station is reported as but twenty feet from the water's edge and the shore wearing away, having been washed off some sixty or seventy feet the past year. Some protection should be afforded the site at once, for which an appropriation of \$2,500 is asked.

588. *Frankfort pier-head light, Lake Michigan, Michigan.*—This light was finished in August, and lighted for the first time on October 15, 1873.

589. *Manistee, Lake Michigan, Michigan.*—The lens was erected on this tower to replace the temporary light in time for the opening of navigation in the spring.

591. *Père Marquette pier-head light, Lake Michigan, Michigan.*—No work was done during the year. The last three annual reports urged an appropriation of \$5,000 for a keeper's dwelling at this point. It is much needed, and the recommendation is renewed. The proposed dredging of the channel this season to a width of 200 feet will take the old house the keeper has been living in, and it is not worth moving. No residence can be had within a half mile, and that on the opposite side of the river from the light.

592. *Pentwater pier-head light, Lake Michigan, Michigan.*—The recommendation in the last annual report, that \$5,000 be appropriated for the erection of a keeper's dwelling at this point, is respectfully renewed.

593. *Petite Pointe au Sable, Lake Michigan, Michigan.*—This station was begun at the opening of the last fiscal year, and was prosecuted with some difficulties in the landing of materials to the close of the season. The inside of the tower and covered way were plastered in the spring, wood-work painted, the grading round the tower done, and the light exhibited on the opening of navigation in 1874.

594. *White River pier-head light, Lake Michigan, Michigan.*—The

small store-house here was washed away by the storm of December 4, 1873. The crib on which the light stands needs filling and planking. An appropriation of \$15,000 having been made for a new tower and keeper's dwelling at this station, plans will be prepared and the work taken in hand without unnecessary delay.

606. *Calumet, Lake Michigan, Illinois.*—This station having been repaired and renovated during the last fiscal year, the lens was set up, and the light exhibited September 7, 1873.

607. *Chicago, Lake Michigan, Illinois.*—There is no way of procuring a proper supply of good water at this station, except by laying a water-pipe to connect with those of the city. The distance from the keeper's dwelling to the nearest point of connection is about 2,600 feet, and the cost of the work will be about \$1,200, for which an appropriation is recommended.

609. *Grosse Point, Lake Michigan, Illinois.*—The tower and dwelling were finished in readiness for lighting March 1, 1874. The light was exhibited on the opening of navigation.

—*Racine Point, Lake Michigan, Wisconsin.*—The recommendation contained in the last four annual reports, that a lake-coast light be established on Racine Point, is respectfully renewed, and an appropriation of \$40,000 recommended. The importance of the erection of a light at this point has been repeatedly urged, and should be established. At the same time the present lake-coast light at Racine should be discontinued.

619. *Sheboygan pier-head light, Lake Michigan, Wisconsin.*—The establishment of this light was commenced in September, 1873, and finished the following month.

623. *Twin River Point, Lake Michigan, Wisconsin.*—The construction of this station commenced last August. Unusual difficulties were met with in landing materials and in digging for the foundations, quicksand being encountered beneath the water-level. Work was suspended November 7, with the concrete in place on the grillage which covers the pile-heads. Work began again April 23, 1874, and the construction has steadily progressed since. On June 30, the tower was 19 feet high above the water-table, the first landing and stairs being set. The dwelling-walls were finished, and the roof being shingled.

—*Sturgeon Bay Ship-Canal, Lake Michigan, Wisconsin.*—The recommendation in the last annual report that a light and steam fog-signal be established at this important point is renewed, and an appropriation of \$20,000 is respectfully asked.

627. *Port du Mort, Lake Michigan, Wisconsin.*—No repairs have been made for some time at this station. Boat house and ways are much needed. A new roof is required on the dwelling, and repairs on the boats, which were badly injured saving a shipwrecked crew. An appropriation of \$1,200 is asked.

627. *Poverty Island, Lake Michigan, Michigan.*—The construction of this light-house began August 28, 1873. The work was closed by a fire which commenced in the sleeping-shanties, while the men were at work, October 25, and which destroyed the temporary shelter and some material. Work with a small party was recommenced May 13, and was brought to a condition to permit of occupancy and the exhibition of a temporary light by the 14th of July, 1874, and then stopped for want of funds. The present condition of the station is as follows: The tower walls are up 31 feet from water-table and covered. All steps and landings up with the walls, the plastering inside partly done. The dwelling is completed and painted and a wooden lantern erected on the roof for a tem-

porary light, the lens for which will soon be set up. The completion of this light will cost about \$3,000, for which an appropriation is asked.

— *Whale's Back Reef, Green Bay.*—An examination and report on the advisability of a light at this point has been ordered by the board.

641. *Big Sable, Lake Superior, Michigan.*—The erection of a light-house at this station was begun during the month of July last year. At the end of the fiscal year it was completed with the exception of plastering and outside whitewashing. It will be ready for lighting as soon as the lens can be set up.

— *Stannard's Rock, Lake Superior, Michigan.*—The survey of this dangerous rock was made as provided for by the act of Congress of March 3, 1873. The results of this survey show that it is practicable to build a light-house to mark this dangerous rock in water varying from 10 to 12 feet and approachable from three sides. This light-house should be built and a fog-signal also erected. This rock lies near the track of all the vessels running to the north side and western portion of Lake Superior, and is an object of great anxiety, especially in dark nights and the almost interminable fog which prevails in that neighborhood during the greater part of the season of navigation. The keeper at Manitou Island reports only five days during the whole month of June, 1874, when there was no fog in that vicinity. The construction of this station will benefit the large, growing, and valuable commerce of the Lake Superior region. This is the proper time to begin it, because it can now be built cheaper than at any future time for the reason that the costly apparatus and machinery used at Spectacle Reef is now available and are especially adapted to works such as this. The work are nearly twenty miles distant from the nearest land and forty from a suitable harbor, and as it will be placed in from ten to twelve feet of water, it will require a structure of the most costly and substantial character. It will cost at least \$300,000, but no accurate detailed estimate can be given in advance. Large as this sum is, its outlay is fully warranted by the necessities of the navigation of the lakes, and therefore an appropriation of \$200,000 is recommended to begin the work.

— *L'Anse, Keweenaw Bay, Lake Superior.*—A clear title has not yet been acquired for the land which has been selected and surveyed for the site of this station. As soon as title to site is secured the work will be taken in hand.

659. *Portage Lake Ship-Canal, Lake Superior, Michigan.*—After a great delay, a clear title for the land required for this station was acquired. Some of the material needed for its construction has been landed, and all purchased. As soon as the station at Outer Island is completed the party will be transferred here, and it is expected to light it about the 15th of October.

661. *Outer Island, Lake Superior, Michigan.*—The work at this station was begun during the month of August, 1873. The work is now progressing, and will probably be ready for lighting about the 1st of October.

— *Sand Island, Lake Superior, Wisconsin.*—The recommendation made in three previous annual reports, that a station should be erected on the northern end of Sand Island, is renewed, and an appropriation of \$18,000 is asked.

666. *Duluth, Lake Superior, Minnesota.*—This station, after a great delay on the part of the contractors, was finally completed during the month of January, 1874, and lighted for the first time on the night of June 2, 1874.

667. *Isle Royale, Lake Superior, Michigan.*—Work could not be com-

menced on this station last year on account of difficulty in determining its proper location. When the location is decided on the work will be prosecuted.

— *Rock Harbor, (Isle Royale,) Lake Superior, Michigan.*—In the latter part of the month of June, 1874, the old station at this place, which had been discontinued, was repaired, and arrangements made for relighting, under the appropriation for that purpose made by Congress. It is expected that the light will be exhibited in August.

— *Passage Island, Lake Superior, Michigan.*—An appropriation of \$18,000 for a station on this island is again recommended. This is an important matter for the valuable commerce of the northern portion of Lake Superior.

PIER-HEAD LIGHTS.

During the year pier-head light structures have been erected and lights exhibited at:

Au Sable, Lake Huron.

Frankfort, Lake Michigan.

Sheboygan, Lake Michigan.

Manitowoc, Lake Michigan.

Duluth, Lake Superior.

As the erection of pier-head lights depends upon the extension of the harbor improvements, it is not practicable to make an estimate in detail, but the amount of \$20,000 in the aggregate will certainly be required for this purpose.

REPAIRS.

Repairs of greater or less extent have been made or are in process of execution at the following stations:

558. *Saint Clair Flats.*

559. *Saint Clair Flats beacon.*

560. *Saint Clair Flats, Canal, (lower light.)*

561. *Saint Clair Flats Canal, (upper light.)*

562. *Fort Gratiot.*

563. *Point aux Barques.*

564. *Saginaw Bay.*

565. *Charity Island.*

566. *Taras.*

569. *Thunder Bay Island.*

570. *Presque Isle Harbor, (front light.)*

571. *Presque Isle Harbor, (rear light.)*

572. *Presque Isle.*

574. *Detour.*

575. *Bois-Blanc.*

576. *Cheboygan.*

580. *Skulligallee.*

583. *South Fox Island.*

586. *South Manitow.*

587. *Point Betsy.*

589. *Manistee, Michigan.*

590. *Grand Point au Sable.*

593. *Petite Pointe au Sable, Michigan.*

596. *Muskegon pier-light, Michigan.*

600. *Kalamazoo, Michigan.*

604. *Michigan City, Indiana.*

607. *Chicago, Illinois.*

- 608. *Chicago pier-light*, Illinois.
- 610. *Waukegan*.
- 612. *Kenosha pier-head*, Wisconsin.
- 614. *Racine pier-head light*.
- 617. *Milwaukee*.
- 615. *Milwaukee beacon*.
- 616. *Milwaukee North-Cut beacon*.
- 621. *Manitowoc pier-light*, Wisconsin.
- 622. *Manitowoc*, Wisconsin.
- 624, 625. *Bailey's Harbor Ranges*.
- 626. *Cana Island*, Wisconsin.
- 630. *Point Peninsula*, Michigan.
- 631. *Escanaba*, Michigan.
- 632. *Eagle Bluff*.
- 635. *Tail-Point*, Wisconsin.
- 636, 637. *Grassy Island*.
- 640. *White-Fish Point*.
- 642. *Grand Island*.
- 643. *Grand Island Harbor*.
- 644. *Marquette*.
- 647. *Granite Island*.
- 649. *Portage River*.
- 652. *Manitou*.
- 653. *Gull Rock*.
- 658. *Eagle River*.
- 660. *Ontonagon*.
- 662. *Michigan Island*.
- 663. *La Pointe*.
- 664. *Raspberry Island*.

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

- Fort Gratiot*, an 8-inch steam-whistle.
- Thunder-Bay Island*, a 10-inch steam-whistle.
- Spectacle Reef*, a 10-inch steam-whistle.
- Detour*, a 10-inch steam-whistle.
- White Fish Point*, a 10-inch steam-whistle.
- Marquette*, a 10-inch steam-whistle.

BUOYS.

The buoyage of this district has been carefully attended to during the year, is in conformity with the printed buoy-list, and generally in good order.

DEPOT.

Light-house depot, Detroit, Michigan.—During the year work was continued on this important depot until the money was all expended. The grounds around the building were graded, as far as they could be; the slopes were sodded; the platform of the front door laid; the sashes for all the windows hung; and elevator constructed; the front door and two doors in basement, all of iron, were hung; the basement flagging

laid and all the flooring; partition and hand-railing in the attic and both (temporary) doors constructed; the iron-work, both inside and outside of the building, painted with one coat for protection; about 60 feet of the small brick drain running through the depot-lot and with which the depot and keeper's dwelling are drained were taken up and renewed, to perfect the drainage; an oil-testing room has been fitted up, and slight damage to the roof of the building, caused by high winds, has been repaired. In this depot is stored the entire supply of oil for the whole lake region, all the valuable material used or to be used in this district, and also some from the tenth district, and it therefore should have an appropriation to complete it and make it perfectly fire-proof. The landing-pier is in a dilapidated and very unsafe condition. The piles and planking are very rotten and no heavy weight can be landed on it. To complete this depot and to build a new landing-pier will require an appropriation of \$10,000, which is earnestly recommended.

SURVEYS OF LIGHT-HOUSE SITES.

The surveys completed since the last report are L'Anse, Isle Royale, and Rock Harbor. In addition a number of preliminary surveys in connection with light-houses now building or to be built, have been made. It is intended to continue this work in accordance with settled plan of the board as rapidly as possible.

TWELFTH DISTRICT.

CALIFORNIA.

This district embraces all aids to navigation on the Pacific coast of the United States, between the Mexican frontier and the southern boundary of Oregon, and includes the coast of California.

Inspector.—Commodore James H. Spotts, United States Navy.

Engineer.—Maj. N. Michler, Corps of Engineers, brevet brigadier-general, United States Army, until October 1, 1873; Lieut. Col. R. S. Williamson, Corps of Engineers, United States Army, present engineer.

In this district there are:

Light-houses and lighted beacons.....	18
Day or unlighted beacons.....	4
Light-ships	0
Fog-signals operated by steam or hot-air engines.....	8
Buoys actually in position	42
Spare buoys for relief and to supply losses.....	28
Tender Shubrick, common to twelfth and thirteenth districts, used for inspectors' and engineers' purposes.....	1

The numbers preceding the names of stations correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1874.

LIGHT-HOUSES AND LIGHTED BEACONS.

432. *Point Fermin, coast of California.*—An appropriation of \$20,000 was made June 10, 1872, for the purpose of erecting at this station a fourth-order light-house. As it was found impossible to secure the proper site from the owners (several being minor heirs) by purchase, it was found expedient to secure the same by condemnation under the laws of this State. Suit was accordingly brought for that purpose, which terminated favorably to the United States on the 4th day of November, 1873. The

plans for the structure having been prepared, on the 21st of February of this year the work was commenced. It has progressed favorably since that time. In addition to the light-house keeper's dwelling, two large cisterns and the necessary out-houses have been built. The reservation is inclosed by a substantial fence, and the grounds in the immediate vicinity of the keeper's dwelling and tower are inclosed by a neat picket-fence. The lantern has been set up at the station. It is expected to exhibit the light during the present season.

433. *Point Hueneme, sea-coast of California.*—An appropriation of \$22,000 was made by Congress on the 3d of March, 1873, for building a fourth-order light-house, the appropriation made by previous act for a fog-signal to revert to the Treasury. It being impracticable to procure the requisite amount of land for light-house purposes by purchase, a suit for condemnation was commenced against the owners of the land. The suit terminated favorably to the United States on the 6th day of November, 1873. Plans for the structure were prepared, and on the 25th of April work was commenced, and has progressed favorably since that time. An artesian well has been bored at the station, which is 7 inches in diameter and 152 feet in depth. This well furnishes an abundant supply of water for all necessary purposes.

435. *Point Conception, sea-coast of California.*—An additional dwelling has been built at this station, the water-shed made for the fog-signal; the old dwelling, fences, out-houses, &c., have been thoroughly repaired. The title to this station is in dispute, but a survey is being made with a view to settling the matter.

436. *Piedras Blancas, sea-coast of California.*—An appropriation of \$75,000 was made by Congress on the 10th of June, 1872, for a first-order light-house and fog-signal at this point. The plans for the tower having been prepared, the necessary party of mechanics and laborers was organized, the material to commence the work purchased, shipped to the point, and successfully landed through the surf on the 25th of April last. The work of blasting off the top of the rock on the site selected for the tower was then commenced. A contract for the iron-work of the tower has been made, and is nearly completed. The work of reducing the rock for a site for the tower has proved to be a very expensive operation; the rock being so hard as almost to resist the best-tempered drills. Finding that to reduce the rock to the level of the base of the tower, as per plan, would add very largely to the cost of the structure, it was determined to reduce it to a level of the floor-line of the tower only. An equally good foundation was by this means obtained at less cost. It is expected to complete the brick-work of the tower for the lantern about November 1. Plans for a dwelling have been prepared, but the amount of the appropriation left after the completion of the tower will not be sufficient to construct it with the necessary cistern and out-houses. The lantern and lens for the station are in store. An appropriation of \$10,000 is therefore required to complete the station. Piedras Blancas is one of the most important points on this coast, and a steam fog-signal of the most improved kind should be established there. An appropriation of \$5,000 is therefore asked for that purpose.

— *Point Sur, sea-coast of California.*—Vessels leaving San Francisco for the south, having proceeded as far as Pigeon Point light, take their departure from Point Sur, some sixty miles distant, the great indentation of the Bay of Monterey intervening. Vessels to the southward bound to San Francisco having arrived at Piedras Blancas, take their departure for Point Sur again about sixty miles distant; hence Point Sur is a most

important point, and should be the site of a light-house. In considering the various points on the California coast where light-houses are still required Point Sur claims the place of greatest importance. In 1866 the Light-House Board ordered an examination of this point to be made, and the following is an extract from the report of examining officer :

Point Sur is a metamorphic sandstone, and has an altitude of 363 feet, (established from observations with the aneroid barometer.) It covers an area of nearly three acres, its general shape being that of a wedge with an indented edge. The general direction of the wedge, as indicated by the compass, is east-southeast and west-north-west. The north side and top of Point Sur are covered with grass, and the sides are very steep, making the ascent very difficult. The extreme eastern and western portions of this point, or rock, are almost vertical, and the upper edge very narrow, not being more than 10 or 12 feet in width. Point Sur is situated at a distance of about half a mile from the foot of the range of hills which form the prominent feature of the coast, the intervening portion of the country being low and sandy. In very rough weather the low land is overflowed, thus making an island of the rock. Sur River, which is about three miles southeast of Point Sur, contains good water during the whole year, and near its mouth is a good landing-place for vessels. The only way in which supplies can be sent to Point Sur is by water, for the only road is a trail almost impassable even for a horse.

The Coast Survey Directory for the Pacific coast contains these remarks :

From Piedras Blancas the coast tends northwest half west for a distance of fifty-seven miles in an almost perfectly straight line. * * * Continuing on the same bearing, and at a distance of forty-nine miles from Piedras Blancas, is Point Sur, sometimes called Lobos, making out nearly half a mile. As seen from the north or south, at a distance of ten miles, Point Sur appears a high, large, round-topped island ; but upon approaching it a low neck of land is seen connecting it with the main.

From the preceding it is apparent that the importance of this point as a light-house site is very great. It must also appear that the erection there of a light-house, with the accompanying buildings, will be an expensive operation. It will be necessary to make a detailed survey of the rock before anything definite can be known as to the cost of establishing this station. As nearly as can be estimated with the data available, it will cost not less than \$100,000, and an appropriation of \$60,000 is asked to begin the work.

437. *Point Pinos, sea-coast of California.*—The suit for a title to this station is still pending and will come up again for trial in the district court for the county of Monterey, which meets on the third Monday of November next.

441. *Point Montara, midway between Pigeon Point and entrance to San Francisco Bay and Harbor, sea-coast of California.*—An appropriation of \$15,000 was made by Congress, March 3, 1873, for the establishment of steam fog-signal at this point. A site has been secured and a favorable opinion to title given by the Attorney-General of the United States. The boiler and the necessary machinery are on hand ; plans for a keeper's dwelling and signal-house will be prepared, and the work will then be commenced.

442. *Farallones, off entrance to San Francisco Bay.*—The dwelling at this station is very much out of repair, and is much too small for the wants of a first-order station. It was built in 1855 out of rock quarried on the island, and is very damp. A substantial wooden structure is needed, and it is respectfully recommended that an appropriation of \$15,000 be made for this purpose. The tower requires some repairs, and a small stable is also needed for the mule which is kept to carry oil and other supplies up to the light-house tower.

443. *Point Bonita.*—During a severe storm, February 9 of this year,

a portion of the bank sustaining the trumpet of the fog-signal at this station fell into the sea, endangering the foundation of the signal-house and machinery. One of the trumpets was taken down, the bank was sloped off, and every precaution taken to insure the safety of the signal-house and machinery. The top of the ridge or point on which the signal-house stands is very narrow, and the banks on either side are very precipitous, in fact almost perpendicular. The signal-house and machinery are in a dangerous position, and orders have therefore been given to have the proper steps taken to render it safe, the expense to be borne by the general appropriation for fog-signals. An additional cistern was built for the fog-signal in December last. An alarm-signal between the tower and fog-signal was put up in June of this year. The dwelling at this station is entirely too small and is much out of repair, although considerable money is spent each year in trying to put it in a comfortable condition for the keepers. It is very damp. An appropriation of \$12,000 for the purpose of erecting a substantial wooden dwelling for the use of the keepers at this station is recommended.

446. *Yerba Buena, San Francisco Bay, California.*—The fog-bell recently in use at Point Conception light-station, California, has been put in position here, and is operated by a Stevens clock apparatus. Congress at its last session made an appropriation of \$10,000 for the establishment of a light-house and fog-signal on the southeastern extremity of this island; an examination for the purpose of selecting a proper site for the light-house has been made. As soon as plans are prepared the construction of the same will be taken in hand.

447. *East Brother Island light station, off Point San Pablo, and the straits separating San Francisco and San Pablo Bays.*—An appropriation of \$30,000 was made by Congress March 3, 1873, "for a light-house and steam fog-signal at Point San Pablo, California." In consequence of the litigation necessary to obtain a site on the mainland, it was determined to erect the light-house and fog-signal structures on East Brother Island, which is immediately opposite and about a quarter of a mile distant from Point San Pablo. A contract was made to blast off the top of the rock, build a sustaining-wall around the same, and erect the light-house and fog-signal. They were completed in February and the light was exhibited for the first time on the evening of 1st of March of this year. A subsequent contract was made for building the cistern, water-shed, wharf, tramway, and out-houses. This contract was completed in April and the steam fog-signal was put in operation on May 1st of this year.

448. *Mare Island, Strait of Karquines, California.*—The fog-bell and machinery formerly in use at Point Bonita light-station has been removed to this station, where a suitable house has been built for it.

449. *Point Reyes, sea-coast of California.*—The steam fog-signal was stopped by the want of water in July of 1873. The water-shed and cistern were put in thorough order in December of 1873, and during the past rainy season the large cistern was filled. The fog-signal recommenced sounding January 20, 1874. Quite extensive repairs were made to the retaining-wall which sustains the rear of the keeper's dwelling to the wind-fences which protect the same, and to the steep path leading to the steam fog-signal. At Point Reyes is a cistern of the capacity of 75,000 gallons, and around it is a basin capable of holding one-fourth more. The cistern is filled by rain received on water-shed of 10,000 square feet. This water-shed is composed of a thin layer of concrete, and requires constant repairs to prevent the rain which falls on it from soaking into the ground. Last year, in mid-summer, the cistern became empty, and this important fog-signal became inoperative until the rains

of last winter put enough water in the cistern to permit of the signal being again used. Last winter the rains were more than the average, and it is hoped that no stoppage of the signal will occur this year. But should there come a dry season, it is certain the cistern will be emptied unless steps are taken to prevent it. If the area of the water-shed were enlarged to 15,000 square feet, and covered with asphaltum, nearly all the water falling on the shed would be secured, and there would be no probability of the signal's being again stopped. An asphaltum water-shed can be laid at 30 cents per square foot. An appropriation of \$3,000 for this purpose is therefore recommended.

452. *Humboldt, coast of California.*—An appropriation of \$10,000 was made by Congress March 3, 1873, for a steam fog-signal at this station. The work was commenced in December of 1873, and was completed in March last. The fog-signal structures are built in a very substantial manner. Water is obtained from wells (three in number) dug near the site. These wells will afford an ample supply of water for the use of the signal. The signal went into operation on the 10th of May last. Some repairs are needed to the keeper's dwelling, which will be made during the present season from general appropriations for repairs.

455. *Crescent City, sea-coast of California.*—The keeper's dwelling at this station is in a very dilapidated condition and should be rebuilt. An appropriation of \$5,000 is asked for that purpose.

— *Point Saint George or vicinity, sea-coast of California.*—This is one of the most important points for a sea-coast light on the coast of California. The bluff point is about 130 feet high, with level land for some distance back of it. Off the point, extending some six or seven miles, is a very dangerous reef of rocks, quite a number of which show above water, and many are awash at low tide; others have from three to four fathoms of water on them. The passage between the outlying rocks of this reef and Point Saint George is quite wide, and is used by the coasting-steamers and sailing-vessels. The steamer Brother Jonathan was wrecked on this reef some years ago during a fog, and many lives were lost; among them General Wright and staff, with the families of himself and several of his staff. A light-house and fog-signal should be erected here. An appropriation of \$50,000 is asked to commence the work.

REPAIRS.

At each of the following-named stations repairs and renovations more or less extensive have been made during this year:

- 431. *Point Loma.*
- 434. *Santa Barbara.*
- 435. *Point Conception.*
- 437. *Point Pinos.*
- 438. *Santa Cruz.*
- 439. *Año Nuevo Island.*
- 440. *Pigeon Point.*
- 443. *Point Bonita.*
- 444. *Fort Point.*
- 445. *Alcatraz.*
- 448. *Mare Island.*
- 449. *Point Reyes.*
- 452. *Humboldt.*

LIGHT-SHIPS.

There are no light-ships in this district.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

Point Conception.—A 12-inch steam-whistle.
Año Nuevo Island.—A 12-inch steam-whistle.
Pigeon Point.—A 12-inch steam-whistle.
Point Montara.—A 13-inch steam-whistle.
Point Bonita.—A first-order steam-siren.
East Brother Island.—A 12-inch steam-whistle.
Point Reyes.—A 12-inch steam-whistle.
Point Arena.—A 12-inch steam-whistle.
Humboldt.—A 12-inch steam-whistle.

DAY OR UNLIGHTED BEACONS.

Fauntleroy Rock Beacon, Crescent City Harbor, California.—This beacon was carried away during a heavy gale in December last. A new spindle to replace it will be put in position during the present season.

Four day-beacons, each formed by four piles, with box 8 feet by 5 on top, have been placed in the Upper Bay of San Francisco, to take the place of iron buoys.

DEPOT.

Yerba Buena Depot, San Francisco Bay, California.—This depot is in good condition, and meets the wants of the district.

THIRTEENTH DISTRICT.

This district embraces all aids to navigation on the Pacific coast of the United States north of the southern boundary of Oregon. It extends from the forty-first parallel of latitude to British Columbia, and includes the coasts of Oregon and of Washington Territory.

Inspector, Commodore James H. Spotts, United States Navy.

Engineers, H. M. Robert, Major of Engineers, United States Army, until October 16, 1873; N. Michler, Corps of Engineers, United States Army, present engineer.

There are in this district—

Light-houses and lighted beacons.....	11
Day or unlighted beacons.....	0
Light-ships, in position.....	0
Light-ships, for relief.....	0
Fog-signals, operated by steam or hot-air engines.....	2
Buoys actually in position.....	56
Spare buoys, for relief and to supply losses.....	36
Tender (steam) Shnbrick, common to twelfth and thirteenth districts.....	1

The following numbers, which precede the names of stations, correspond with those of the "Light-house List of the Atlantic, Gulf, and Pacific Coasts of the United States," issued January 1, 1874:

458. *Yaquina, entrance to Yaquina Bay, Oregon.*—Since the establishment of the light upon Cape Foulweather, (Yaquina Head,) Yaquina light is no longer necessary. An examination of this station was made in May last, by the inspector and engineer of the district, and its discontinuance recommended. The light will be extinguished October 1.

459. *Cape Foulweather, Yaquina Head, Oregon.*—This station was completed, and the light exhibited for the first time on the night of August 20, 1873.

— *Point Adams, south side of the entrance to Columbia River, Oregon.*—The site for the light-house and steam fog-signal to be erected at this

place has been selected by the district officers, and a survey of the locality made. Proposals for their construction were invited, and the contract awarded to the lowest bidder. It is expected to complete the station by the 1st of November.

448. *Shoalwater Bay, on Toke Point, north point of Shoalwater Bay, Washington Territory.*—An extension to the dwelling for kitchen and other purposes, a wood-shed, and boat-house have been built.

449. *Cape Flattery, (Tatoosh Island,) entrance to the Strait of San Juan de Fuca.*—An appropriation of \$18,000 having been made for the erection of a new dwelling at this station, which is much needed, owing to the additional number of keepers required for working the fog-signal, the work will be commenced without delay. The old cistern, which had been leaking badly, has been repaired, and a large wooden tank constructed to insure a more certain and ample supply of water for the steam fog-signal. The almost inaccessible position of Tatoosh Island for many months of the year renders it necessary to supply this station with a boat-derrick and hoisting-apparatus and tram-ways leading to the store-house to enable the keepers to safely land supplies and to raise them to the top of the bluff bank and then to transport them to the light-house.

450. *Ediz Hook, Strait of San Juan de Fuca, Washington Territory.*—Slight repairs have been made at this station during the year.

464. *New Dungeness, Strait of San Juan de Fuca, Washington Territory.*—The fog-signal, for which an appropriation was made by act of March 3, 1873, has been completed and is in operation. A frame addition to the old stone dwelling has been built during the year. Four cisterns enlarged and curbing raised several feet above the ground. Very little rain falls at this point, and no springs are available. This necessitates the establishment of large cisterns for the collection of water for the fog-signal.

465. *Smith's or Blunt's Island, near the entrance to Puget's Sound, Washington Territory.*—A special appropriation of \$1,500 having been made for construction of cistern and general repairs, the work will be attended to without unnecessary delay.

466. *Admiralty Head, on Red Bluff, Whidby's Island, entrance to Puget's Sound, Washington Territory.*—An appropriation of \$3,500 having been made for general repairs at this station, the necessary steps will be taken to place the station in good condition.

— *Point no Point, Puget Sound.*—An appropriation is still available for the erection of a light-house at Point no Point, Puget Sound, Washington Territory, or such other point in Puget Sound as the Light-House Board may select. The work will be taken in hand as soon as the best site is secured and plans determined on.

REPAIRS.

Repairs more or less extensive have been made during the year at each of the following-named stations:

Cape Arago, Oregon.

Yaquina Bay, Oregon.

Cape Foulweather, Oregon.

Cape Disappointment, Washington Territory.

Shoalwater Bay, Washington Territory.

Cape Flattery, Washington Territory.

Ediz Hook, Washington Territory.

New Dungeness, Washington Territory.
Smith's Island, Washington Territory.
Admiralty Head, Washington Territory.

LIGHT-SHIPS.

There are no light-ships in this district.

DAY OR UNLIGHTED BEACONS.

An appropriation of \$3,000 has been made for day-beacons in the Columbia River. The sites have not yet been determined upon.

FOG-SIGNALS OPERATED BY STEAM OR HOT-AIR ENGINES.

Cape Flattery.—A 12-inch whistle.
Dungeness.—A 12-inch whistle.

BUOYS.

Buoyage in this district is in good condition and agrees with the published list.

DEPOT.

A depot for buoys, supplies, &c., is much needed in this district, and an appropriation of \$10,000 is respectfully asked for that purpose.

In submitting this report, it gives the Board much pleasure to state to the honorable the Secretary of the Treasury that every district of the extended coast of the United States is in good working condition, and has been constantly improved during the past year; that the inspectors and engineers have faithfully and industriously performed their duties; that regular meetings of the Light-House Board have been held every Wednesday, instead of once a quarter as formerly, at which the reports of the standing committees elaborated meantime have been acted upon, and that an earnest desire has been evinced to render the light-house system as perfect an aid to navigation as the present state of science and art would indicate and the appropriations made by Congress permit.

Respectfully submitted.

JOSEPH HENRY,
Chairman.

J. G. WALKER,
Commander U. S. N., Naval Secretary.
 PETER C. HAINS,
Major of Engineers, U. S. A., Engineer Secretary.

APPENDIX.

REPORT OF THE OPERATIONS OF THE LIGHT-HOUSE BOARD RELATIVE
TO FOG-SIGNALS.BY JOSEPH HENRY, *Chairman.*

FOG.

Among the impediments to navigation none are perhaps more to be dreaded than those which arise from fogs, and consequently the nature of this impediment and the means which may be devised for obviating it are objects of great interest to the mariner. Fogs are in all cases produced when cold air is mingled with warm air saturated with moisture. In this case the invisible vapor of the warmer air is condensed by the cold into minute particles of liquid water, which, by their immense number and multiplicity of reflecting surfaces, obstruct the rays of light, in the same way that a piece of transparent glass when pounded becomes almost entirely opaque and is seen by reflection as a white mass. So greatly does a dense fog obstruct light that the most intense artificial illumination, such as that produced by the combustion of magnesium, by the burning of oxygen and hydrogen in contact with lime, and that produced between the charcoal points of a powerful electrical apparatus, are entirely obscured at comparatively short distances. Even the light of the sun, which is far more intense than that of any artificial illumination, is so diminished by a single mile of dense fog that the luminary itself becomes invisible. Recourse must therefore be had to some other means than that of light to enable the mariner to recognize his position on approaching the coast when the land is obscured by fog.

The only means at present known for obviating the difficulty is that of employing powerful sounding instruments which may be heard at a sufficient distance through the fog to give timely warning of impending danger. Investigations, therefore, as to the nature of sound and its applications to fog-signals become an important object to those in charge of aids to navigation. Such investigations are of special importance in connection with the light-house service of the United States. The northeastern coast of the United States on the Atlantic, and the entire western coast on the Pacific, included in our territory, are subject, especially during the summer months, to dense fogs, which greatly impede navigation, as well as endanger life and property.

The origin of the fogs on our coast is readily explained by reference to a few simple principles of physical geography. In the Atlantic Ocean there exists a current of warm water proceeding from the Gulf of Mexico, between Cuba and Florida, which flows along our coast to the latitude of about 35° , and then turning gradually to the eastward, crosses the Atlantic and impinges against the coast of Northern Europe. Throughout its entire course, on account of the immense capacity of water for heat, the temperature of the stream is greater than that of the ocean on either side. In addition to this stream, the Atlantic Ocean is traversed by another current of an entirely opposite character, one of cold water, which, coming from arctic regions down Davis's Strait, is thrown, by the rotation of the earth, against our coast, passing between it and the Gulf-stream, and sinking under the latter as it approaches the southern extremity of the United States.

These conditions are those most favorable to the production of fogs, since, whenever the warm air, surcharged with moisture, is blown from the Gulf-stream over the arctic current and mingles with the cold air of the latter, a precipitation of its vapor takes place in the form of fog. Hence, especially in summer, when the wind in the eastern part of the United States is in a southeasterly direction, fogs prevail. As we proceed southerly along the coast, the fog-producing winds take a more easterly direction.

A somewhat similar circulation in the Pacific Ocean produces fogs on the western coast of the United States. In this ocean a current of warm water, starting from the equatorial regions, passes along the shores of China and Japan, and, following the general trend of the coast, continues along our shore. The northern part of this current being warmer than the ocean through which it passes, tends to produce dense fogs in the region of the Aleutian Islands and the coast of Alaska. As this current descends into lower latitudes it gradually loses its warmth, and at a certain point it assumes the character, in regard to the water through which it passes, of a comparatively colder stream, and to this cause we would attribute the prevalence of fogs on the coast of Oregon and California, which are most prevalent during the spring and early summer, with wind from the northwest and west.

From what has been said, it is evident that the fogs in the Aleutian Islands occur chiefly in summer, when southwesterly winds prevail and mingle the moist air from the warm current with the colder air of the more northerly latitude. In winter, the wind being from the north chiefly, the moist air is driven in an opposite direction, and dense fogs therefore at this season do not prevail.

In regard to the fogs on the coast of Maine, the following interesting facts were furnished me by the late Dr. Stimpson, formerly of the Smithsonian Institution and of the Chicago Academy of Sciences, who had much experience as to the weather during his dredging for marine specimens of natural history in the region of Grand Manan Island, at the entrance of the Bay of Fundy.

"So sharply marked," says Dr. Stimpson, "is the difference of temperature of the warm water from the Gulf-stream and that of the polar current, that in sailing in some cases only a few lengths of a ship the temperature of the water will change from 70° to 50°. The fog frequently comes rolling in with the speed of a race-horse; in some cases while dredging, happening to turn my eyes to the south, a bank of fog has been seen approaching with such rapidity that there was scarcely time in which to take compass-bearing of some object on shore by which to steer, before I would be entirely shut in, perhaps for days together." He also mentions the fact that it frequently happened during a warm day, while a dense fog existed some distance from the shore, close in to the latter there would be a space entirely clear; this was probably due to the reflection and radiation of the heat from the land, which converted the watery particles into invisible vapor.

Dr. Stimpson has also noticed another phenomenon of some interest. "When a dense fog, coming in regularly from the sea, reaches the land, it gradually rises in the atmosphere and forms a heavy, dark cloud, which is frequently precipitated in rain." This rising of fog is not due, according to the Doctor, to a surface-wind from the west pressing under it and buoying it upward, since the wind at the time is from the ocean. It is probably due to the greater heat of the land causing an upward current, which, when once started, by its inertia carries the cloud up to a region of lower temperature, and hence the precipitation. The height of the fog along the coast is not usually very great, and can be frequently overlooked from the mast-head. The deception as to size and distance of objects as seen in a fog is also a remarkable phenomenon when observed for the first time. A piece of floating wood at a little distance is magnified into a large object, and after much experience the Doctor was not able to overcome the delusion. It is said that the sailors in the Bay of Fundy prefer of two evils a fog that remains constant in density to one that is variable, although the variation may be toward a greater degree of lightness, the varying intensity producing a varied and erroneous impression of the size and distance of the object seen through it. It is also his impression that sound can be heard as well during fog as in clear weather, although there is a delusion even in this, since the source of sound, when seen, appears at a greater distance than in a clear atmosphere, and hence the sound itself would appear to be magnified.

Fogs also exist on the Mississippi, especially on the lower portion of the river. They are of two classes, those which result from the cooling of the earth, particularly dur-

ing the summer in clear nights, with wind probably from a northerly direction, followed by a gentle, warm wind from the south surcharged with moisture, and the other induced by the water of the river, which, coming from melting snow of northern regions, is colder than the air in the vicinity. The air over the river being thus cooled below the temperature of a gentle wind from the south, the moisture of the latter is precipitated. This fog, which occurs in the last of winter, during the spring, and beginning of summer, is very dense, but is confined entirely to the atmosphere above the river, while the other class of fog exists over the land as well.

FOG-SIGNALS.

The importance of fog-signals as aids to navigation, especially on the northeastern portion of our coast, of which the shore is exceedingly bold and to the approach of which the sounding-line gives no sure indication, has been from the first an object of special attention.

At the beginning of the operations of the Light-House Board such instruments were employed for producing sound as had been used in other countries; these consisted of gongs, bells, guns, horns, &c. The bells were actuated by clock-machinery which was wound up from time to time and struck at intervals of regular sequence by which their position might be identified. The machinery, however, by which these bells were struck was of a rude character and exceedingly wasteful of power, the weight continuing to descend during the whole period of operation, including the successive intervals of silence. This defect was remedied by the invention of Mr. Stevens, who introduced an escapement arrangement, similar to that of a clock, which is kept in motion by a small weight, a larger one being brought into operation only during the instant of striking.

Bell-buoys were also introduced at various points. These consisted of a bell supported on a water-tight vessel and rung by the oscillation of the waves, but all contrivances of this kind have been found to be untrustworthy; the sound which they emit is comparatively of feeble character, can be heard at but a small distance, and is frequently inefficient during a fog which occurs in calm weather. Besides this, automatic fog-signals are liable to be interfered with by ice in northern positions, and in all sections to derangement at times when no substitute can be put in their place, as can be in the cases of the bells rung by machinery under the immediate control of keepers. A signal which is liable to be interrupted in its warnings is worse than no signal, since its absence may give confidence of safety in midst of danger, and thus prevent the necessary caution which would otherwise be employed.

Guns have been employed on the United States coast, first under the direction of General Bates, engineer of the twelfth district, at Point Bonita, San Francisco Bay, California. The gun at this station consisted of a 24-pounder, furnished by the War Department. The necessary arrangements being made, by the construction of a powder-house, and laying of a platform, and employment of a gunner, notice to mariners was given that after the 8th of August, 1856, a signal-gun would be fired every hour and half hour, night and day, during foggy or thick weather. The first year, with the exception of eighty-eight foggy days, omitted for want of powder, 1,390 rounds were fired. These consumed 5,560 pounds of powder, at a cost of \$1,437, pay of gunner and incidentals excluded. The following year the discharges were 1,582, or about one-eleventh of the number of hours and half-hours of the whole time. The fog-gun was found to answer a useful purpose; vessels by the help of it alone having come into the harbor during a fog at night, as well as in the day, that otherwise could not possibly have entered. This signal was continued until it was superseded by a bell-boat. A gun was also used at West Quoddy Head, near the extreme eastern part of Maine. It consisted of a short piece, or carronade, 5 feet long, with a bore of $5\frac{1}{2}$ inches, charged with four pounds of blasting-powder. The powder was made up in cartridges and kept in chests in the work-house. The gun was only fired on foggy days, when the steamboat running between Boston and Saint John's, New Brunswick, was approaching the light-house from

the former place. In going in the other direction the signal was not so much required, because in the former case the vessel had been for some time out of sight of land, and consequently its position could not be so well known. The firing was commenced with the hearing of the steamer's whistle as she was approaching, and as the wind during the fog at this place is generally from the south, the steamer could be heard five or six miles. The firing was continued as frequently as the gun could be loaded until the steamer answered by a signal of three puffs of its whistle. The number of discharges was from one to six; the latter exhausting a keg of powder valued at \$8. The keeper of the light-house acted as gunner, without compensation other than his salary. The cost of powder was paid by the steamboat company. The report of the gun was heard from two to six miles.

This signal has been abandoned because of the danger attending its use, the length of the intervals between the successive explosions, and the brief duration of the sound which renders it difficult to determine with accuracy its direction.

The lamented General Bache, of the Light-House Board, adopted a very ingenious plan for an automatic fog-signal, which consisted in taking advantage of a conical opening in the coast, generally designated a blow-hole. On the apex of this hole he erected a chimney which terminated in a tube surmounted by a locomotive-whistle. By this arrangement a loud sound was produced as often as a wave entered the mouth of the indentation. The penetrating power of the sound from this arrangement would not be great if it depended merely on the hydrostatic pressure of the wave, since this, under favorable circumstances, would not be more than that of a column of water 20 feet high, giving a pressure of about 10 pounds to the square inch. The effect, however, of the percussion might add considerably to this, though the latter would be confined in effect to a single instant. In regard to the practical result from this arrangement, which was continued in operation for several years, it was found not to obviate the necessity of producing sounds of greater power. It is, however, founded on an ingenious idea, and may be susceptible of application in other cases.

EXPERIMENTS IN 1855.

The Light-House Board was not content with the employment alone of the fog-signals in ordinary use, but directed a series of experiments, in order to improve this branch of its service. For this purpose the board employed Prof. J. H. Alexander, of Baltimore, who made a report on the subject, which was published among the documents. The investigations of Professor Alexander related especially to the use of the locomotive steam-whistle as a fog-signal, and in his report he details the results of a series of experiments in regard to the nature and adjustment of the whistle, the quantity of steam necessary to actuate it, with suggestions as to its general economy and management. He found, what has since been fully shown, that the power of the sound depends upon the pressure of the steam in the boiler, and the pitch upon the distance between the circular orifice through which the steam issues and the edge of the bell. He appears, however, to be under an erroneous impression that the sound is produced by the vibrations of the metal of the goblet or bell, while in fact this latter portion of the apparatus is a resounding cavity, which, as I have shown in subsequent experiments, may be constructed of wood as well as of brass, in order to produce the same effect. Mr. Alexander also mentions the effect of the wind in diminishing the penetrating power of sound when in an adverse direction, either directly or approximately. He also recommends the adoption of an automatic pump to supply the boilers with water, and also to open and shut the valves at the proper intervals for blowing the whistle. He states that the location of a sound can be determined more precisely in the case of loud, high sounds, than in that of feebler or lower ones. On this point I am not prepared to concur with him in experiments of my own. In all cases, however, loud sounds are more desirable than feebler ones, in order that they may be heard at a greater distance above the noise of the surf and that of the wind as it passes through the spars and rigging of vessels.

The board, however, at this time were not prepared to adopt these suggestions, and an unsuccessful attempt to use a steam-boiler, rendered abortive by the incapacity of the keeper to give it proper attendance, discouraged for a time efforts in this line.

Previous to the investigations of Mr. Alexander, at the expense of the Light-House Board, Mr. Daboll, of New London, had for several years been experimenting on his own account with reference to a fog-signal. His plan consisted in employing a reed trumpet, constructed after the manner of a clarionet, and sounded by means of air condensed in a reservoir, the condensation being produced by horse-power operating through suitable machinery. Although the sound of this was more penetrating than that of bells, still, the expense and inconvenience of the maintenance of a horse, together with the cost of machinery, prevented its adoption. Mr. Daboll, however, after this presented to the Board a modification of his invention, in which a hot-air engine of Ericsson's patent was substituted as the motive-power, instead of the horse; and the writer of this report, as chairman of the committee on experiments in behalf of the Board, examined this invention and reported in favor of its adoption. The other member of the committee made an unfavorable report on the ground that fog-signals were of little importance, since the mariner should know his place by the character of his soundings in all places where accurate surveys had been made, or should not venture near the coast until the fog was dissipated. The Board, however, established Daboll trumpets at different stations, which have been in constant use up to the present time.

EXPERIMENTS NEAR NEW HAVEN.

The subject of sound, in connection with fog-signals, still continued to occupy the attention of the Board, and a series of investigations was made in October, 1865, at the light-house near New Haven, under the direction of the writer of this report, in connection with Commodore, now Admiral, Powell, inspector, and Mr. Lederle, acting engineer of the third district.

The principal object was to compare the sound of bells, of steam-whistles, and other instruments, and the effect of reflectors, and also the operation of different hot-air engines. For this purpose the committee was furnished with two small sailing-vessels. As these were very imperfectly applicable, since they could not be moved without wind, the writer of the report devised an instrument denominated an "artificial ear," by which the relative penetrating power of different sounding bodies could be determined and expressed in numbers by the removal of the observer to a comparatively short distance from the point of origin of the sound. This instrument consisted of a conical horn, made of ordinary tinned sheet-iron, the axis of which was about 4 feet in length, the diameter of the larger end 9 inches, and tapering gradually to $1\frac{1}{2}$ of an inch at the smaller end. The axis of this horn was bent at the smaller end in a gentle curve, until the plane of the section of the smaller end was at right angles to the perpendicular section of the larger end, so that when the axis of the trumpet was held horizontally and the larger section vertically, then the section of the smaller end would be horizontal. Across the smaller end a thin membrane of gold-beater's skin was slightly stretched and secured by a thread. On this membrane fine sand was strown. To protect the latter from disturbance by the wind, it was surrounded by a cylinder of glass, cut from a lamp-chimney, the upper end of which was covered with a plate of glass; and, in the improved condition of the instrument, with a magnifying lens, with which to observe more minutely the motions of the sand. To use this instrument in comparing the relative penetrating power of sound from different sources, as, for example, from two bells, the axis being held horizontal, the mouth was turned toward one of the bells, and the effect causing agitation of the sand, was noted. The instrument was then removed to a station a little further from the bell, and the effect again noted, the distance being increased, step by step, until no motion in the sand could be observed through the lens. This distance, being measured in feet or yards, gave the number indicating the penetrating power of the instrument under trial. The same experiment was immediately repeated, under the same conditions of temper-

ature, air, wind, &c., with the other sounding-apparatus, and the relative number of yards indicating the distance, taken as the penetrating powers of the two instruments. It should be observed, in the use of this instrument, that it is intended merely to concentrate the rays of sound, and not to act as a resounding cavity; since in that case the sound, in unison with the resounding note, would produce effect at a greater distance than one in discord.

The indications of this instrument were compared with the results obtained by the ear in the use of the two vessels, and in all cases were in exact accordance; and it was accordingly used in the following investigations, and has been found of great service in all subsequent experiments on the penetration of sound.

The only precaution in using it is that the membrane shall not be of such tension as to vibrate in unison with a singlesound or its octaves; or, in other words, that the instrument must be so adjusted by varying the length of the axis or the tension of the membrane that it shall be in discordance with the sounds to be measured, and only act as a condenser of the sonorous waves.

The first experiments made were with regard to the influence of reflectors. For this purpose a concave wooden reflector had been prepared, consisting of the segment of a sphere of 16 feet radius, and covered with plaster, exposing a surface of 64 square feet. In the focus of this, by means of a temporary railway, a bell or whistle could be readily placed or withdrawn. The center of the mouth of the bell coincided with the horizontal axis of the reflector. This arrangement being completed, the sound of the bell, with and without the reflector behind it, was alternately observed. Within the distance of about 500 yards the effect was evidently increased, as indicated by the motion of the sand on the membrane, but beyond this the difference was less and less perceptible, and at the limit of audibility the addition of the reflector appeared to us entirely imperceptible. This result was corroborated by subsequent experiments in which a whistle was heard nearly as well in the rear of a reflector as before it. It would appear from these results that while feeble sounds, at small distances, are reflected as rays of light are, waves of powerful sound spread laterally, and even when projected from the mouth of a trumpet at a great distance tend to embrace the whole circle of the horizon.

Upon this and all the subsequent experiments, as it will appear, the principle of reflection as a means of re-enforcing sound is but partially applicable to fog-signals. It is evident, however, that the effect will be increased by augmenting the size of the reflector, and by more completely inclosing the source of sound in a conical or pyramidal reflector.

Another series of experiments was made to ascertain whether the penetration of the sound was greater in the direction of the axis of the bells, or at right angles to the axis; or, in other words, whether the sound was louder in front of the mouth of a bell or of its rim. The result of this experiment was considered of importance, since, in one of the light-houses, a bell has been placed with the plane of its mouth at right angles to the horizon, instead of being placed, as usual, parallel to the same. The effect on the sound in these two positions was similar to that produced by the bell with a reflector, the noise being greater at a short distance with the mouth toward the observer than when the rim was in the plane of the ear. At a distance, however, the difference between the two sounds was imperceptible. In practice, therefore, it is of very little importance whether the axis of the bell is perpendicular or parallel to the horizon.

The first fog-signal examined in this series of experiments was a double whistle, improperly called a steam-gong, designed principally for a fire-alarm and for signals for the commencement of working hours in large manufacturing establishments. It consisted of two bells of the ordinary steam-whistle on the same hollow axis, mouth to mouth, with a flat hollow cylinder between them, through the upper and lower surface of which the circular sheets of steam issue, the vibration of which produces the sound. In the instrument under examination, the upper bell was 20 inches in length

of axis, and 12 inches in diameter, and the lower whistle was of the same diameter, with a length of axis of 14 inches. The note of the shorter bell was a fifth to that of the longer. This arrangement gave a melodious sound, unlike that of the ordinary locomotive whistle, and on that account had a peculiar merit. The sound was also very loud, and, according to testimony, had been heard under favorable circumstances more than twenty miles. It, however, required a large quantity of steam to give it its full effect, and the only means to obtain an approximate idea as to this quantity was that afforded by observing its action on a boiler of a woolen manufactory near Newport. It was here blown with a pressure of at least 75 pounds. From theoretical considerations, however, it might be inferred that its maximum penetrating power would be not greater than that of a single whistle using the same amount of steam, and this theoretical inference was borne out by the subsequent experiments of General Duane. But from the strikingly distinctive character of its tone it has, in our opinion, an advantage over a single whistle expending an equal quantity of steam.

The fact that the vibration of the metal of the bell had no practical effect on the penetrating power of the sound was proved quite conclusively by winding tightly around each bell, over its whole length, a thick cord, which would effectually stop all vibration. The penetration of the sound produced under this condition was the same as that with the bells free. It is true, the latter produces a difference in the quality of the tone, such as that which is observed in a brass instrument and that of one of wood or ivory. The inventor was not aware that the sound produced was from the resonance of the air within the bell, and not from the metal of the bell itself, and had obtained a patent, not only for the invention of the double whistle, but also for the special compound of metal of which it was composed.

Another apparatus proposed to be used as a fog-signal was presented for examination by the Marine Signal Company, of Wallingford, Conn. It consisted of a curved tube of copper nearly in the form of the letter C, and was supported on an axis passing through the center of the figure. An ordinary bell-whistle was attached to each extremity of the tube, the instrument being placed in a vertical position and partially filled with water, then made to oscillate on its center of support. By this means the air was drawn in at one end and forced out through the whistle at the other. The motion being reversed the air was drawn in at the end through which it had just made its exit and forced out through the whistle at the other. By rocking the instrument, either by hand or motion of the vessel, a continued sound could be produced. The motive-power in the latter case was muscular energy, and the experiments which were made at this time, as well as all that have been made subsequently, conclusively prove that the penetrating power of the sound for practical use as a fog-signal depends upon the intensity of the motive-energy employed. No instrument operated through levers and pumps by hand-power is sufficient for the purpose.

One of these instruments with two 4-inch whistles gave a sound, as indicated by the artificial ear, the power of which was about one-tenth of that of a steam-trumpet. It was supposed, however, that this instrument would be applicable for light-ships; and that if extended entirely across the vessel, and armed with whistles of large size, it would be operated by the rolling of the vessel, and thus serve to give warning in time of thick weather. But as it frequently happens that fog exists during a calm, this invention could not be relied upon to give warning in all cases of danger. Besides this, the ordinary roll of a ship is not sufficient to produce a hydrostatic pressure of more than five or six pounds to the square inch, which is insufficient to give an effective sound. It has, however, been proposed to increase the power by using quicksilver instead of water; but, besides the first cost of this material, and the constant loss by leakage and oxidation, the tendency to affect the health of the crew is an objection to the introduction of this modification of the apparatus into light-ships.

The other instruments which were subjected to trial were an ordinary steam-whistle and a Daboll trumpet. The bell of the whistle was 6 inches in diameter, 9 inches in

height, and received the sheet of steam through an opening of one-thirtieth of an inch in width; was worked by a pressure of condensed air of from 20 to 35 pounds per square inch, and blown once in a minute for about five seconds. The air was condensed by a Roper engine of one horse-power. The penetrating power of the sound was increased by an increase in the pressure of the air, and also the pitch. The tone, however, of the instrument was lowered by increasing the distance between the orifice through which the circular sheet of air issued at the lower rim of the bell or resounding cavity. To prove conclusively that the bell performs the part of a mere resounding cavity, a wooden one, on a subsequent occasion, was substituted for that of metal without a change in the loudness or the pitch of the sound.

The penetrating power of the whistle was compared with a Daboll trumpet, actuated by an Ericsson engine of about the same power; the reservoir for the condensed air of each machine was furnished with a pressure-gauge, and by knowing the capacity of the condensing pumps and the number of strokes required to produce the pressure, the relative amount of power was determined. The result was that the penetrating power of the trumpet was nearly double that of the whistle, and that an equal effect was produced at the same distance by about one-fourth of the power expended in the case of the latter. It must be recollected, however, that the whistle sends sonorous waves of equal intensity in every direction, while the greatest power of the trumpet is in the direction of its axis. This difference, however, is lessened on account of the spreading of the sound to which we have before alluded. The whistle was blown, as we have said, with a pressure of from 20 to 35 pounds, while the trumpet was sounded with a pressure of from 12 to 15 pounds. In the case of the whistle, the pressure in the reservoir may be indefinitely increased with an increase in the penetrating power of the sound produced, while in the case of the trumpet a pressure greater than a given amount entirely stops the blast by preventing the recoil of the vibrating tongue; this being made of steel, in the larger instruments 2½ inches wide and 8 inches long, would receive a pressure of steam, at only 10 pounds to the square inch, of 200 pounds, tending to press it into the opening and to prevent its recoil; this circumstance limits, as it were, the power of a trumpet of given dimensions. It is, however, well fitted to operate with a hot-air engine, and is the least expensive in fuel of any of the instruments now employed. The whistle is the simpler and easier of management, although they both require arrangement of machinery in order that they may be operated automatically.

It is a matter of much importance to obtain a hot-air engine of sufficient power, and suitable for working fog-signals of all classes. This will be evident when we consider the difficulty in many cases of obtaining fresh water for producing steam, and the expense of the renewal of the boilers in the use of salt-water, as well as that of the loss of power in frequently blowing out the latter, in addition to the danger of the use of steam by unskillful attendants.

The merits of the two engines, however, under consideration could not be fully tested by the short trial to which they were subjected during these experiments. The principal objection to the Ericsson engine was the size of the fly-wheel and the weight of the several parts of the machine; the Roper engine was much more compact, and appeared to work with more facility, but from the greater heat imparted to the air the packing was liable to burn out and required to be frequently renewed. Although at first the impression of the committee was in favor of the Roper engine, yet in subsequent trials of actual practice it was found too difficult to be kept in order to be employed for light-house purposes, and its use has consequently been abandoned; another hot-air engine has been employed by the board, the invention of a Mr. Wilcox, which has also been discontinued for a similar reason. I was assured by the person last named, a very ingenious mechanician, that when the several patents for hot-air engines expired, a much more efficient instrument could be devised by combining the best features of each of those now in use.

For determining the relative penetrating power of these instruments, the use of two

vessels had been obtained, with the idea of observing the sound simultaneously in opposite directions.

Unfortunately, however, the location which had been chosen for these experiments was of a very unfavorable character in regard to the employment of sailing-vessels and the use of the artificial ear. It was fully open to the ocean only in a southerly direction, navigation up the bay to the north being limited to three and a half miles, while on shore a sufficient unobstructed space could not be obtained for the proper use of the artificial ear. With these obstructions and the necessity of beating against the wind, thereby constantly altering the direction of the vessel, exact comparisons were not possible, yet the observations made were sufficiently definite to warrant certain conclusions from them as to the relative power of the various instruments submitted to examination.

The following is a synopsis of the observations on four different days.

Before giving these, however, it is necessary to observe that at each stroke of the piston of the hot-air engine a loud sound was produced by the blowing off of the hot air from the cylinder after it has done its work. In the following statement of results the noise thus produced is called the exhaust. On the first day but one set of observations was made, the vessel's course being nearly in the line of the axis of the trumpet. The order of penetrating power was as follows: 1, trumpet; 2, exhaust; 3, bell; these instruments being heard respectively at $5\frac{1}{2}$, $3\frac{1}{2}$, and 2 miles. The whistle was not sounded.

The second day simultaneous observations were made from two vessels sailing nearly in opposite directions. The results of the observations made on the vessel sailing in a southerly direction were very irregular. The trumpet was heard at $3\frac{3}{4}$ miles and lost at $4\frac{3}{4}$ miles with the wind slightly in favor of the sound, and heard at $6\frac{1}{2}$ miles with the wind somewhat against the sound; it was heard even at $7\frac{1}{2}$ miles from the mast-head, though inaudible from the deck. In all these cases the position of the vessel was nearly in line with the axis of the trumpet.

The whistle and exhaust were heard at $7\frac{1}{2}$ miles with a feeble opposing wind, and lost at $6\frac{1}{2}$ miles when the force of the wind became greater.

The order of penetration in this series of observations was: 1, trumpet and gong; 2, whistle; 3, exhaust.

In the case of the vessel sailing northward, its course being almost directly against the wind and in the rear of the trumpet, all the sounds were lost at less distances than in the case of the other vessel. The observations showed very clearly the effect of the wind, the bell at a certain distance being heard indistinctly with a strong opposing wind and more and more plainly as the wind died away.

The trumpet was only heard as far as the whistle, the vessel being in the rear of it.

The third day observations were made from the two vessels, both, however, sailing to the south. From the vessel sailing at right angles to the direction of the wind the order of penetration was: 1, trumpet; 2, whistle; 3, exhaust; 4, bell.

In the case of the other vessel, the opposing effect of the wind was greater, and the sounds were heard to a less distance; the order was: 1, trumpet; 2, whistle; 3, exhaust; 4, bell; 5, rocker.

On the fourth day two trips were made by the same vessel in the course of the day, one being northward and the other southward. In the first case the trumpet was lost at $3\frac{3}{4}$ miles, the vessel being nearly in its rear; in the second case, the wind being almost directly opposed to the sound, the large bell was heard at $1\frac{1}{4}$ miles, and lost at $\frac{7}{8}$ of a mile, probably due to increase of the force of the wind; the trumpet was lost at $3\frac{3}{4}$ miles.

In all these observations, owing to the unfavorable conditions of the locality, and the direction of the wind, we were unable to obtain any satisfactory observations on sound moving with the wind. In all cases the results were obtained from sounds moving nearly against the wind, or at right angles to it. From the results of the whole it appears that the sound was heard farther with a light opposing wind than with a

stronger one, and that it was heard farthest of all at right angles to the wind. From this latter fact, however, it should not be inferred that in this case sound could be heard farther at right angles to the wind than with the wind, but that in this direction the effect of the wind was neutralized. The results also exhibited, in a striking manner, the divergency of sound from the axis of the trumpet, the trumpet being heard in the line of its axis in front at 6 miles, and behind at 3, the wind being nearly the same in both cases.

All the observations were repeated on land with the artificial ear as far as the unfavorable condition of the surface would permit. Although the limit, as to distance, at which the sand might be moved was not in most cases observed, yet the relative degree of agitation, at a given distance established clearly which was the most powerful instrument, the result giving precisely the same order of penetration of the different instruments as determined by direct audition.

During this series of investigations an interesting fact was discovered, namely, a sound moving against the wind, inaudible to the ear on the deck of the schooner, was heard by ascending to the mast-head. This remarkable fact at first suggested the idea that sound was more readily conveyed by the upper current of air than the lower, and this appeared to be in accordance with the following statement of Captain Keeney, who is commander of one of the light-house vessels, and has been for a long time on the banks of Newfoundland in the occupation of fishing: "When the fishermen in the morning hear the sound of the surf to the leeward, or from a point toward which the wind is blowing, they take this as an infallible indication that in the course of from one to five hours the wind will change to the opposite direction from which it is blowing at the time." The same statement was made to me by the intelligent keeper of the fog-signal at Block Island. In these cases it would appear that the wind had already changed direction above, and was thus transmitting the sound in an opposite direction to that of the wind at the surface of the earth.

Another remarkable fact bearing on this same point is established by the observations of General Duane. At Cape Elizabeth, nine miles southeasterly from the general's house, at Portland, is a fog-signal consisting of a whistle 10 inches in diameter; at Portland Head, about four miles from the same city, in nearly the same direction, is a Daboll trumpet. There can be no doubt, says the general, that those signals can be heard much better during a heavy northeast snow-storm than at any other time. "As the wind increases in force, the sound of the nearer instrument, the trumpet, diminishes, but the whistle becomes more distinct; but I have never known the wind to blow hard enough to prevent the sound of the latter from reaching this city." In this case, the sound comes to the city in nearly direct opposition to the course of the wind, and the explanation which suggested itself to me was that during the continuance of the storm, while the wind was blowing from the northeast at the surface, there was a current of equal or greater intensity blowing in an opposite direction above, by which the sound was carried in direct opposition to the direction of the surface current. The existence of such an upper current is in accordance with the hypothesis of the character of a northeast storm, which sometimes rages for several days at a given point on the coast without being felt more than a few miles in the interior, the air continuously flowing in below and going out above. Indeed, in such cases a break in the lower clouds reveals the fact of the existence above of a rapid current in the opposite direction.

The full significance, however, of this idea did not reveal itself to me until in searching the bibliography of sound I found an account of the hypothesis of Professor Stokes in the Transactions of the British Association, Vol. XXIV, in which the effect of an upper current in deflecting the wave of sound so as to throw it down upon the ear of the auditor, or directing it upward far above his head, is fully explained. This subject will be referred to in the subsequent parts of the report, in the attempt to explain various abnormal phenomena of sound which have been observed during the series of investigations connected with the Light-House Board.

During these investigations an attempt was made to ascertain the velocity of the wind in an upper stratum as compared with that in the lower. The only important result, however, was the fact that the velocity of the shadow of a cloud passing over the ground was much greater than that of the air at the surface, the velocity of the latter being determined approximately by running a given distance with such speed that a small flag was at rest along the side of its pole. While this velocity was not perhaps greater than six miles per hour, that of the shadow of the cloud was apparently equal to that of a horse at full speed.

During this and subsequent investigations, inquiries were made in regard to the effect of fog upon sound, it being a subject of considerable importance to ascertain whether waves of sound, like the rays of light, are absorbed or stifled by fog. On this point, however, observers disagree. At first sight, from the very striking analogy which exists in many respects between sound and light, the opinion largely prevails that sound is impeded by fog; although observers who have not been influenced by this analogy have, in many instances, adopted the opposite opinion, that sound is better heard during a fog than in clear weather. For instance, the Rev. Peter Ferguson, of Massachusetts, informs me that, from his own observations, sound is conveyed farther in a fog than in a clear air. He founds this opinion on observations which he has made on the sound of locomotives of several railways in passing over bridges at a distance. Unfortunately, the question is a difficult one to settle, since the effect of the wind, in order to arrive at a true result, must be carefully eliminated. Captain Keeney, who has previously been mentioned, related the following occurrence, in the first part of which he was led to suppose that fog had a very marked influence in deadening sound, though in a subsequent part he came to an opposite conclusion. He was sailing during a dense fog, with a slight wind bearing him toward a light-vessel, the locality of which he expected to find by means of the fog-signal. He kept on his course until he thought himself very near the ship, without hearing the stroke of the bell. He then anchored for the night, and found himself next morning within a short distance of the light-vessel, but still heard no sound, although he was assured when he got to it that the bell had been ringing all night. He then passed on in the same direction in which he had previously sailed, leaving the light-vessel behind, and constantly heard the bell for a distance of several miles, the density of the fog not perceptibly diminishing. In this case it is evident that the deadening of the sound was not due to the fog, but, as we shall hereafter see, in all probability to the combined action of the upper and the lower currents of air.

On returning to Washington the writer took advantage of the occurrence of a fog to make an experiment as to the penetration of the sound of a small bell rung by clock-work, the apparatus being the part of a moderator-lamp intended to give warning to the keepers when the supply of oil ceased. The result of the experiment was contrary to the supposition of absorption of the sound by the fog, but the change in the condition of the atmosphere as to temperature and the motion of the air, before the experiment could be repeated in clear weather, rendered the result not entirely satisfactory.

EXPERIMENTS AT SANDY HOOK, OCTOBER, 1867.

The next series of experiments was made from October 10 to October 18, 1867, under the direction of the writer of this report, in connection with General Poe, engineer-secretary of the Light-House Board, Commodore (now Admiral) Case, then inspector of the third light-house district, and Mr. Lederle, acting engineer of the same district.

The principal object of these investigations was to compare different instruments, and to ascertain the improvements which had been made in them since the date of the last investigations, especially the examination of a new fog-signal called the siren, and the comparison of it with the Daboll trumpet, although other investigations were made relative to the general subject of sound in relation to fog-signals. The locality

chosen was Sandy Hook, a narrow peninsula projecting northward, almost at right angles to the coast, about five miles into the middle of the Lower Bay of New York, having a width of about half a mile. Near the northern point on the east shore a temporary building was erected for the shelter of the engines and other instruments.

The comparisons in regard to penetrating power were made by the use of the artificial ear, heretofore described, by carrying this off a measured distance until the sand ceased to move. This operation was much facilitated by the previous surveys of members of the Engineer Corps, who had staked off a straight line parallel with the shore, and accurately divided it into equal distances of 100 feet.

On account of the character of the deep and loose sand, walking along this distance was exceedingly difficult, and, to obviate this, a carriage with broad wheels, drawn by two horses, was employed. An awning over this vehicle protected the observer from the sun, and enabled him, without fatigue and at his ease, to note the agitations of sand on the drum of the artificial ear, the mouth of which was directed from the rear of the carriage toward the sounding instrument.

For these and other facilities we were indebted to General Humphreys, Chief of the Engineer Bureau, who gave orders to the officer in charge of the military works at Sandy Hook to afford us every aid in his power in carrying on the investigation.

The instruments employed were—

1st. A first-class Daboll trumpet operated by an Ericsson hot-air engine, of which Mr. James A. Robinson had become proprietor since the death of Mr. Daboll.

It carried a steel reed 10 inches long, $2\frac{1}{4}$ inches wide, and $\frac{1}{2}$ inch in thickness at the vibrating end, but increasing gradually to an inch at the larger extremity. This was attached to a large vertical trumpet curved at the upper end into a horizontal direction and furnished with an automatic arrangement for producing an oscillation of about 60° in the arc of the horizon. Its entire length, including the curvature, was 17 feet. It was $3\frac{1}{2}$ inches at the smaller end and had a flaring mouth 38 inches in diameter. The engine had a cylinder 32 inches in diameter with an air-chamber of $4\frac{1}{2}$ feet in diameter and 6 feet long, and was able to furnish continually a five-second blast every minute at a pressure of from 15 to 30 pounds.

2d. A siren, originally invented by Cagniard de Latour, and well known to the physicist as a means of comparing sounds and measuring the number of vibrations in different musical notes. Under the direction of the Light-House Board, Mr. Brown, of New York, had made a series of experiments on this instrument in reference to its adoption as a fog-signal, and these experiments have been eminently successful.

The instrument as it now exists differs in two essential particulars from the original invention of Latour: 1st, it is connected with a trumpet in which it supplies the place of the reed in producing the agitation of the air necessary to the generation of the sound; and, 2d, the revolving disk, which opens and shuts the orifices producing the blasts, is driven not by the blast itself impinging on oblique openings, as in the original instrument, but by a small engine connected with the feed-pump of the boiler.

The general character of the instrument may be understood from the following description:

Suppose a drum of short axis, into one head of which is inserted a steam-pipe connected with a locomotive-boiler, while the other end has in it a triangular orifice, through which the steam is at brief intervals allowed to project itself.

Immediately before this head, and in close contact with it, is a revolving disk, in which are eight orifices. By this arrangement, at every complete revolution of the disk, the orifice in the head of the drum is opened and shut eight times in succession, thus producing a rapid series of impulses of steam against the air into the smaller orifice of the trumpet placed immediately in front of the revolving disk. These impulses are of such intensity and rapidity as to produce a sound unrivaled in magnitude and penetrating power by that of any other instrument yet devised.

The siren was operated by an upright cylindrical tubular boiler, with a pressure of from 50 to 100 pounds on the square inch. For this form of boiler has been subse-

quently substituted an ordinary horizontal locomotive-boiler with a small engine attached for feeding it and for rotating the disk, the latter being effected by means of a band passing over pulleys of suitable relative dimensions.

3d. A steam-whistle 8 inches in diameter. Through some misunderstanding a series of whistles of different diameters was not furnished as was intended.

The first experiments to be noted were those in regard to the comparison of penetrating power of the siren and the whistle, the fitting up of the Daboll trumpet not having been completed. The principal object of this, however, was to test again the truthfulness of the indications of the artificial ear in comparison with those of the natural ear.

An experiment was made both by means of the artificial ear on land and by actually going off on the ocean in a steamer until the sounds became inaudible to the natural ear. By the latter method the two sounds ceased to be heard at the distances of six and twelve and a half miles, respectively.

The indications of the artificial ear gave a similar result, the distance at which the sand ceased to move in one case being double that of the other. In both cases the conditions of wind and weather were apparently the same. In the case of the steamer the distance was estimated by noting the interval of time between the flash of steam and the perception of the sound.

Comparison of the Daboll trumpet and the siren.—The pressure of the hot air in the reservoir of the hot-air engine of the trumpet was about 20 pounds, and that of the steam in the boiler of the siren about 75 pounds. These pressures are, however, not considered of importance in these experiments, since the object was not so much to determine the relative amount of motive-power employed as the amount of penetrating power produced by these two instruments, each being one of the first of its class.

At distance 50 the trumpet produced a decided motion of the sand, while the siren gave a similar result at distance 58. The two observations being made within ten minutes of each other, it may be assumed that the condition of the wind was the same in the two cases, and hence the numbers above given may be taken as the relative penetrating power of the two instruments.

Another series of experiments was instituted to determine whether a high or a low note gave the greatest penetration. For this purpose the siren was sounded with different velocities of rotation of the perforated disk, the pressure of steam remaining at 90 pounds per square inch. The effect upon the artificial ear in causing greater or less agitation of sand was taken as the indication of the penetrating power of the different tones. The number of revolutions of the disk in a given time was determined by a counting apparatus, consisting of a train of wheels and a series of dials showing tens, hundreds, and thousands of revolutions; this was temporarily attached to the projecting end of the spindle of the revolving disk by pushing the projecting axis of the instrument into a hole in the end of the spindle.

From the whole of this series of experiments it appeared that a revolution which gave 400 impulses in a second was the best with the siren when furnished with a trumpet. On reflection, however, it was concluded that this result might not be entirely due to the pitch, but in part to the perfect unison of that number of impulses of the siren with the natural tone of the trumpet. To obviate this complication, a series of experiments was next day made on the penetration of different pitches with the siren alone, the trumpet being removed. The result was as follows:

The siren was sounded at five different pitches, the artificial ear being at such a distance as to be near the limit of disturbance by the sound. In this condition the lowest pitch gave no motion of sand. A little higher, slight motion of sand. Still higher, considerable motion of sand, and with a higher pitch again, no motion of sand. The best result obtained was with a revolution which gave 360 impulses in a second.

An attempt was made to determine the most effective pitch or tone of the steam-whistle. It was started with what appeared to be the fundamental note of the bell, which gave slight motion of sand; a higher tone a better motion; still higher, sand.

briskly agitated; next several tones lower, no motion; higher, no motion; still higher, no motion. The variation in the tone was made by altering the distance between the bell and the orifice through which the steam was ejected.

The result of this experiment indicated nothing of a definite character, other than that with a given pressure there is a maximum effect produced when the vibrations of the sheet of air issuing from the circular orifice are in unison with the natural vibrations from the cavity of the bell, a condition which can only be determined in any case by actual experiment.

In practice Mr. Brown was enabled to produce the best effect by regulating the velocity until the trumpet gave the greatest penetrating power, as indicated by an artificial ear of little sensibility, in order that it might be employed for determining the relative power while the observer was but a few yards from the machine.

These experiments have been made in an apartment of less than 80 feet in length, in which the sounding apparatus was placed at one end and the artificial ear at the other, substituting fine shot instead of sand.

The experiments with the siren, however, indicate the fact that neither the highest nor the lowest pitch of an instrument gives the greatest penetrating power, but one of a medium character.

Another element of importance in the construction of these instruments is the volume of sound. To illustrate this, it may be mentioned that a harpsichord-wire stretched between two strings of India rubber, when made to vibrate by means of a fiddle-bow, gives scarcely any appreciable sound. We attribute this to the want of quantity in the aerial wave; for if the same wire be stretched over a sounding-board having a wide area, the effect will be a comparatively loud sound, but of less duration, with a given impulse. It was, therefore, suggested that the width of the reed in the Daboll trumpet, the form and size of the holes in the disk of the siren, and the circumference of the vibrating sheet of air issuing from the circular orifice of the whistle, would affect the power of the sound. The only means of testing this suggestion is by using reeds of different widths, sirens with disks of different-shaped openings, and whistles of different diameters. In conformity with this view, Mr. Brown has made a series of empirical experiments with openings of different forms, which have greatly improved the operation of the siren, while Mr. Wilcox has experimented on several forms of reeds, of which the following is the result:

The best reed obtained was $2\frac{1}{4}$ inches wide, 8 inches long in the vibrating part, $\frac{3}{4}$ inch thick at the butt, and $\frac{1}{4}$ inch thick at the loose end. This sounded at a pressure of from 20 to 30 pounds. The thinner reeds gave a sound at a less pressure, from 5 to 10 pounds, the thicker at from 20 to 30 pounds. A reed $8\frac{1}{4}$ inches long in the vibrating part, 1 inch thick at the butt, $\frac{1}{4}$ inch thick at the end, and 3 inches wide, did not begin to sound until a pressure of 80 pounds was reached, then gave a sound of a dull character. Another reed of the same width, $\frac{5}{8}$ inch thick at the butt, and $\frac{1}{16}$ inch at the end, and same length, gave a sound at 75 pounds pressure, but still dull and of little penetrating power. These reeds were evidently too heavy in proportion to their elasticity. These were made without the addition of a trumpet, and therefore, to produce the best result when used with a trumpet, the latter must be increased or diminished in length until its natural vibrations are in harmony with those of the former, as will be seen hereafter. General Duane has also made experiments on whistles of different diameters, of which the result will be given.

Another consideration in regard to the same matter is that of the amplitude of the oscillations of the tongue or steel reed in its excursion in producing the sound; the time of oscillation remaining the same, that is the pitch, the amplitude will depend upon the elasticity of the reed, the power to surmount which will again depend upon the pressure of steam in the boiler, and hence we might infer that an increase of pressure in the boiler with an increase of the elasticity of the reed, everything else being the same would produce an increase in penetrating power. From the general analogy of mechanical effects produced by motive power we may denote the effect upon the ear by

the expression $M V^2$, in which M expresses the mass or quantity of air in motion, and V the velocity of the particles in vibration.

If this be the expression for the effect upon the ear it is evident that in case of a very high note the amplitude of the vibration must be so small that the effect would approximate that of a continued pressure rather than that of distinct alternations of pressure, giving a vibrating motion to the drum of the ear.

Next, experiments were made to determine the penetrating power in the case of the siren under different pressures of steam in the boiler. The experiments commenced with a pressure of 100 pounds. The pressure at each blast was noted by two observers, and to compare these pressures with the indications of the sand, the time of the blasts was also noted.

The following are the results:

Pressure:	Relative distances at which sand ceased to move.
100.....	61
90.....	59
80.....	58
70.....	57
60.....	57
50.....	56
40.....	55
30.....	53
20.....	51

From this series of experiments, it appears that a diminution of pressure is attended with a comparatively small diminution in the penetrating power of the siren.

In regard to this unexpected result of great practical importance, the following appears to be the explanation. It is a well-known principle in aerial mechanics that the velocity of the efflux of air from an orifice in a reservoir does not increase with an increase of condensation, when the spouting is into a vacuum. This is evident when we reflect that the weight or density of the air moving out is increased in proportion to the elasticity or pressure; that is, the increase in the propelling force is proportional to the increase in the weight to be moved, hence the velocity must remain the same.

In the foregoing experiments with high pressures large in proportion to the resistance of the air, the velocity of efflux should therefore be but little increased with the increase of pressure, and inasmuch as the velocity is the most important factor in the expression $M V^2$, which indicates the effect on the tympanum, the penetrating power of the sound should be in accordance with the above experimental results.

A similar result cannot be expected with the use of the whistle or the trumpet, since in the former the stiffness of the aerial reed depends upon its density, which will be in proportion to the pressure in the boiler, and in the case of the latter no sound can be produced on the one hand unless the pressure be sufficient to overcome the resistance of the reed, and on the other the sound must cease when the pressure is so great as to prevent the recoil of the reed.

5. An experiment was made to determine the effect of a small whistle inserted into the side of a trumpet near the small end. The whistle being sounded before and after it was placed in the trumpet, the result was as follows: The penetrating powers were in the ratio of 40: 51, while the tone was considerably modified. From this experiment it appears that a whistle may be used to actuate a trumpet or to exercise the functions of a reed. In order, however, to get the best results, it would be necessary that the trumpet and whistle should be in unison, but it may be doubted, however, whether an increase of effect, with a given amount of power, would result from using such an arrangement; it might, nevertheless, be of advantage in certain cases to direct the sound of a locomotive in a definite direction, and to use a smaller whistle, especially in cities, in which the locomotive passes through long streets; perhaps in this case the sound might be less disagreeable than that of the naked whistle, which sends its sound waves laterally with as much force as in the direction of the motion of the engine.

6. General Poe called attention to the sound produced by the paddle-wheels of a steamer in the offing at a distance estimated at four and a half miles. The sound was quite distinct when the ears were brought near the surface of the beach.

In this connection he stated that he had heard the approach of a small steamer on the northern lakes when its hull was still below the horizon, and was even enabled to designate the particular vessel from among others by the peculiarity of the sound.

The sound in the case of the steamer is made at the surface of the water, and it might be worth the trouble to try experiments as to the transmission of sound under this condition, and the collection of it by means of ear-trumpets, the mouths of which are near the water, the sound being conveyed through tubes to the ears of the pilot. In order, however, to determine in this case the direction of the source of sound, two trumpets would be necessary, one connected with each ear, since we judge of the direction of a sound by its simultaneous effects on the two auditory nerves. This suggestion, as well as many others which have occurred in the course of these researches, is worthy of special investigation.

7. A series of experiments was made to compare trumpets of different materials and forms having the same length and transverse areas, all blown at a pressure of 9½ pounds.

The following table gives the results :

No.	Material of trumpet.	Cross-section.	Relative distances at which sand ceased to move.
1	Wood.	Square.	13
2	Brass.	Circular.	23
3	Cast-iron.	Circular.	24
4	Wood.	Circular.	30

From these experiments it would appear that the material or elasticity of the trumpet had little or no effect on the penetrating power of the sound, although the shape appeared to have some effect, the pyramidal trumpet, or one with square cross-section, (No. 1,) giving a less result than the conical ones of the same sectional area. A comparison was made between a long straight trumpet and one of the same length curved at its upper end, which gave the same penetrating power with the same pressure. It is probable that a thin metallic trumpet would give greater lateral divergency to the sound, and also a slightly different tone.

8. The effect of a hopper-formed reflector was next tried with the whistle, the axis of which was about 5 feet in length, the mouth 6 feet square, and the small end about 18 inches. When the whistle was sounded at the small end of this reflector, the distance at which the sand ceased to move was 51; the sound of the same whistle without the reflector ceased to move the sand at 40. The ratio of these distances would have been less with a more sensitive instrument at a greater distance on account of the divergency of the rays.

9. In order to determine the diminution of sound by departing from the axis of the trumpet, a series of experiments was made with a rotating trumpet, the axis of which was at first directed along the graduated line of observation, and subsequently deflected from that line a given number of degrees. The following were the results :

Direction of the trumpet.	Relative distance at which sand moved.
Along the line	26
Deflected 30°	23
Deflected 60°	21
Deflected 90°	18
Deflected 120°	13

These results illustrate very strikingly the tendency of sound to spread on either side of the axis of the trumpet; had the experiments been made with a more sensitive instrument, and at a greater distance, the effect would have shown a much greater divergency. It should be observed, however, that the mouth of the trumpet in this case was 36 inches, which is unusually large.

From the experiments made near New Haven, and also from those at this station, it appears that the actual amount of power to give sound of a given penetration is absolutely less with a reed trumpet than with a locomotive whistle. This fact probably finds its explanation in the circumstance that in each of these instruments the loudness of the sound is due to the vibration of the air in the interior of the trumpet and in the bell of the whistle, each of these being a resounding cavity; and furthermore, that in these cavities the air is put in a state of sustained vibration by the undulations of a tongue, in the one case of metal, in the other of air; and, furthermore, that it requires much more steam to set the air in motion by the tongue of air than by the solid tongue of steel, the former requiring a considerable portion of the motive power to give the current of which it consists the proper degree of stiffness, if I may use the word, to produce the necessary rapidity of oscillation. But, whatever may be said in regard to this supposition, it is evident, in case reliable hot-air engines cannot be obtained, that the Daboll trumpet may be operated by a steam-engine, although at an increased cost of maintenance, but this increase, we think, will still not be in proportion to the sound obtained in comparison with the whistle.

Another question which naturally arises, but which has not yet been definitely settled by experiment, is whether both the siren and the whistle would not, equally, with the trumpet, give more efficient results when worked by condensed air than by steam.

From hypothetical consideration this would appear to be the case, since the intensity of sound depends upon the density of the medium in which it is produced; and, as the steam is considerably lighter than air, and as the cavities of all of these instruments are largely filled with steam, the intensity of sound would, on this account, seem to be less.

At the conclusion of the experiments at Sandy Hook the siren was adopted as a fog-signal, in addition to the reed-trumpet and the locomotive-whistle, to be applied to the more important stations, while large bells were retained for points at which fog-signals were required to be heard at but comparatively small distances. These instruments of the first class being adopted, it became of importance to determine, in actual practice, the cost of maintenance, the best method of working them, and any other facts which might have a bearing on their use.

But as investigations of this kind would require much time and peculiar advantages as to location and mechanical appliances, this matter was therefore referred to General Duane, the engineer in charge of the 1st and 2d light-house districts, who had peculiar facilities near his residence, at Portland, Me., in the way of workshops and other conveniences, and who, from his established reputation for ingenuity and practical skill in mechanism, was well qualified for the work. The assignment of this duty to General Duane by the Light-House Board was made during my absence in Europe, in 1870, and as my vacation in 1871 was devoted to light-house duty in California, I had no opportunity of conferring with him on the subject until after his experiments were completed. His results are therefore entirely independent of those obtained under my direction, and I give them herewith in his own words, with such comments as they may suggest and as are necessary to a proper elucidation of the subject.

EXPERIMENTS AT PORTLAND, ME., 1871, BY GENERAL DUANE.

The apparatus employed consisted of the first-class siren, first-class Daboll trumpet and steam-whistles of various sizes.

The points to be decided were:

- 1st. The relative power of these machines, *i. e.*, the distances at which they could be heard under various conditions of the atmosphere.
- 2d. The amount of fuel and water consumed by each.
- 3d. The attention and skill required in operating them.

4th. Their endurance.

5th. Whether they are sufficiently simple in construction to permit of their being managed and kept in running order by the class of men usually appointed light-house-keepers.

In conducting these experiments the following method was pursued:

The signals were sounded at alternate minutes, and their sound compared at distances of two, three, and four miles, and from different directions. On every occasion the quantity of fuel and water consumed per hour by each was carefully noted, and the condition of each machine examined, both before and after the trial, to ascertain whether any of its parts had sustained injury.

Before giving the results of these experiments some facts should be stated, which will explain the difficulty of determining the power of a fog-signal.

There are six steam fog-whistles on the coast of Maine; these have been frequently heard at a distance of twenty miles, and as frequently cannot be heard at the distance of two miles, and this with no perceptible difference in the state of the atmosphere.

The signal is often heard at a great distance in one direction, while in another it will be scarcely audible at the distance of a mile. This is not the effect of wind, as the signal is frequently heard much farther against the wind than with it. For example, the whistle on Cape Elizabeth can always be distinctly heard in Portland, a distance of nine miles, during a heavy northeast snow-storm, the wind blowing a gale directly from Portland toward the whistle.

[In this sentence, General Duane certainly does not intend to convey the idea that a signal is frequently heard "at a much greater distance against the wind than with it," since this assertion would be at variance with the general experience of mankind; but the word "frequently" applies to the whistle on Cape Elizabeth, which has been already mentioned as a remarkably exceptional case, in which the sound is heard best against the wind during a northeast snow-storm.]

The most perplexing difficulty, however, arises from the fact that the signal often appears to be surrounded by a belt, varying in radius from one to one and a half miles, from which the sound appears to be entirely absent. Thus, in moving directly from a station, the sound is audible for the distance of a mile, is then lost for about the same distance, after which it is again distinctly heard for a long time. This action is common to all ear-signals, and has been at times observed at all the stations, at one of which the signal is situated on a bare rock twenty miles from the main-land, with no surrounding objects to affect the sound.

[This statement was of so remarkable a character that I hesitated, as chairman of committee on experiments, to publish it until the conditions under which the phenomena occurred had been definitely ascertained; it has, however, since the late conclusions of Professor Tyndall, received a plausibility which at first sight it did not possess. I think the phenomena, however, can be explained from the action of the upper and lower currents of wind on sound, in conjunction with the peculiar topography and prevailing atmospheric currents of the locality at which abnormal phenomena of sound have been observed.]

All attempts to re-enforce the sound by means of reflectors have hitherto been unsuccessful. Upon a large scale, sound does not appear, on striking a surface, to be reflected after the manner of light and heat, but to roll along it like a cloud of smoke.

[This statement is in a measure in accordance with results which I have previously found in connection with investigations at the light-house near New Haven, in which the conclusion was arrived at, that although rays of feeble sounds, and for a short distance, observe the law that the angle of reflection is equal to the angle of incidence after the manner of light, yet powerful sounds tend to diverge laterally to such a degree as to render reflectors of comparatively little use.]

In view of these circumstances, it will be obvious that it was extremely difficult to determine the extent of the power of the various signals under examination.

It should be remembered that while the sound from the whistle is equally distributed in all directions, that from the two other signals, both of which are provided with trumpets, is not so distributed.

[The difference is apparent near by, but, as we have seen before, on account of the tendency of sound to spread it is imperceptible at a distance.]

* The sound of the whistle is equally distributed horizontally. It is, however, much stronger in the plane containing the lower edge of the bell than on either side of this plane. Thus, if the whistle is standing upright, in the ordinary position, its sound is more distinct in a horizontal plane passing through the whistle than above or below it.

In the siren the sound is most distinct in the axis of the trumpet.

In the Daboll trumpet it is usually strongest in a plane perpendicular to this axis.

[This is at variance directly with any observation I have myself made.]

Relative power.—From the average of a great number of experiments the following result was obtained:

The power of the first-class siren, 12"-whistle, and first-class Daboll trumpet, may be expressed by the numbers 9, 7, 4.

The extreme limit of sound of the siren was not ascertained. That of the 12"-whistle is about twenty miles, and of the trumpet twelve.

Consumption of fuel and water.—The siren, when working with a pressure of 72 pounds of steam, consumes about 180 pounds of coal and 12½ gallons of water per hour.

The 12"-whistle, with 55 pounds pressure of steam, consumes 60 pounds of coal and 40 gallons of water per hour.

The Daboll trumpet, with 10 pounds pressure of air in the tank, consumes about 20 pounds of coal per hour.

The relative expenditure of fuel would be: siren, 9; whistle, 3; trumpet, 1.

The siren.—Of the three machines this is the most complicated. It uses steam at a high pressure, and some of its parts move with very great velocity, the siren spindle making from 1,800 to 2,400 revolutions per minute. The boiler must be driven to its full capacity in order to furnish sufficient steam. A large quantity of steam is, at intervals, suddenly drawn from the boiler, causing a tendency to foam, and to eject a considerable amount of water through the trumpet.

The constant attention of the keeper is required to regulate the fire, the supply of water to the boiler, of oil to the journals, &c.

In general terms, it may be stated that the siren requires more skill and attention in its management than either of the other signals.

The Daboll trumpet.—As the caloric-engine, which has been hitherto employed to operate this signal, requires little fuel, no water, and is perfectly safe as regards danger from explosion, it would, at the first glance, appear to be the most suitable power that could be applied to fog-signals, and was accordingly at first exclusively adopted for this purpose. It was, however, found to be so liable to accident and so difficult to repair that of late years it has been almost entirely rejected. In the steam-boiler, the furnace is surrounded by water, and it is impossible, under ordinary circumstances, to heat the metal much above the temperature of the water. The furnace of the caloric-engine is surrounded by air, and is, therefore, liable to be burned out if the fire is not properly regulated.

The working-piston is packed with leather, and as it moves horizontally, with its whole weight resting on the lower side of the cylinder, the packing at its lower edge is soon worn out.

If the engine is allowed to stop, with the piston at the furnace-end of the cylinder, the leather is destroyed by the heat. The repacking of a piston is a difficult and expensive operation, requiring more skill than can be expected among the class of men from whom light-house-keepers are appointed.

Another accident to which these engines are subject arises from a sudden check in the velocity of the piston, caused either by the jamming of the leather-packing or the introduction of dirt into the open end of the cylinder, in which case the momentum of the heavy, eccentrically-loaded fly-wheel is almost sure to break the main rocker-shaft.

The expense of repairs is considerably increased by the fact that these engines are not now in general use, and when important repairs are required it is usually necessary to send to the manufacturer.

This signal requires much attention. The fires must be carefully regulated to avoid burning out the furnace, the journals thoroughly oiled, and the cylinders well supplied with tallow.

The steam-whistle.—This machine requiring much less steam than the siren in proportion to the size of its boiler, there is not the same necessity for forcing the fire; the pressure of steam required is less, and the point from which it is drawn much higher above the water-level in the boiler, and there is consequently no tendency to foam.

The machinery is simple; the piston-pressure very light, producing but little strain on the different parts of the engine, which is therefore not liable to get out of order, and requires no more attention than a common stationary engine.

One marked advantage possessed by this signal is that, should the engine become disabled, the whistle may still be sounded by working the valve by hand. This is not the case with the two others, where an accident to any part of the machinery renders the signal for the time useless.

It will thus be seen that the siren is the most expensive of the fog-signals as regards

maintenance, and that it is adapted only to such stations as are abundantly supplied with water and situated in the vicinity of machine-shops where the necessary repairs can be promptly made.

On the other hand, as it is the most powerful signal, there are certain stations where it should have the preference; as, for example, Sandy Hook, which from its importance demands the best signal that can be procured, regardless of cost. Such stations should be provided with duplicate apparatus, well supplied with spare parts, to guard against any possibility of accident.

There should be a keeper whose sole business must be to attend the signal, and who should have sufficient mechanical skill to make the ordinary repairs. He should, moreover, be a licensed engineer.

There will also be required an assistant, who may be one of the light-keepers, to relieve him during the continuance of foggy weather.

The steam-whistle is the simplest in construction, most easily managed and kept in repair, and requires the least attention of all the fog-signals. It is sufficiently powerful for most localities, while its consumption of fuel and water is moderate.

It has been found on this coast that a sufficient quantity of rain-water can be collected to supply the 12"-whistle at nearly every station. This has been the case for the last two years at Martineus.

The Daboll trumpet, operated by a caloric engine, should only be employed in exceptional cases, such as at stations where no water can be procured, and where, from the proximity of other signals, it may be necessary to vary the nature of the sound.

The trumpet, however, may undoubtedly be very much improved by employing steam-power for condensing the air. The amount of work required, which is that of compressing 70 cubic feet of air to an average pressure of 8 pounds per inch, would be less than two horse-power. For this purpose the expenditure of fuel and water would be moderate; indeed, the exhaust-steam could be condensed and returned to the cistern, should the supply of water be limited.

The siren also is susceptible of improvement, especially as regards simplification.

[In the foregoing remarks we think the general has expressed a somewhat undue partiality for the whistle, and somewhat overestimated the defects of the other instruments. The trumpets, with Ericsson engine, have not been abandoned, except partially in the two districts under the direction of General Duane, to which he probably intended to confine his statement. They are still in use in the third district, where they are preferred by General Woodruff, who finds no difficulty in keeping them in repair, having employed a skilled machinist who has made these instruments his special study, and who, visiting them from time to time, makes repairs and supplies new parts.]

The intermittent action of fog-signals makes it necessary to employ a peculiar form of boiler. The steam used is at a high pressure, and drawn off at intervals; consequently there is a tendency to foam and throw out water with the steam. To obviate this difficulty the form of boiler found by experience to be best adapted to this service is a horizontal tubular boiler, (locomotive,) with rather more than one-half of the interior space allowed for steam-room. The steam-dome is very large, and is surmounted by a steam-pipe 12" in diameter. Both the dome and pipe were formerly made much smaller, but were gradually enlarged as long as any difficulty with regard to foaming was noticed. The steam is drawn off at a point 10" above the water-level in the boiler. The main points to be observed are to have plenty of steam-room, and to draw the steam from a point high above the water-level. It will be readily perceived that a vertical tubular boiler is entirely unsuited to this work.

It is essential, both as regards economy of fuel, and the efficient working of the signal, that the boiler, including the dome and stand-pipe, should be well covered with some good non-conductor of heat. A material, called salamander felting, manufactured in Troy, N. Y., was used on the fog-whistle boiler at House Island during the winter of 1870. There resulted a saving of more than 20 per cent. of fuel over that consumed in the same boiler when uncovered. Where this material cannot be procured, a thick layer of hair felting, covered with canvas, will be found to answer a good purpose.

Various expedients have been proposed with the view of keeping the water in the boilers hot when the signals are not in operation, that the signal may always be ready to sound at a very short notice, and that the water in the boiler and pipes may be prevented from freezing in extremely cold weather. One of these contrivances is "Sutton's circulating water-heater." It consists essentially of a small, vertical, tubular boiler, entirely filled with water, and connected with the boiler or tank which contains the water to be heated, by two pipes on different levels. As soon as the water in the heater is warmed, a circulation commences, the hot water flowing through the upper pipe into the boiler, and the cold through the lower pipe from the boiler to the heater.

As the furnace in the heater is very small, but little fuel is consumed, and nearly the entire heat produced by the combustion is utilized.

The apparatus has been extensively employed in heating the water in tanks designed for filling the steam fire-engine boilers, when the alarm of fire is first given, and appears admirably adapted to this purpose. If used in connection with a steam-boiler it should be disconnected before steam is raised in the latter, as from its construction it is not calculated to withstand any considerable pressure.

An arrangement similar in principle has been used in the first light-house district, consisting of a small cylinder coal-stove of the ordinary pattern, around the interior of which, and above the grate, is introduced a single coil of $\frac{3}{4}$ " pipe. This coil is connected with the boiler by two pipes, one entering near the bottom, the other about 2 feet higher. It has been found that in consequence of the rapid circulation of the water through this coil, and the great capacity of water for heat, that nearly all the heat from the fire in the stove is transferred to the water in the boiler. This arrangement possesses the advantage of the $\frac{3}{4}$ " pipe, being strong enough to stand any pressure that can be used in the boiler, rendering it unnecessary to disconnect it at any time.

Experience has, however, proved that none of these contrivances are essential. It is seldom that an attentive keeper cannot foresee the approach of fog or snow in time to have the apparatus in operation as soon as required, even when obliged to start his fire with cold water in the boiler.

Keepers should be directed to watch the state of the weather carefully, and to light their fires at the first indication of fog or snow-storm. As soon as the water in the boiler is near the boiling-point, should the necessity for sounding the signal have not yet arisen, the fire may be banked, and in this state the water may be kept hot for any length of time at a moderate expenditure of fuel. With proper care no more fuel is required to keep the water at the requisite temperature by means of a banked fire than by any other method, and it is a matter of great importance to avoid complicating fog-signal apparatus by unnecessary appendages.

The same plan should be adopted in extremely cold weather, to prevent the water in the boiler from freezing. There should be a small air-cock in the draught-pipe near its junction with the feed-pump, and in cold weather this should be opened when the pump is not in use, in order to allow the pipe to empty itself.

When the draught-pipe cannot be protected from the cold, and the well is at a considerable distance from the engine, the following expedient has been employed with success: The pipe is inclosed in an India-rubber hose of about double its diameter, and from time to time steam is forced through the space between the hose and draught-pipe by means of a small pipe from the boiler.

Although the laws governing the reflection of light and heat are undoubtedly in a great measure applicable to sound, there are yet so many disturbing influences, such as inflection, refraction, caused by the varying density of the atmosphere, &c., interfering with the reflection of the latter, that but little use can be made of this property in directing and condensing the waves of sound issuing from a fog-signal. This fact may be illustrated by an account of some experiments made during the last year.

A whistle being sounded in the focus of a large parabolic reflector, it was very perceptible to an observer in the immediate vicinity that the sound was louder in the front than in the rear of the reflector. As the distance of the observer from the whistle was increased this disparity rapidly diminished, and at the distance of a few hundred yards entirely disappeared. The *beam* of sound had been dissipated and the *shadow* had vanished. The effect of a horizontal sounding-board 10 feet square, suspended over the whistle to prevent the escape of sound in a vertical direction, was inappreciable at the distance of a quarter of a mile.

The employment of a trumpet with the whistle was rather more successful. The trumpet was constructed of wood, in the form of a square pyramid; the lower base being 10' by 10', the upper base 2' by 2', and the height 20'. The axis was horizontal and the whistle placed at the smaller end. By this arrangement the increased power of the sound could be perceived at the distance of a mile, the action being similar to that of a speaking-trumpet.

It is probable that some modification of this form of whistle may be advantageously employed in certain localities, but there is, however, a disadvantage attending the use of a trumpet with fog-signals.

The sound from a trumpet not being uniformly distributed, it is difficult to estimate the distance of the signal, or, as the pilots term it, "to locate the sound." This has been observed in the siren and Daboll trumpet. The sound from these signals being stronger on one course than any other, may be distinctly heard from a vessel when crossing the axis of the beam of sound, but as its distance from this line increases, the sound appears fainter and more remote, although the vessel may be approaching the signal.

From an attentive observation, during three years, of the fog-signals on this coast, and from the reports received from captains and pilots of coasting vessels, I am con-

vinced that in some conditions of the atmosphere the most powerful signals will be at times unreliable.

Now it frequently occurs that a signal, which under ordinary circumstances would be audible at the distance of fifteen miles, cannot be heard from a vessel at the distance of a single mile. This is probably due to the reflection mentioned by Humboldt.

The temperature of the air over the land where the fog-signal is located, being very different from that over the sea, the sound, in passing from the former to the latter, undergoes reflection at their surface of contact. The correctness of this view is rendered more probable by the fact that when the sound is thus impeded in the direction of the sea, it has been observed to be much stronger inland.

When a vessel approaches a signal in a fog, a difficulty is sometimes experienced in determining the position of the signal by the direction from which the sound appears to proceed, the apparent and true direction being entirely different. This is undoubtedly due to the refraction of sound passing through media of different density.

Experiments and observation lead to the conclusion that these anomalies in the penetration and direction of sound from fog-signals are to be attributed mainly to the want of uniformity in the surrounding atmosphere, and that snow, rain, fog, and the force and direction of the wind have much less influence than has generally been supposed.

[In the foregoing I differ entirely in opinion from General Duane, as to the cause of extinction of powerful sounds being due to the unequal density of the atmosphere. The velocity of sound is not at all affected by barometric pressure, but if the difference in pressure is caused by a difference in heat, or by the expansive power of vapor mingled with the air, a slight degree of obstruction of sounds may be observed. But this effect we think is entirely too minute to produce the results noted by General Duane and Dr. Tyndall, while we shall find in the action of the currents of wind above and below a true and sufficient cause.]

The experimental whistles were of the following dimensions, viz: $2\frac{1}{2}$ ", 3", 4", 5", 6", 10", 12", and 18" in diameter. Those of $2\frac{1}{2}$ ", 3", 5", and 10", were fitted, instead of the ordinary bell, with long cylinders, provided with movable pistons, so that the effective length of the bell could be altered at pleasure. The pitch of the blast was found to vary with the length of the bell, and the power of the whistle with its diameter. The ratio of the power to the diameter was not accurately obtained; but it is probable that the extreme range of sound of a whistle is proportional to the square root of its diameter.

[This result, that the pitch varies with the length of the bell, is in conformity with well-established principles of resounding cavities; and that the power should increase with the extent of the aerial reed, the vibrations of which give motion to the resounding air within the cavity, is also, as we have seen, in accordance with hypothetical considerations; but as the density of this stream of steam, and consequently the rapidity of its vibrations, depends upon the pressure of the steam in the boiler, a perfect whistle should have the capability of changing its dimensions, not only in relation to the width of its throat, but also in regard to the pressure of the steam in the reservoir.]

The pitch giving the greatest range appears to be at the middle of the scale of sound. It is certain that a good result cannot be obtained from either a very shrill or a bass note. This remark is applicable to all varieties of signal.

The 10" and 12" whistles are recommended for ordinary use. The 18" whistle is more powerful, but the increase of power bears too small a proportion to that of the expenditure of fuel to render its employment generally advisable. The best results were obtained by giving the whistle the following proportions: The diameter of the bell equaling two-thirds of its length, and the set of the bell, *i. e.*, the vertical distance of the lower edge above the cup, from one-third to one-fourth of the diameter for a pressure of from 50 to 60 pounds of steam.

A bell, whether operated by hand or by machinery, cannot be considered an efficient fog-signal on the sea-coast. In calm weather it cannot be heard half the time at a greater distance than one mile, while in rough weather the noise of the surf will drown its sound to seaward altogether.

On approaching a station I have frequently seen the bell rung violently by the keeper, without being able to hear the sound until I had landed.

Nevertheless, all important stations should be provided with bells, as there are occasions when they may serve a useful purpose, but it should be well understood by mariners that they must not expect always to hear the bells as a matter of course.

Bells should not be omitted at stations furnished with steam fog-signals, especially when the latter are not in duplicate, and mariners should be warned that the bell will be sounded when the regular signal is disabled.

It has been observed that a bell rung by hand can be heard farther than when sounded by machinery, and many of the steamboat companies on this coast pay the keepers of bells rung by clock-work, to ring them by hand when the boats of their line are expected to pass.

[We think the difference in the effect of ringing of bells by hand or by machinery is so slight as to be inappreciable except at a short distance. It is true, as I have before observed, that the sound is louder when the mouth of the bell is directed toward the hearer than when the edge is so directed, but on account of the spreading of this sound the effect is lost in a small distance, and, indeed, in one light-house the bell is permanently placed with the axis of its mouth directed horizontally, and in this position, if the bell were struck interiorly with a hammer, which would give it a larger vibration than when struck exteriorly, I doubt whether any difference could be observed between the two methods of ringing; and if any existed it would probably be in favor of the fixed bell rung by machinery.]

On rivers, narrow channels, and lakes, where the difficulty from the noise of the surf does not exist, this species of signal may be used to advantage, as its maintenance requires but a small expenditure of either money or labor, and by a proper arrangement of the machinery the intervals between the strokes of the bell may be so regulated as to avoid the danger of confounding the signals, however near together.

Although a bell may be heard better when sounded by hand than by clock-work, yet in thoroughfares where the signal must be kept in constant operation during the entire continuance of a fog, it would be impracticable to make use of the former method, and recourse must be had to machinery.

In arranging the signal the bell and machinery must be placed as low as possible, as the sound is heard much more plainly on the water when the bell is near its surface, and also as the machinery, when thus situated, is steadier and more readily accessible.

Particulars as to the siren.—The boiler of a second-class apparatus is 12 feet long, 42 inches in diameter, and has 300 feet heating-surface. The dome is 2 feet in diameter and 3 feet high.

The cylinder of the engine is 4 inches in diameter and 6 inches stroke. The prolongation of the piston-rod forms the plunger of the feed-pump. The main shaft carries three pulleys, the larger driving the siren-spindle; the second, the worm and screw gear; and the third, the governor.

In the worm-gear the wheel makes two revolutions per minute, and is provided with a cam, which, acting on a lever, opens the valve, admitting steam through the siren-disks. The cam has such a length as to hold the valve open for about seven seconds. A counter-weight closes the valve as soon as the lever is released by the cam.

The siren itself consists of a cylindrical steam-chest, closed at one end by a perforated brass plate. The perforations are twelve in number, equidistant from each other, and arranged on the circumference of a circle, whose center is in the axis of the cylinder. The other end is closed by a cast-iron head. The heads are connected by a brass pipe, through which the spindle passes.

The perforated head is covered on the exterior by a brass disk, attached to the spindle, having twelve rectangular notches corresponding to the apertures in the former, and so arranged that by its revolution these apertures are simultaneously opened and closed. The spindle is driven by a belt from the large pulley on the main shaft. This shaft makes 180 revolutions per minute; the spindle, 1,620; and as there are 12 apertures in the disks, from each there will issue jets of steam at the rate of 19,440 per minute. The sound produced by these impulses may be rendered more or less acute by increasing or diminishing the velocity of revolution.

The valve and valve-seat are disks similar to those already described, having, however, four openings instead of twelve. The valve revolves on the brass tube inclosing the siren-spindle, and is worked by a bevel gear. The trumpet is of cast iron.

The Daboll trumpet.—The apparatus used in the foregoing experiments is a second-class trumpet, operated by an Ericsson caloric-engine. The air-pump is single-acting. Its cylinder is 12" in diameter by 12" stroke. The engine makes forty strokes per minute. There is a screw-thread raised on the main shaft, which, acting on a wheel, drives a bevel gear, giving motion to a cam-wheel. The latter makes one revolution in two minutes, and is furnished with three equidistant cams. These cams, pressing on the valve-lever, throw the valve open once in forty seconds, admitting the compressed air through the reed-chest into the trumpet.

The quantity of air forced into the tank should be in excess of that needed for the trumpet, the surplus being allowed to escape through a delicate safety-valve. This is necessary to provide against a deficiency in case of leakage, and also to allow the pressure of air to be regulated to accommodate the reed. Each reed requiring a differ-

ent pressure, it is necessary to alter the pressure of the valve-spring whenever a reed is changed.

The first-class trumpet differs only in size from that described.

The caloric-engine for the first class has a 30" cylinder. The air-pump is 16½" by 15" stroke.

The steam-whistle.—The boiler of this machine is that of the siren. On the forward part of the boiler the bed-plate of a small engine is secured by two cast-iron brackets. The cylinder of this engine is 4" by 9". The fly-wheel shaft carries an eccentric, which, acting through a rod and pawl on a ratchet-wheel, gives the required motion to the cam-wheel shaft.

The cam-wheel, which makes one revolution per minute, is provided with one or more cams, depending on the number of blasts to be given in a minute; the length of the blast being regulated by that of the cams.

The valve for admitting the steam into the whistle is a balance-valve, the diameters of the two disks being respectively 3½" and 2½", which difference is sufficient to cause the pressure of steam to close the valve tight without requiring too great a force to open it. The valve is worked by a stem attached to the rocker-shaft at the lower part of the steam-pipe. This shaft passes through a stuffing-box in the steam-pipe, and is provided with a collar which the pressure of the steam forces against the interior boss on the pipe, thus making the joint steam-tight. The exterior arm on this rocker-shaft, as well as that on the engine, is perforated in such a manner as to allow the throw of the valve to be adjusted.

In the comments we have made on the report of General Duane, the intention was not in the least to disparage the value of his results, which can scarcely be too highly appreciated; but, inasmuch as the true explanation of the phenomena he has observed has an important bearing on the location of fog-signals and on their general application as aids to navigation, as well as of great interest to the physicist who values every addition to theoretical as well as practical knowledge, we have not only thought the remarks we have offered necessary, but also that special investigations should be made to ascertain more definitely the conditions under which the abnormal phenomena he has described occur, and to assign, if possible, a more definite and efficient cause than those to which he has attributed them.

We have, therefore, given much thought to the subject, and, since the date of General Duane's report, have embraced every opportunity which occurred for making observations in regard to them. The first step we made toward obtaining a clew to the explanation of the phenomena in question resulted from observations at New Haven, namely: 1st, the tendency of sound to spread laterally into its shadow; 2d, the fact that a sound is frequently borne in an opposite direction to the wind at the surface, by an upper current; and 3d, that a sound moving against a wind is heard better at a higher elevation. The first point to consider is in what manner the wind affects sound. That it is in some way connected with the distance to which sound can be heard is incontestably settled by general observation. At first sight, the explanation of this might seem to be very simple, namely, that the sound is borne on in the one direction and retarded in the other by the motion of the wind. But this explanation, satisfactory as it might appear, cannot be true. Sound moves at the rate of about 780 miles an hour, and therefore, on the above supposition, a wind of 7.8 miles per hour could neither retard nor accelerate its velocity more than one per cent., an amount inappreciable to ordinary observation; whereas we know that a wind of the velocity we have mentioned is frequently accompanied with a reduction of the penetrating power of sound of more than 50 per cent. The explanation of this phenomenon, as suggested by the hypothesis of Professor Stokes, is founded on the fact that in the case of a deep current of air, the lower stratum, or that next the earth, is more retarded by friction than the one immediately above, and this again than the one above it, and so on. The effect of this diminution of velocity as we descend toward the earth is, in the case of sound moving with the current, to carry the upper part of the sound-waves more rapidly forward than the lower parts, thus causing them to incline toward the earth, or, in other words, to be thrown down upon the ear of the observer. When the sound is in a contrary direction to the current, an opposite effect is produced—the upper portion of the sound-waves is more retarded than the lower

which, advancing more rapidly, in consequence inclines the waves upward and directs them above the head of the observer. To render this more clear, let us recall the nature of a beam of sound, in still air, projected in a horizontal direction. It consists of a series of concentric waves perpendicular to the direction of the beam, like the palings of a fence. Now, if the upper part of the waves have a slightly greater velocity than the lower, the beam will be bent downward in a manner somewhat analogous to that of a ray of light in proceeding from a rarer to a denser medium. The effect of this deformation of the wave will be cumulative from the sound-center onward, and hence, although the velocity of the wind may have no perceptible effect on the velocity of sound, yet this bending of the wave being continuous throughout its entire course, a marked effect must be produced. A precisely similar effect will be the result, but perhaps in a considerably greater degree, in case an upper current is moving in an opposite direction to the lower, when the latter is adverse to the sound, and in this we have a logical explanation of the phenomenon observed by General Duane, in which a fog-signal is only heard during the occurrence of a northeast snow-storm. Certainly this phenomenon cannot be explained by any peculiarity of the atmosphere as to variability of density, or of the amount of vapor which it may contain.

The first phenomenon of the class mentioned by General Duane, which I had the good fortune to witness, was in company with Sir Fred. Arrow and Captain Webb, of the Trinity House, London, in their visit to this country in 1872. At the distance of two or three miles from an island in the harbor of Portland, Maine, on which a fog-signal was placed, the sound, which had been distinctly heard, was lost on approaching the island for nearly a mile, and slightly regained at a less distance. On examining the position of the fog-signal, which was situated on the farther side of the island from the steamer, we found it placed immediately in front of a large house with rising ground in the rear, which caused a sound-shadow, into which, on account of the lateral divergence of the rays, the sound was projected at a distance, but not in the immediate vicinity of the island. In the same year I made an excursion in one of the light-house steamers, with Captain Selfridge, to an island on the coast of Maine, at which abnormal phenomena were said to have been observed, but on this occasion no variation of the sound was noted, except that which was directly attributable to the wind, the signal being heard much farther in one direction than in the opposite. The next opportunity I had to study the abnormal phenomena of sound is described in the following report made to the Light-House Board:

INVESTIGATIONS IN REGARD TO SOUND AND FOG-SIGNALS, AUGUST, 1873.

Professor Henry, chairman, and Commander Walker, naval secretary of the Light-House Board, left Portland at 3 o'clock p. m., in the steam-tender Myrtle, Captain Foster, for Whitehead light-station, at which place abnormal phenomena of sound had been observed.

Whitehead light-station is on a small island about a mile and a half from the coast of Maine, on the western side of the entrance to Penobscot Bay, and in the direct line of the coasting-steamers and other vessels from the westward bound into the Penobscot Bay and River. The light-house and fog-signal are situated on the southeast slope of the island, the surface of which consists almost entirely of rock, the middle being at an elevation of 75 feet above the mean tide-level.

The phenomena which had been observed at this and other stations along the coast consisted of great variation of intensity of sound while approaching and receding from the station. As an example of this we may state, the experience of the observers on board the steamer City of Richmond on one occasion, during a thick fog in the night in 1872. The vessel was approaching Whitehead from the southwestward, when, at a distance of about six miles from the station, the fog-signal, which is a 10-inch steam-whistle, was distinctly perceived and continued to be heard with increasing intensity of sound until within about three miles, when the sound suddenly ceased to be heard, and was not perceived again until the vessel approached within a quarter of a mile of

the station, although from conclusive evidence furnished by the keeper it was shown that the signal had been sounding during the whole time. The wind during this time was from the south, or approximately in an opposite direction to the sound. Another fact connected with this occurrence was that the keeper on the island distinctly heard the sound of the whistle of the steamer, which was commenced to be blown as soon as the whistle at the station ceased to be heard, in order to call the attention of the keeper to what was supposed to be a neglect of his duty in intermitting the operations of his signal. It should be observed in this case that the sound from the steamer was produced by a 6-inch whistle, while that of the station was from an instrument of the same kind, of 10 inches in diameter; or, in other words, a lesser sound was heard from the steamer, while a sound of greater volume was unheard in an opposite direction from the station. It is evident that this result could not be due to any mottled condition or want of acoustic transparency of the atmosphere, since this would absorb the sound equally in both directions. The only plausible explanation of this phenomenon is that which refers it to the action of the wind. In the case of the sound from the steamer, the wind was favorable for its transmission, and hence it is not strange that its sound should be heard on the island when the sound from the other instrument could not be heard on the steamer. To explain on the same principle the fact of the hearing of the sound at the distance of six miles, and afterward of losing it at the distance of three miles, we have only to suppose that in the first instance the retarding effect of the wind was small, and that in the second it became much greater on account of a sudden increase in the relative velocity of the current in the upper and lower portions.

After making a critical examination of the island and the position of the machinery, and also in regard to any obstacle which might interfere with the propagation of the sound, the keeper was directed to put the instrument in operation and to continue to sound it for at least two hours, or until the steamer was lost sight of, which direction was complied with. In passing from the island, almost directly against a light wind; the intensity of the sound gradually diminishing as a whole, with the increase of distance, but varying in loudness from blast to blast, now louder, then again more feeble, until it finally ceased at a distance of about fifteen miles, as estimated by the intervals between the blasts and the sight of the steam as seen through a spy-glass, and also from points on the Coast-Survey charts.

The result of this investigation clearly showed the power of the apparatus in propagating sound under conditions not entirely favorable, since the wind, though light, was in opposition to the sound.

Cape Elizabeth Light-Station, Maine, August 29, 1873.—The fog-signal at this place is on a prominent headland to which the course of all vessels is directed when bound from the southward into Portland Harbor. It is furnished with two light-houses 919 feet apart and 143 feet above sea-level. The easterly tower is connected with the keeper's dwelling by a wooden covered way 200 feet long and about 12 feet high; the station is furnished with a 10-inch steam fog-whistle, placed to the southward of the easterly tower, at a distance of about 625 feet and about at right angles with the covered way; it therefore has a background, including the covered way, of about 65 feet above the height of the whistle, which was found to reflect a perceptible echo. The whistle was actuated by steam at 55 pounds pressure, consuming from 60 to 65 pounds of anthracite coal per hour. The whistle itself differs from the ordinary locomotive-whistle by having a projecting ledge or rim around the lower part through which the sheet of steam issues to strike against the lower edge of the bell. What effect this projecting ledge or rim may have is not known to the observers. This whistle is provided, for the purpose of concentrating the sound in a given direction, with a hollow truncated pyramid 20 feet long, 10 feet square at the large end, and 2½ feet square at the small end, the axis of the pyramid being placed parallel to the horizon, with the whistle at the smaller end. In order to ascertain the effect of this appendage to the whistle the simplest plan would have been to have noted the intensity of sound at various points on a circle of which the whistle

would have been the center. This being impracticable on account of the intervention of the land, the observations were confined to points on three arcs of a circle of about 120° , of which the axis divided the space into 80° and 40° and a radius of one, two, and three miles. The result of these observations was that starting from the axis of the trumpet on the east side, the sound grew slightly less loud until the prolongation of the side of the trumpet was reached, when it became comparatively faint and continued so until the line between the whistle and observer was entirely unobstructed by the side of the trumpet, when the sound was apparently as loud as in the prolongation of the axis itself. On the west side of the axis of the trumpet the sound in a like manner diminished from the axis until the prolongation of the side of the trumpet was reached when it became feeble again, slightly increased, and then gradually diminished until the line of direction made an angle of about 80° with the axis of the trumpet, when it ceased to be heard at a distance of about one and a half miles. It should be observed, however, that at this point the line of sight of the observers was obstructed by the side of the trumpet and the smoke-stack of the boiler. The wind was light, at south-southwest, approximately in direct opposition to the direction of the sound when it ceased to be heard. We are informed that complaints had previously been made by officers of steamers passing near this point, that the sound was here inaudible previous to the introduction of this trumpet; it would therefore follow that it is of no use in increasing the effect on the western side of the axis and is of injury to the sound on the lines of prolongation of its sides. If the sound ceased to be heard at the point mentioned, when the trumpet is removed, the only apparent cause of the phenomenon will be the prevailing direction of the wind, which, coming from the southwest, will be in opposition to the sound of the whistle; but in the case of the present investigation the force of the wind was so small that it scarcely appeared adequate to produce the effect, and this question, therefore, must be left for further investigation. It may be important to state that, in the case where the sound ceased to be heard, it was regained by sailing directly toward the station about one mile, or at half a mile from the station. After making the foregoing observations as to the intensity of sound in different directions from the station, the observations were closed by sailing directly along the axis of the trumpet until the sound, which gradually grew fainter as the distance increased, finally ceased to be heard at a distance of about nine miles. In comparing this last result with an instrument of about the same power at Whitehead, which gave a perceptible sound at a distance of fifteen miles, the only apparently variable circumstance was the velocity of the wind, in both cases adverse to the direction of the sound; but in that of Cape Elizabeth it was of considerable more intensity.

During the foregoing experiments, when the vessel was about a mile from the station, steaming directly outward, in the prolongation of the axis of the instrument, there was heard after each sound of the whistle a distinct echo from the broad, unobstructed ocean, which was attributed at the time, as in other cases, to reflections from the crests and hollows of the waves, a similar phenomenon having since been referred to a reflection from air of a different density. This observation becomes important in regard to the solution of the question as to the abnormal phenomena of sound.

Cape Ann Light-Station, Massachusetts, August 31, 1873.—This is one of the most important stations on the New England coast. It is furnished with two first-order lights, and a 12-inch steam-whistle, actuated by 60 pounds pressure of steam. The present is the fourth engine which has been erected at this station, in consequence of the complaints either as to the inefficiency of the sound or its failure to be heard in certain directions. It was at first proposed to sail entirely around the island in order to test the intensity of the sound in different directions, but this was found impracticable on account of want of depth of water on the inland side; the observations were therefore confined to the direction in which complaints had been made as to the deficiency of the signal, namely, in a southerly direction. The result of

these observations, the points of which included an arc of 120° , was that the sound was heard with equal intensity except when the direction of the station was to the northward and eastward of the observers; then, in one instance, the sound became very indistinct, and in another was entirely lost, both at a distance of about two miles. In these cases the line of sight between the observers and the signal was interrupted, in the first by a small building, the gable-end of which was within 10 feet of the whistle, and in the second by the south light-tower, which is within 30 feet of the whistle. In this series of experiments, as with the last, the wind was against the sound; the effect was noted by passing over the arc several times at different distances. The wind was from the southward and westward and very light, and the sound was finally lost at about six miles, and in the direction of the obstructions.

Boston Light-Station, August 31, 1873.—The light-house is situated on a low, rocky island, on the north side of the main outer entrance to Boston Harbor, nine miles from the city. It is furnished with three caloric engines, two of the second class and one of the first. The two second-class engines are so arranged as to act separately or together, and in the latter arrangement serve to duplicate the larger engine. At the time the observations were made, the large engine was about being repaired, and one of the smaller engines with the double air-reservoir was used. The larger engine is used with 12 pounds pressure of air, which falls to 8 pounds in producing the sound. The smaller engine, with the double reservoir, is started with 9 pounds pressure, which falls to 8 pounds. This difference in the pressure of air in the two engines is caused by the larger ratio of the reservoir to the size of the reed. With a greater pressure than 12 pounds to the square inch in the larger engine and 9 pounds in the smaller no sound is produced; the reed is unable to act against the pressure, and, consequently, the orifice remains closed. The trumpet of the larger of the engines is reported to have been heard eighteen miles at sea, which, in consideration of the results obtained at Whitehead, we thought very probable. The time required, from starting fires, to get a good working-pressure, is about half an hour. The amount of coal consumed per hour is 17 pounds.

There is moreover at this station a bell, operated by a Stevens clock, not at present used. It is placed on a high, wooden frame-structure, on which one of the ancient bell-striking machines was originally erected. The most proper position for the fog-signal is on the ground occupied by this bell-tower, but as this was not removed at the time of the erection of the trumpets, they were placed in such positions as to have the line of sound interrupted to the northeastward by the bell and light towers. It was therefore thought probable that this was the cause of the deficiency of sound in this direction. To test this the vessel was caused to traverse the arcs of several concentric circles, in the portion of the horizon where the sound was most required as a signal. The first arc traversed was about one and one-half miles from the signal. The vessel on this crossed the axis where the sound was quite loud, and proceeded northward until the sight of the trumpet was obscured by the before-mentioned towers, when the sound became almost inaudible. The vessel next returned across the axis, on a circle of about three miles radius, with similar results; but after crossing the axis the sound on the southern side continued to be but little diminished in intensity along an arc of two and a half miles, or as far as the land would allow the vessel to go. The vessel was next put upon an arc, of which the radius was one and a half miles, and on the south side of the axis, and sailed to the northward until the axis was reached, then turned and ran for the entrance of the harbor, hugging the southern shore, keeping as far from the signal as possible. Throughout this passage the sound was clear and loud, showing very little, if any, diminution of power as the several positions deviated more and more from the direction of the axis, until the vessel was at right angles with the axis, the loud not permitting any greater distance. The vessel approached to within three-quarters of a mile of the signal and then continued still farther around, until nearly in the rear of it, the sound still continuing clear and

loud. The vessel next proceeded up the harbor, nearly in the line of the axis of the trumpet prolonged in the rear, still continuing to hear the signal distinctly until the keeper, losing sight of the vessel, stopped sounding the instrument. These observations were made under very favorable circumstances, it being nearly calm. What wind did exist was about equally favorable to points on either side of the axis. The inference from these observations is, first, that small objects placed near the source of sound tend to diminish its intensity in the direction of its interruption, and should, therefore, if possible, be removed, or the instrument so placed as to obviate such obstructions; and, second, that, even with the trumpet, the sound so diverges from the axis as to be efficient even in the rear of the instrument.

INVESTIGATIONS RELATIVE TO FOG-SIGNALS, AUGUST 25, 1874.

The first of these was on board the steamer Putnam, at Little Gull Island, with Admiral Trenchard, inspector of lights of the third district, accompanied by Governor Ingersoll of Connecticut and Captain Upshur, U. S. N.

At this place are two sirens, the one to replace the other in case of an accident. One of the sirens was sounded with a pressure of 50 pounds per square inch. The wind was across the axis of the trumpet, and almost precisely at right angles to it.

The steamer was headed against the wind, on a line at right angles to the axis of the trumpet. The sound in this case also traveled against the wind, which was at an estimated velocity of from 4 to 5 miles per hour. The distance traveled before the sound became inaudible was estimated, by the speed of the steamer, at $3\frac{1}{2}$ miles.

The steamer was next headed in an opposite direction and returned along its previous path, across the mouth of the trumpet of the siren, the sound gradually increasing in strength without any marked irregularity, until the siren was reached, and on leaving this, the course remaining the same, the sound gradually diminished in intensity, but with less rapidity than before, until it was finally lost at a distance of $7\frac{1}{2}$ miles. In the latter instance the movement of the sound was with the wind. The result of these observations was conformable to that generally obtained from previous observations, namely, that the sound is seldom or never heard at the same distance in different directions, and, moreover, that it is generally heard farther with the wind than against it.

The observations of this day also illustrate the spread of the sound-wave on either side of the axis of the trumpet, a fact which has frequently been observed in other investigations. It may be well to mention that the siren trumpet at this locality is directed horizontally with its prolonged axis passing over, immediately in front of the mouth of the trumpet, a space of very rough ground, the surface of which is principally composed of bowlders, one of which, of very large size, is directly in front of the trumpet, and the idea occurred to me that this rough surface might produce some effect on the transmission of sound to a distance. I observed by strewing sand upon a paper that the former was violently agitated when held near the surface of the large boulder just mentioned, during the blast of the siren-trumpet.

At this station, during the visit of Sir Frederick Arrow, the sound was lost in the direction of the axis of the trumpet at a distance of two miles, and then again regained with distinctness at the light-vessel, a distance of four and one-half miles; this was what we have denominated as an abnormal phenomenon which we think was due to a slight variation in the velocity of the lower or upper part of the current of air, but, unfortunately, the demand for the use of the vessel as a light-house tender prevented the attempt to ascertain whether the same phenomenon would be observed a second time and to further investigate its cause.

The second investigations this season were September 1, 1874, with General Barnard, of the Light-House Board, and General Woodruff, engineer of the third district. We proceeded on this occasion in the steamer Mistletoe to Block Island, one of the outer stations of the Light-House Board, fully exposed, without intervention of land, to the waves and storms of the ocean.

On the southerly side of this island a light-house is about being erected, and a siren station at this locality had been established and was in full operation.

REPORT ON THE FINANCES.

There are here two sirens attached to one boiler, one to be used in case of an accident to the other. For the sake of experiment they are of slightly different qualities, one with a larger trumpet with a revolving disk of the old pattern, giving a lower tone; the other a smaller trumpet, having a revolving disk with openings allowing a much more sudden full blast of steam, and revolving with greater velocity so as to give a higher pitch. The latter is far the superior instrument, as was evident to us by the sound which it produced, and as had been established by the use of the artificial ear in the manufactory of Mr. Brown. The effect on the unguarded ear was scarcely endurable, and the very earth around appeared to tremble during the blast. The keeper (an intelligent man who has been promoted from the station of assistant keeper at Beaver Tail light to this station) informed us that a fleet of fishing-vessels coming in distinctly heard it at a distance estimated by their rate of sailing at scarcely less than thirty miles; this was on two separate occasions. The keeper had been directed to note and record the date at which he heard the sound from other signals; he reported that he had frequently heard the fog-signal at Point Judith, a distance of seventeen miles, and that the observer at the latter place frequently heard his signal; but on comparing records the two sounds had not been heard simultaneously by the two keepers; when it was heard from one station it was not heard from the other, illustrating again the general rule that sound is not transmitted simultaneously with equal intensity in opposite directions.

This occasion also furnished very favorable conditions for observing the remarkable phenomenon of the ocean-echo. At the cessation of each blast of the trumpet, after a slight interval, a distinct and prolonged echo was returned from the unobstructed ocean. It is important to observe, in regard to this phenomenon, that the siren is placed near the edge of a perpendicular cliff, at an elevation of from 75 to 100 feet above the ocean, and, furthermore, that the direction of the wind formed an angle of about 35° with the axis of the trumpet. Now, the loudness of this echo was not the greatest at the siren-house, but increased in intensity until a point was reached several hundred yards from the trumpet, approximately more in accordance with a reflection from the waves. The wind was blowing from the shore with the direction of the sound as it went off from the trumpet, and nearly against it on the return of the echo. I have attributed this phenomenon, which was first observed in 1866 at East Quoddy Head, on the coast of Maine, and since at various stations, at which the trumpet or siren has been used, to the reflection of the sound from the crests and slopes of the waves, and the observation we have mentioned would appear to favor this hypothesis. In connection with this explanation, I may mention that my attention has been called by General Meigs, of the United States Army, to an echo from the palings of a fence, and also from a series of indentations across the under side of the arch one of the aqueduct bridges of the Washington water-works. The fact that the sound was much louder at a point considerably distant from the trumpet was noted by one of the party entirely unacquainted with the hypothesis.

The keeper at this station confirmed without a leading question the statement of Captain Keeney, that it frequently happens that a feeble sound of a distinct object, as the roar of the surf, can be heard against the direction of the wind, and that in this case it always betokens a change in the weather, and is, in fact, used generally by the fishermen as a prognostic of a change in the direction of the wind, which will, in the course of a few hours, invariably spring up from an opposite quarter. In such case it is highly probable, as has been stated, that a change has already taken place in the direction of the upper strata of the air, although, from theoretical considerations, we might infer that the same result would be produced if the wind were stationary above and moving with a considerable velocity in a direction opposite to the sound at the surface of the earth, the velocity gradually diminishing as we ascend, for in this case, also, the inclination of the sound-waves would be downward.

Third series of investigations, September 23, 24, 1874, was made in company with Captain John Davis and Major Haines, both of the Light-House Board, and General

Woodruff, engineer of the third district, and Mr. Brown, patentee of the siren. For the purpose three light-house tenders were employed, viz: Mistletoe, Captain Keeney Putnam, Captain Field; Cactus, Captain Latham.

The place of operation chosen for the first day's series was about $1\frac{1}{2}$ miles from the northern point of Sandy Hook.

From the experience gained by the accumulated observations which had been made, it was concluded that the phenomena of sound in regard to perturbing influences could not be properly studied without simultaneously observing the transmission of sound in opposite directions. It was therefore concluded to employ at least two steamers in making the investigations.

In regard to this point the commission was fortunate in being able to command the use for a limited period of the three tenders mentioned above, which happened to be at the time assembled at the light-house depot, Staten Island, and could be spared from their ordinary operations for a few days without detriment to the service. It was also fortunate in selecting for the scene of the investigations an unobstructed position in the lower bay of New York, and perhaps still more fortunate in the season of the year when, on account of the heat of the sun, a land and sea breeze, which changed its direction at a particular hour of the day, enabled results to be obtained bearing especially on the phenomena to be investigated.

Attention was first given to the character of the several steam-whistles which were intended to be used as the sources of the sound during the series of investigations.

These whistles, which were sounded during the whole of the observations with 20 pounds of steam on each boiler) gave at first discordant sounds, and were found by their effect upon an artificial ear to be considerably different in penetrating power; they were then adjusted by increasing or diminishing the space between the bell and the lower cylinder by turning a screw on the axis of the bell intended for that purpose, until they produced the same effect upon the sand in the membrane of the artificial ear; but in order to further be insured of the equality of the penetrating power of the several whistles, the three steamers abreast, forming as it were a platoon, were directed to proceed against the wind, sounding all the time in regular succession; the Cactus first, then, after an interval of a few seconds, the Mistletoe, and then the Putnam, until the stationary observers lost the sound of each. They became inaudible all very nearly at the same moment. The sound of the Putnam was thought to be slightly less distinct; it was therefore chosen as a stationary vessel, from which the observations of the sound of the other two were to be made.

The Putnam being anchored at the point before mentioned, arrangements were made for sending off the other two vessels in opposite directions, one with and the other against the wind, with instructions to return when the sound became inaudible to those on the stationary vessel, this to be indicated by a flag-signal. It should be mentioned that the velocity of the wind was measured from time to time during the subsequent experiments with one of Robinson's hemispherical cup anemometers made by Casella, of London. The velocity of the wind first observed by this instrument just before the starting of the vessels was 6 miles per hour, the instrument being freely exposed on the paddle-boxes of the steamer. A sensitive aneroid barometer marked 30.395 in., and continued to rise gradually during the day to 30.43 in.; the temperature was 71° F.

The vessels left at 11.18 a. m., the wind being from the west, Captain Davis taking charge of the sounding of the whistle on the Cactus, which proceeded east with the wind, the sound coming to the ear of the observer against the wind; while the sounding on the Mistletoe was in charge of General Woodruff, and, as the vessel steamed against the wind, the sound came to the observers on the stationary vessel with the wind; the other members of the party remained on the Putnam, at anchor at the point before mentioned, off the Hook, Major Haines having charge of the signals. The sound of the first of the vessels was heard faintly at 14 minutes after leaving, but not heard at 16 minutes; we may therefore assume that it became inaudible at 15 minutes. And within a minute of the same time, by a mistake of the signal, the other ceased to

advance, and commenced to come back; the sound from it, however, was very distinct, while at the same moment the sound from the other was inaudible. On account of the mistake mentioned, the relative distance at which the sounds from the two vessels might have become inaudible cannot be accurately given; but the fact observed, that the sound which came with the wind was much more audible than the other, is in conformity with the generally observed fact that sound is heard farther with the wind than against it. In the meantime the velocity of the wind had sunk to $1\frac{1}{2}$ miles per hour.

Next, the vessels, leaving at 11.55 a. m., changed positions; the Cactus, under Captain Davis, steamed west, directly in the direction from which the wind came, while the Mistletoe, under General Woodruff, steamed east, directly before the wind. The result of this trial was well marked in all respects; the sound of the Mistletoe was lost in 9 minutes, which, from the speed of the steamer, was estimated at about $1\frac{1}{2}$ miles, while the sound of the Cactus was heard distinctly for 30 minutes, or at an estimated distance of 5 miles. The wind at the middle of this trial had sunk to .42 mile per hour, or nearly to a calm. The result of this trial was somewhat abnormal, for though the wind had sunk nearly to a calm, the sound was still heard three times as far in the direction of the slight wind as against it.

After a lapse of an hour and a half a third trial was made; in the mean time the wind had changed within two points of an exactly opposite direction, blowing, from the indications of the anemometer, at the rate of ten and one-half miles per hour.

The Cactus again steamed in the eye of the wind, which was now, however, from nearly an opposite point of the compass, while the other vessel steamed in an opposite direction. The sound of the Cactus was lost at the end of twenty-seven minutes, with the wind, or at a distance of four and a half miles.

The sound of the Mistletoe was lost at the end of thirty minutes, or at a distance of five miles, moving against a brisk wind then blowing.

This result was entirely unexpected and much surprised every member of the party, since it was confidently expected that an increase in the intensity of the wind of more than ten miles per hour, and a change to the opposite direction, would materially affect the audibility of the sound, and give a large result in favor of the sound, which moved in the same direction with the wind, but this was not the case. In the course of all the observations in several years in which investigations have been carried on under the direction of the chairman of the board; this is the only instance in which he had heard a sound at a greater distance against the wind than with it, although, as before stated, a number of cases have been reported by other observers in which, under peculiar conditions of the weather, this phenomenon has been observed.

To briefly recapitulate the results, we have in this case three instances, in succession, in which a sound was heard farther from the west than from the east, although in the mean time the wind had changed to nearly an opposite direction. Had these results been deduced from the first observations made on the influence of wind on sound, or, in other words, without previous experience, the conclusion would have been definitely reached that something else than wind affected the conveyance of sound, and this conclusion would have been correct, if the suggestion had been confined to the wind at the surface; but from previous observations and theoretical conclusions, the observed phenomena are readily accounted for by supposing that during the whole time of observation the wind was blowing from the west in the higher part of the aerial current, and that the calm and opposing wind observed were confined to the region near the surface. To test this hypothesis, Major Haines constructed a balloon of tissue-paper, which, after being completed, was unfortunately burned in the attempt to inflate it with heated air.

The remainder of this day was devoted to observations on the sound of the siren at the light-house at Sandy Hook. For this purpose the Cactus, under Captain Davis, was directed to steam in the eye of the wind, while the Mistletoe, under General Woodruff, steamed before the wind, and the Putnam steamed at right angles to the

wind. Unfortunately, on account of the diminution of light at the closing in of the day, nothing could be observed. The only result obtained was that one of the duplicate sirens was heard more distinctly than the other, namely, the one with the higher note.

Experiments September 24, 1874.—The place chosen for the observations of this day was still farther out in the ocean, at the Sandy Hook light-vessel, 6 miles from the nearest point of land. The pressure of the atmosphere was a little greater than the day before, being 30.52; the temperature about the same, 72° Fahr.; wind light, from a westerly direction, as on the previous day, with a force, as indicated by the anemometer, of 1.2 miles per hour. Having been provided with a number of India-rubber toy balloons, the two vessels were sent off in opposite directions—the Mistletoe toward the west, against the wind, the Cactus to ward the east, with the wind, leaving at 10.40 a. m. A change was also made in observing the sound. In these observations the sound was noted at each vessel from the other, the speed of the steamers being the same; the distance between them when the Mistletoe lost the sound of the Cactus was two miles, while the Cactus continued to hear the Mistletoe's sound coming with the wind until they were four miles apart. Simultaneously with this observation a balloon was let off from the Putnam at the light-vessel, which, in its ascent, moved continuously obliquely upward in a line slightly curving toward the horizon, in the direction of the wind at the surface, as far as it could be followed with the eye, indicating a wind in the same direction in the several strata through which it passed, but of a greater velocity in the upper strata.

The vessels now changed places, the Cactus steaming west, the Mistletoe east, the wind having entirely ceased at the surface of the earth. In this case the Cactus lost the sound of the Mistletoe when the vessels were two miles apart, while the Mistletoe continued to hear the sound of the Cactus until they were three miles apart. A balloon let off ascended vertically until it attained an elevation of about 1,000 feet, when, turning east it followed the direction of the previous one. The sound in this case from the east was heard three miles, while that from the west was heard two miles, while in the preceding observations the distances were as 2 to 1; the only changing element, as far as could be observed, was that of the wind at the surface, which became less.

Third trial, 12.45 p. m.—The wind previous to this trial had changed its direction 10 points or about 112½° round through the south, and as indicated by the anemometer at a velocity of 4.8 miles per hour. In this case the Cactus, going against the wind, lost the Mistletoe's sound coming to her against the wind when the vessels were 1 mile apart, while the Mistletoe heard the Cactus sound coming to her, with the wind, when the vessels were 1½ miles apart. The several balloons set off at this time were carried by the surface wind westwardly until nearly lost to sight, when they were observed to turn east, following the direction of the wind observed in the earlier observations. The results of the whole series of observations are extremely interesting. In all the experiments the difference in the audibility of the sound in different directions was very marked, and indeed it rarely happens that the sound is equal in two directions, although from the hypothesis adopted this may be possible, since according to this hypothesis, both the upper and lower currents have an influence upon the audibility of sound in certain directions. From the first trial the motion of the air being in the same direction, both below and above, but probably more rapid above than below on account of resistance, the upper part of the sound-wave would move more rapidly than the lower, and the wave would be deflected downward, and therefore the sound as usual heard farther with the wind than against it. In the third experiment of the same day, in which the wind changed to an almost opposite direction, if the wind remained the same above, as we have reason to suppose it did from the observations on the balloons on the second day, the sound should be heard still farther in the same direction or against the wind at the surface, since, in this case, the sound-wave being more retarded near the surface would be tipped over more above and the sound thus be thrown down.

The observations of the second day are also in conformity with the same hypothesis,

the change in the wind being probably due to the heating of the land as the day advanced, beyond the temperature of the water, and thus producing a current from the latter to the former, while the wind observed in the morning from the west was the land-wind due to the cooling of the latter.

In the morning the wind was blowing from the west, both in the higher strata and at the surface of the earth, and in this condition the sound was heard farther with the wind than against it.

The wind at the surface about midday gradually ceased, and shortly afterward sprung up from an east direction; in this condition the sound, with the wind at the surface was heard at a greater distance. This is also in strict conformity with the theory of a change in the form of the sound-wave, as in the latter case the lower portion would be retarded, while the upper portion of the wave would be carried forward with the same velocity, and hence the sound would be thrown down on the ear of the observer. To explain the result of the third trial of the second day we have only to suppose that the influence of the upper current was less than that of the lower. The conditions for these observations were unusually favorable, the weather continuing the same during the two days, and the change of the wind also taking place at nearly the same hour.

The fact thus established is entirely incompatible with the supposition that the diminution in the sound is principally caused by a want of homogeneity in the constitution of the atmosphere, since this would operate to absorb sound equally in both directions.

In May, 1873, Professor Tyndall commenced a series of investigations on the subject of the transmission of sound, under the auspices of the Trinity House, of England, in which whistles, trumpets, guns, and a siren were used, the last-named instrument having been lent by the Light-House Board of the United States to the Trinity House for the purpose of the experiments in question. The results of these investigations were, in most respects, similar to those which we had previously obtained. In regard to the efficiency of the instruments the same order was determined which has been given in this report, namely, the siren, the trumpet, and the whistle. Professor Tyndall's opinion as to the efficiency of the siren may be gathered from the following remarks. Speaking of the obstruction of sound in its application as a fog-signal, he says, "There is but one solution of this difficulty, which is to make the source of sound so powerful as to be able to endure loss and still retain sufficient residue for transmission. Of all the instruments hitherto examined by us the siren comes nearest to the fulfillment of this condition, and its establishment upon our coasts will, in my opinion, prove an incalculable boon to the mariner." Professor Tyndall arrived at the conclusions which the information we had collected tended to establish, that the existence of fog, however dense, does not materially interfere with the propagation of sound; and also that sound is generally heard farther with the wind than against it, although the variation of the intensity of the sound is not in all cases in proportion to the velocity of the wind. The result of his investigations in regard to the pitch of sound was also similar to those we have given; and, indeed, all the facts which he has stated are, with a single exception as to the direction of the echo, in strict accordance with what we have repeatedly observed. We regret to say, however, that we cannot subscribe to the conclusion which he draws from his experiments as to the cause of the retardation of sound, that it is due to a flocculent condition of the atmosphere, caused by the intermingling with it of invisible aqueous vapor.

That a flocculent condition of the atmosphere, due to the varying density produced by the mingling of aqueous vapor, is a true cause of obstruction in the transmission of sound is a fact borne out by deduction from the principles of wave-motion, as well as by the experiments of the distinguished physicist of the Royal Institution of Great Britain; but from all the observations we have made on this subject we are far from thinking that this is the efficient cause of the phenomena under consideration. A fatal objection, we think, to the truth of the hypothesis Professor Tyndall has advanced is that the obstruction to the sound, whatever may be its nature, is not the same in different

directions. We think we are warranted in asserting that in the cases of acoustic opacity which he has described, if he had simultaneously made observations in an opposite direction, he would have come to a different conclusion. That a flocculent condition of the atmosphere should slightly obstruct the sound is not difficult to conceive; but that it should obstruct the ray in one direction and not in an opposite, or in a greater degree in one direction than in another, the stratum of air being the same in both cases, is at variance with any fact in nature with which we are acquainted. We would hesitate to speak so decidedly against the conclusions of Professor Tyndall, for whose clearness of conception of physical principles, skill in manipulation, and power of logical deduction we entertain the highest appreciation, were the facts which were obtained in our investigations of a less explicit character.

While the phenomena in question are incompatible with the assumption of a flocculent atmosphere as a cause, they are in strict accordance with the hypothesis of the refraction of the waves of sound due to a difference in velocity in the upper and lower portions of the currents of air. We do not say, however, that the transmission of sound in the atmosphere is fully investigated, or that the abnormal phenomena which are said to have been observed in connection with fog-signal stations have been fully explained. So far from this, we freely admit we are as yet in ignorance as to how the hypothesis we have adopted is applicable to the critical explanation of the obstruction to sound in the abnormal cases mentioned by General Duane. We feel, however, considerable confidence in its power to afford a rational explanation of these phenomena when the conditions under which they exist shall have been accurately determined.

We are farther confirmed in our conclusion by the publication of an interesting paper in the proceedings of the Royal Society by Professor Osborne Reynolds, of Owens College, Manchester, intended to show that sound is not absorbed by the condition of the atmosphere, but refracted in a manner analogous to the hypothesis which has been adopted in the preceding report.

Much farther investigation is required to enable us to fully understand the effects of winds on the obstruction of sound, and to determine the measure of the effect of variations of density in the air, due to inequality of heat and moisture. But such investigations can only be made under peculiar conditions of weather and favorable localities, with the aid of a number of steamers, and a series of observers, by whom the transmissibility of the air may be simultaneously observed in different directions. The position which we were so fortunate to obtain in our experiments in the lower bay of New York at the season of the prevalence of land and sea breezes was exceptionally favorable for the study of the action of wind upon sound. It is the intention of the Light-House Board to continue observations in regard to this matter, and to embrace every favorable opportunity for their prosecution under new and varied conditions. The value of these investigations can scarcely be too highly estimated in their bearing on the application of sound as an aid to navigation.

LIGHT-HOUSE BOARD, *October, 1874.*

46 F