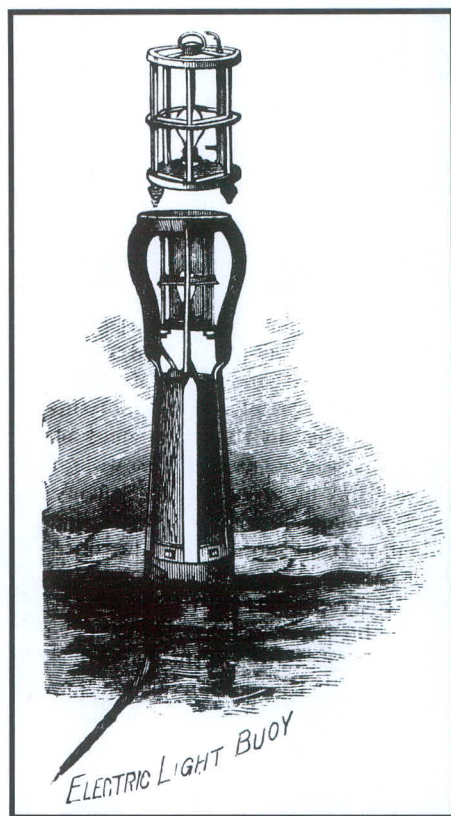
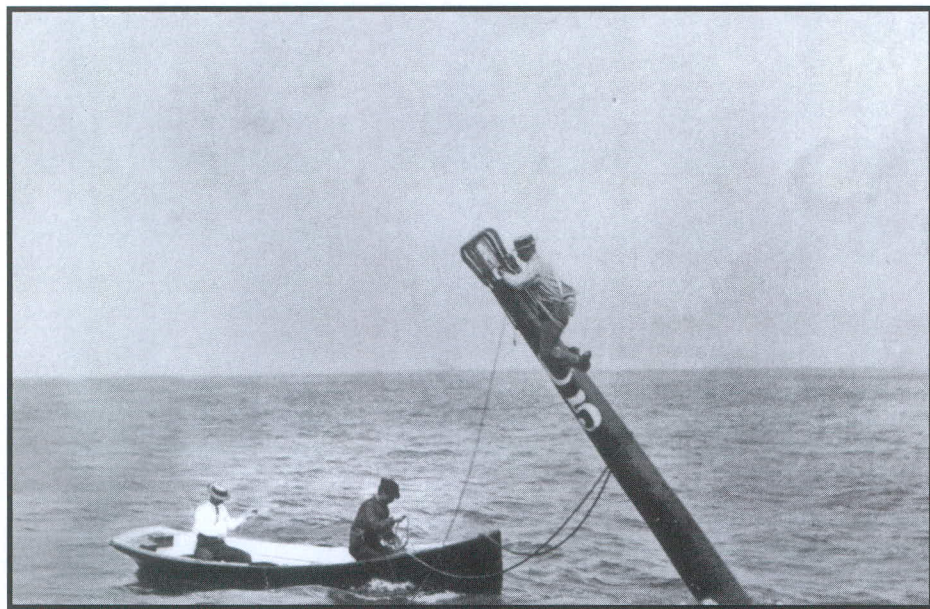


The Electric Buoys of Gedney's Channel



By W.C. Wheeler

Buoys have aided the mariner for thousands of years. The Romans anchored compressed reed mats with rope tied to stone anchors to mark channels and harbor entrances. Later, the Flemish and English used wine and beer barrels, anchored with chains and stone sinkers, as buoys.

By day, unlighted buoys have been the sign posts of the sea, showing the way around obstructions and into harbors. After 1850 an official color system was codified to enhance the buoys' worth. In this country red buoys mark the right, or starboard side of the channel when entering a port; green the left side and red and white vertically striped buoys denote the center of the channel, or the beginning of an entrance channel.

While standard colors improved the system, at night or during periods of reduced visibility, unlit buoys were more of a hazard than a help. Mariners approaching many ports chose to anchor off shore rather than risk entering a narrow channel at night with no lights showing the way.

To solve this, during the latter part of the 19th century, some of the lighthouse authorities of the world began experimenting with lighted buoys. Our lighthouse service experimented with gas fueled lighted buoys and established the first one at the entrance to New York Harbor in 1881. It was fueled with oil gas.

In the 1882 annual report to Congress the Lighthouse Board wrote, "The Board during the year has given much attention to the subject of lighted buoys. For several years past, illuminated buoys have been successfully used in European waters, and have proven to be such valuable and comparatively inexpensive aids to navigation that they have been permanently adopted by the Light-House Establishments of Great Britain and Ireland." The service requested "... \$25,000 for the establishment and maintenance of lighted buoys."

Apparently the service was not totally satisfied with the results of gas buoys as only four were in place by 1888 (one each at Boston and New York Harbors,

two in Charleston Harbor). Although the First District issued a favorable report that year, "In the spring a small gas buoy was placed near Buoy 9, Upper Middle, Boston Harbor, much to the satisfaction of the navigators of these waters. It was run into once, and the jar [shock] disarranged the lens so that the light went out."

Concurrent with the government's experiment with gas fueled buoys, was an experiment with buoys lighted electrically via a cable from shore. From 1888 to 1903 the Gedney Channel into New York Harbor was lighted by electric buoys and this is the story of the trials and tribulations of that experiment.

Appendix 8 to the 1888 Annual Report of the Lighthouse Board is the initial report on the experiment. It was written by LCDR M.R. Mackenzie, Assistant to the Inspector of the Third Lighthouse District.

"Sir,

In obedience to your instructions we have the honor to submit the following report upon the electric lighted buoys

now being established in Gedney's Channel, New York Harbor.

"The conditions which led to devising a system of buoys lighted at night by means of electric lamps operated through submarine conductors connecting with a generating apparatus on shore, for the purpose of defining the main entrance to the harbor of New York, will be understood by reference to the accompanying map, Plate 1.

"The harbor has two communications [channels] with the ocean which are practicable for sea going vessels, one by way of Long Island Sound, through the East River and Hell Gate, and the other through the Narrows, between Staten Island and Long Island Shores. This latter entrance is approached by way of channels crossing the bar which extends from Sandy Hook to Coney Island, across the opening of the lower bay, and being the more direct and accessible from seaward of the two entrances it is by far the more important and is the only one practicable for vessels of the larger class.

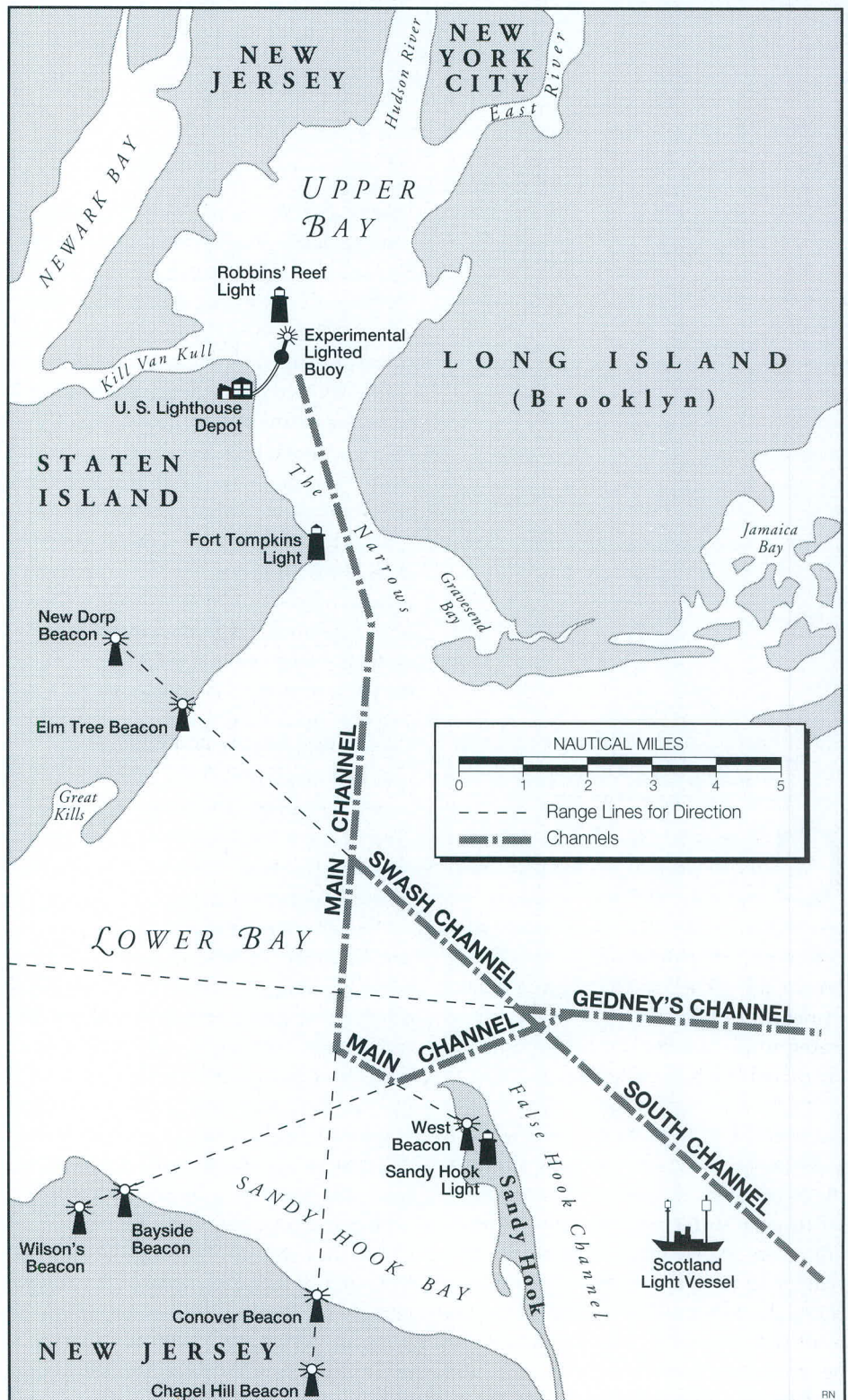
"There are several channels across the bar at the mouth of the lower bay as indicated on the map, but all except two are practically unused except by small craft engaged in local traffic.

"Nearly all the coasting steamers and sea-going vessels of moderate draught pass through the South and Swash Channels, this course being the more direct, but all deep-draught vessels must enter and go out by the less direct route through the Gedney's and Main Channels.

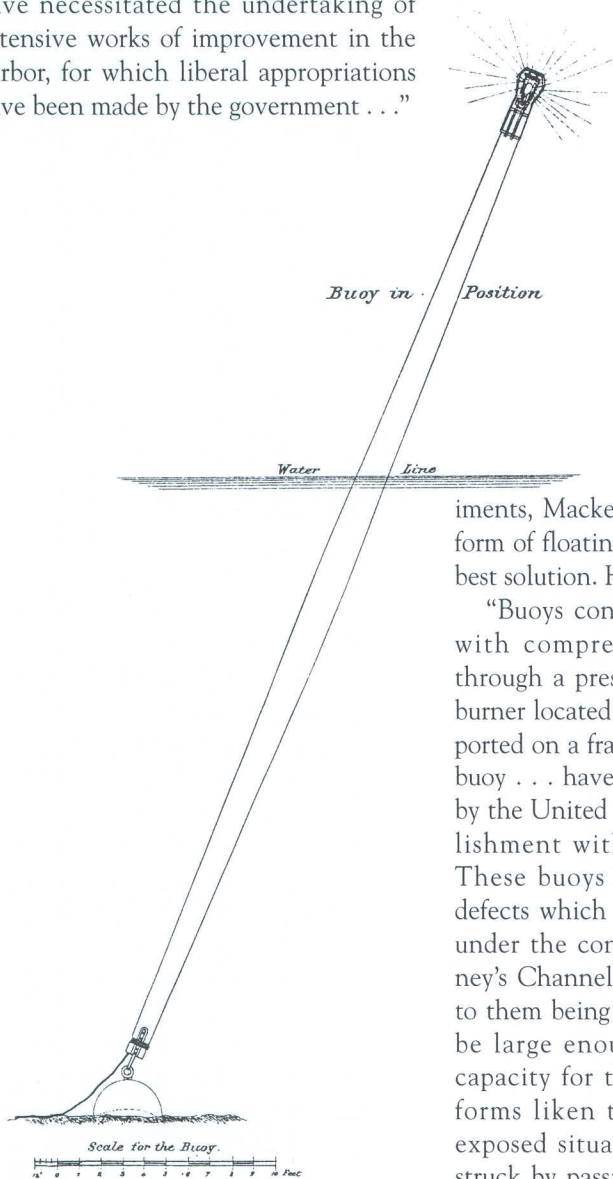
"The different courses through these channels are marked at night principally by range lights established on shore . . . [however] the entrance through Gedney's Channel has heretofore been practically unmarked at night except by unlighted buoys; since, although this channel ranges very nearly [lines up with] with Princess Bay Light[house], near the head of Raritan Bay, this light is at a distance of about 13 miles, and its liability to be observed in even moderately thick weather and the danger of running on a compass bearing of so distant an object through so narrow a channel in which the tide constantly varies

in strength and direction (being often oblique to the axis of the channel) renders the light of very little use so far as Gedney's Channel is concerned, and this channel has therefore been practically of no use at night, and the harbor has been regarded as closed to deep draught vessels except in daylight. . . ."

" . . . The matter has received a great deal of attention in the past and many plans have been proposed as a remedy. The difficulty has been much more serious in recent years on account of the great increase in the number, draught, and speed of ocean steamers running to this port, and the demands of commerce



have necessitated the undertaking of extensive works of improvement in the harbor, for which liberal appropriations have been made by the government . . .”



Commander Mackenzie went on to explain that while range lights would be the best solution, the geography of the area would make that option either extremely expensive or not practicable. The existing Staten Island Princess Bay Light, at 106 feet above the water, would require the construction of an incredibly high structure to the rear of it to form a proper range. And a light constructed in front of the princess Bay Lighthouse (making that light the rear range light) would have to be constructed in deep water which would be difficult, very expensive and probably vulnerable to ice floes in winter. And, even then, the range lights would be too far from the channel (12 and 13 miles) to be of use during moderately thick weather. After mentioning other recent exper-

iments, Mackenzie concluded that some form of floating light appeared to be the best solution. He remarked,

“Buoys containing a reservoir filled with compressed gas, which is fed through a pressure regulator to a small burner located in the focus of a lens supported on a frame-work at the top of the buoy . . . have been used for some years by the United States Light-House Establishment with considerable success. These buoys have, however, certain defects which render them inapplicable under the conditions existing at Gedeney’s Channel, the principal objections to them being form and size. They must be large enough to afford sufficient capacity for the gas supply, and their forms liken them to break adrift in exposed situations, particularly when struck by passing ice or passing vessels. One of these buoys adrift and still burning might become a source of danger [by misleading the mariner].

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

“. . . a lamp can be made of suitable form and of sufficient intensity to compensate . . . for the absence of a lens, and when properly protected from mechanical injury it requires no attention during its “life,” or until it is worn out, when of

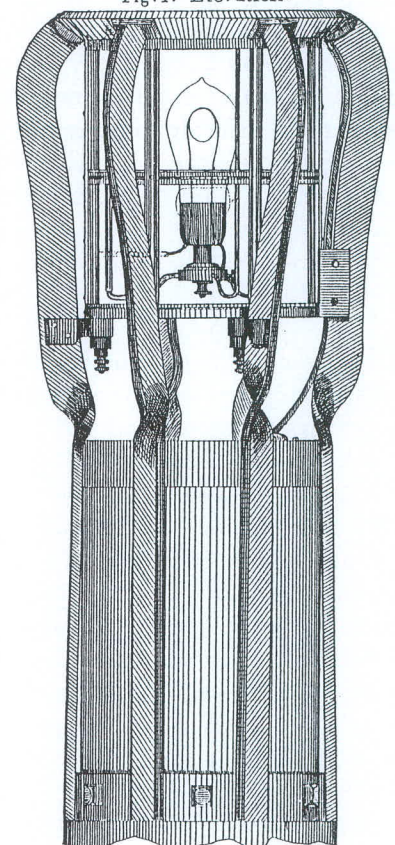
course another lamp must be substituted.

“The lamps on different buoys can easily be rendered distinguishable by making the lamp globes of different colored glass, and the lights can even be made intermittent or flashing . . . by a simple device arranged to interrupt . . . the current . . .”

The plan seemed a winner in theory, but the weak link was the submarine cable. The constant motion of the sea from currents, wind driven waves and tides was sure to cause the cables to sever or wear away the protective armor, expose the electrical wires, and short the system.

Commander Mackenzie reported that the first test proved successful. The service had established a spar buoy near the Robbins Reef Lighthouse in New York Harbor and laid an underwater armor cable between the service depot on Staten Island to the spar buoy, a distance of 6,000 feet. Once the cable reached the buoy it was installed up the length of the spar (in a groove) to the lamp which was covered with a glass jar and protected by

Lantern in Cage.
Fig. 1. Elevation.



an iron cage. A variety of lamps were tested and the buoy survived in various weather stages. However, a protected New York Harbor is a totally different environment than an exposed area like the Gedney Channel.

Nevertheless, the service went ahead with the installation. An engine-dynamo power house was constructed near the East Beacon at Sandy Hook, NJ. It contained duplicate dynamos each powered by a steam boiler. Overhead electric lines were installed between the power house and the area where they entered the water, about 1,500 feet. Two three-conductor electric cables then extended off shore 12,000 to 14,000 feet to junction boxes. From the junction boxes single-conductor cables lead to the six spar buoys, three on each side of the channel. Another single conductor cable of 10,000 feet extended from shore to a single spar buoy marking a turn in the Main Channel near Flynn's Knoll.

In the 1889 Report Cdr. Mackenzie reported "The six electric buoys placed in the Gedney's Channel, off Sandy hook, were first lighted on the night of November 7, 1888, and have been in successful operation with some few exceptions since that date. On the night of February 14, 1889, the resistance of No. 3 suddenly ran down, showing trouble with the cable . . . when No.

3 buoy was lifted, and about 1,000 feet of cable taken up, it was found that the armor and insulation had been cut by some heavy blow such as would be given by the stem or keel of an iron vessel. It is reported that the steamer Republic grounded in Gedney's Channel, near Buoy No. 3, the day before the leak was discovered. The cable was spliced and relaid . . ."

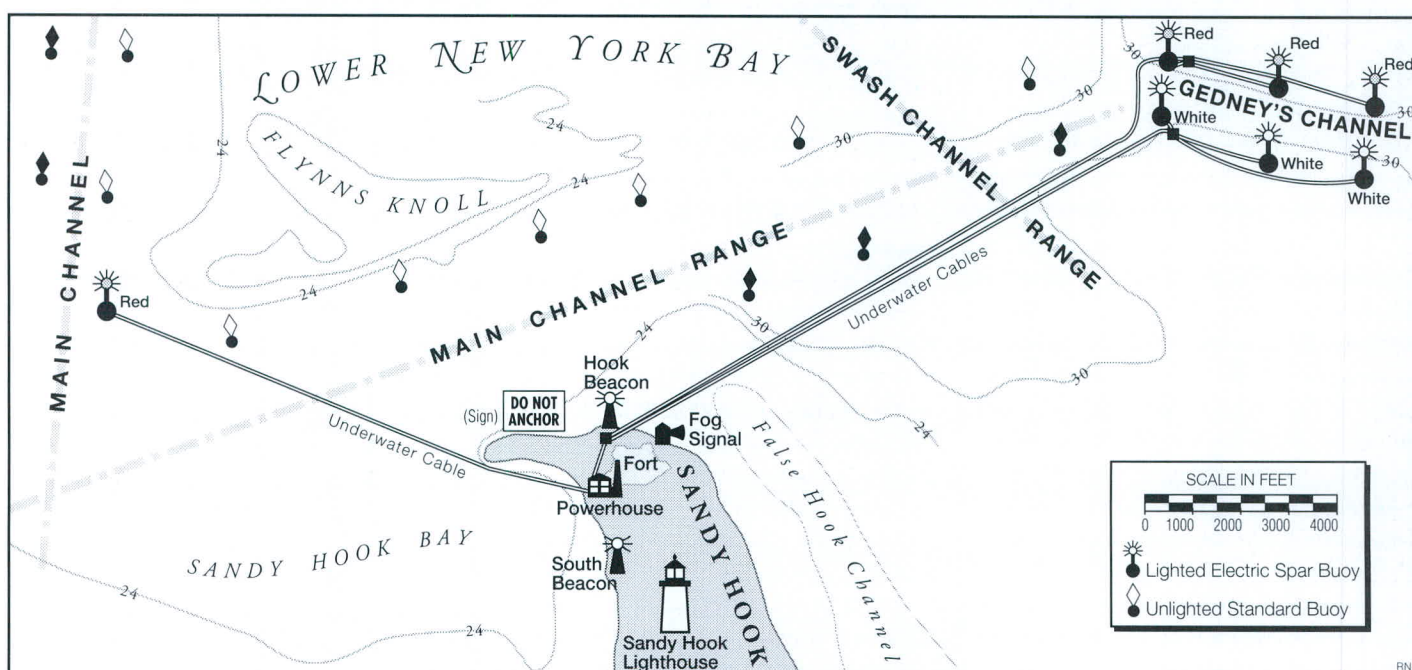
He noted that during the period only 24 outages occurred, and these apparently occurred during "heavy weather" and were because of a faulty lamp design which was being corrected by the manufacturer, the Edison Company. Even with the outages, never did more than two occur at any one time, leaving four lights on at all times. The success of the channel being lighted was underlined by the fact that 224 large vessels used the channel at night during that period. Another drawback to a system that often failed, was the need to have a large buoy tender get underway, or be diverted from another mission, when an outage was reported. To remedy this, the Depot requested an appropriation to construct a 27 foot long, naphtha powered, steam launch to service the buoys. The vessel was stationed near the power station and operated by the crew of that facility.

The 1890 report was submitted by Wm. Babcock, the new Assistant to the 3rd District Inspector. He reported that

569 vessels used the channel during hours of darkness, a sizable increase from the 224 that used the channel during the first year. The figures are based on sightings from a lookout tower located at Sandy Hook. Thus, during some periods of reduced visibility a few large vessels could have escaped detection. Babcock reported the service continued to experience failures with the lamps (bulbs) and cables, even more than the previous year. However, the efficiency rate was still around 90%.

On August 10, 1889, the 25 foot long naphtha steam-launch *Bouquet* was completed and sea trials were conducted which averaged just over 7 knots and, "... she proved herself to be an admirable sea boat for one of her size, and saved the tenders much work in changing the lamps . . . a mast and sail have been fitted for use in case of a breakdown." The sea trials, however, were conducted in August, quite different conditions than would be experienced in January or February.

By the Spring of 1891 more and more vessels had gained confidence in using the Gedney Channel at night. The number of vessel transits increased from 224 during the 1888-89 season to 767 during the 1890-91 year. However, the winter of 1890-91 was far more severe than the two previous winters and the Gedney Channel system suffered an inordinate amount of outages.

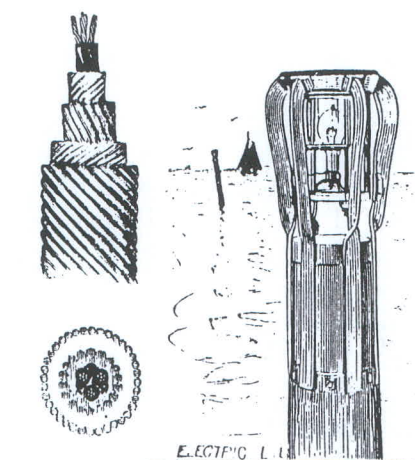


Still the Third District continued to hype the system as a wonderful new invention. Lcdr. West, Assistant to the Third District Inspector reported, “. . . The plant has been under my observation since November 1890, when I reported for duty at this depot . . . Owing to the unusually heavy seas on Gedney's Bar many of the incandescent lamps had but a short life, and it was an incident of every two or three days during the stormy months of December, January and February, to send a tender from the depot to Sandy Hook for the purpose of renewing the electric lamps or remedying slight defects of the general plant . . . the pilots have acquired such confidence in the system that even if two lamps are extinguished at one time the remainder serve the purpose of lighting a vessel through Gedney.”

Commander West thought that the primary cause of the failures was faulty manufactured lamps. Working with the Edison Company, different shape globes were tried, larger filaments installed and different methods of securing the base of the lamps to the buoys devised. What they failed to see was the tremendous forces of nature caused heavy shocks to the buoys and lamps, thus breaking the filaments. In the recent past, the Coast Guard found that even the shock from the bell of a bell buoy will destroy the filaments of some lamps (bulbs) on a lighted bell buoy. Only large filament lamps will survive.

The District also began to experience cable failures. Lcdr. West mentioned in his report to the Lighthouse Board, “I have the honor to report to the board that at about 11:45 p.m. of Monday, July 20, 1891, the three electric buoys, Nos. 2, 4 & 6, on the north side of Gedneys Channel . . . were extinguished simultaneously. This simultaneous extinction indicated that the fault lay in the main cable . . . on the following day . . . work was done with the tender to locate the trouble. After a week's hard work of twelve hours daily, including Sunday, the various faults of the cable were located and repaired, and the buoys relit . . .

“During the process of repairs the north cable was found to be in a process of serious deterioration.” Upon inspection



they found the second cable to have much of the protective armor, near shore, worn away with kinks in several places and the cable badly pitted in deeper water. West went on to remark, “It now remains to be considered what causes these faults, kinks and breaks, which render necessary such great labor and expense in repairs and endanger the existence of the plant itself.

“There is only one answer to this query, and that is, the anchors of vessels casting in that vicinity pick up the cables and [damage or break them] . . . A number of schooners have been anchored within the lines of the prohibitory angle drawn from the [Sandy] Hook Beacon.

“From my observation, here, I doubt if one master in twenty of these schooners ever sees a Notice to Mariners. If they do happen to be aware of the locality of cables at Sandy Hook I still further doubt if one of their masters would forego anchoring in that angle when any stage of tide or cant of wind rendered an anchorage convenient in that vicinity.

Anchors are the worst enemies this plant has had to contend with in the past and so they will be in the future.”

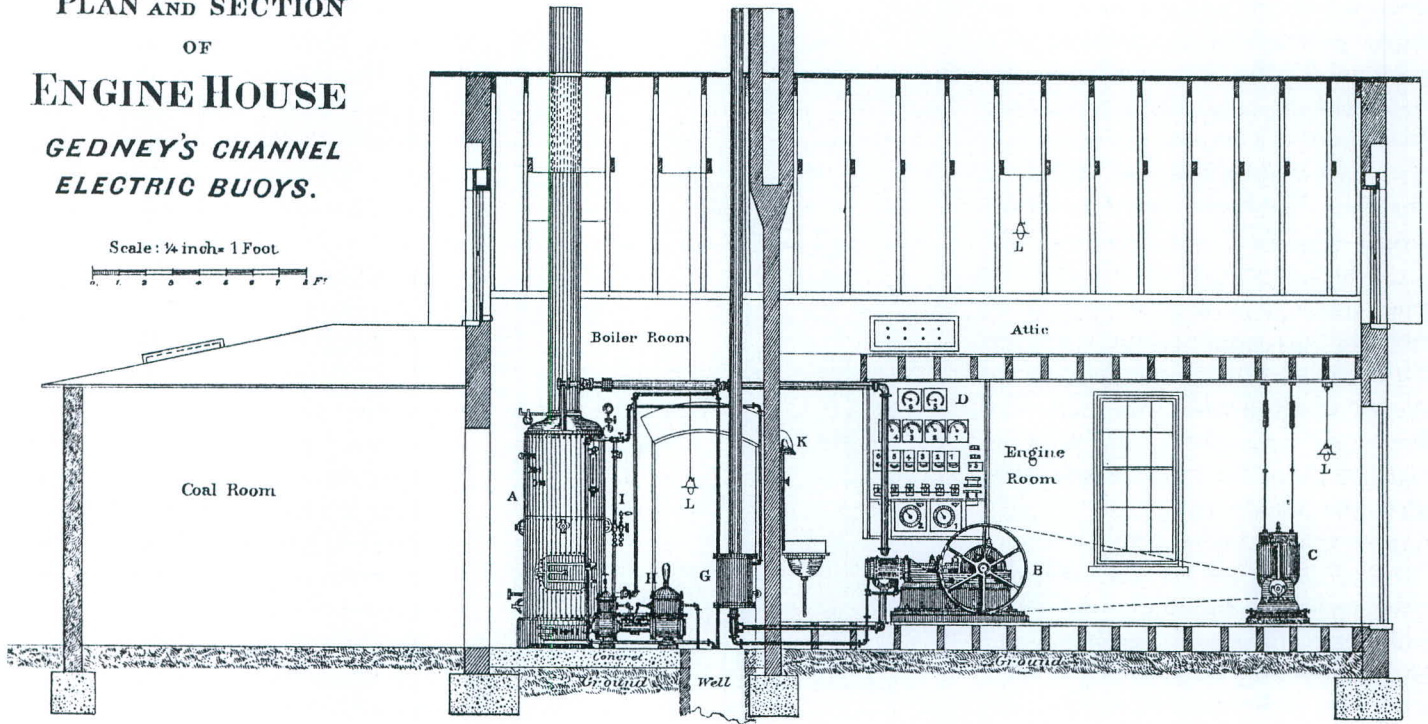
The 1891-92 report showed a slight increase in vessel transits and a continuing problem with the lamps and cables, but nothing as severe as the previous year. The District report did note that after ships passed the Sandy Hook lightship they had a long reach prior to Gedney's Channel and had a hard time spotting the entrance. When the lightship station was established in 1823 (the first outside, or exposed lightship station) it was situated to assist sailing vessels round Sandy Hook and enter that channel. However, by the end of the 19th century the deeper draft vessels were required to sail well beyond the Sandy Hook vessel and enter the Gedney Channel. To allieviate this the service repositioned the lightship to the north in 1891 to better serve the mariner. The station was moved seven more times over the years as conditions changed.

The 1891 report also noted that the 25 foot steam launch Bouquet proved too small for winter use in the area and was replaced by the steam launch of the tender *Armeria*.

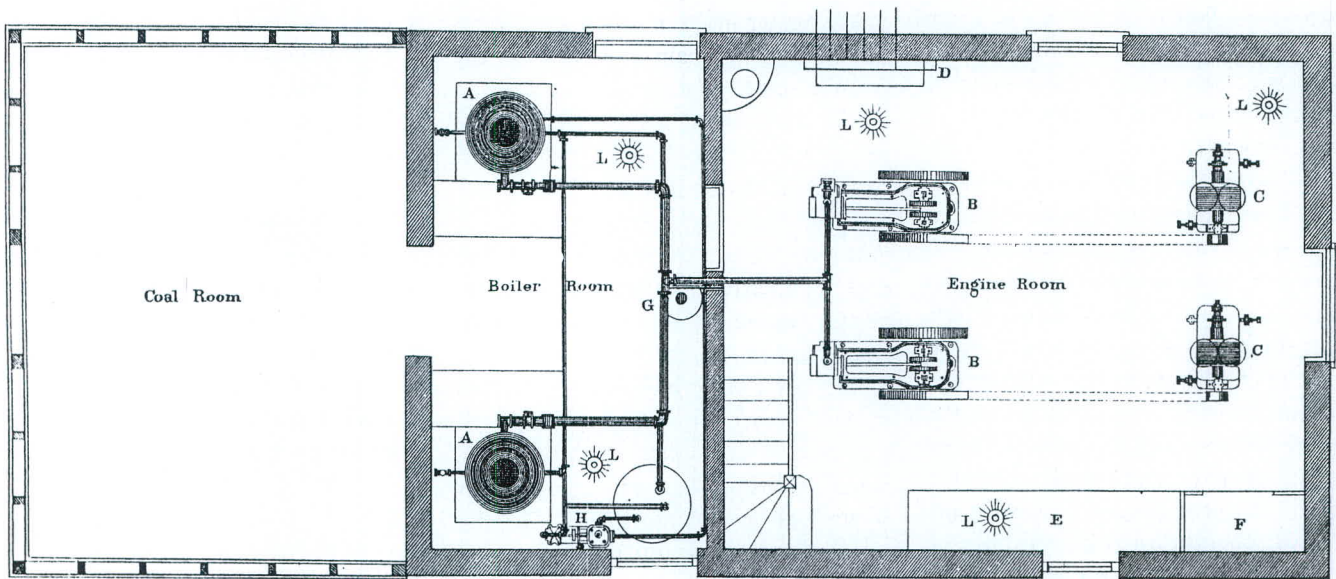
The report ended with an eloquent, if long winded, plea from Lcdr. West lauding the system, “So important and necessary have these lighted buoys become to the pilots that I consider any premeditated discontinuance of the system would lead to a protest from the vast commercial interests of New York not less vehement than the outcry which would follow the abandonment of any first order seacoast light. In these days of rapid transit between the emporiums of the world, when all the ingenuity of modern research, the power of wealth, and the energy of man are devoted to abridging a 3,000 mile voyage by a petty but all important hour, it is self-evident that the enlightened policy of the Light-House Board to thus hold wide open the gates of Sandy Hook is in intelligent accord with that same spirit of enterprise and progress. For the solicitous master of a steamer, who in this task of emulation has passed anxious days and nights in speeding his vessel across the ocean's highway, it is indeed an encouragement and solace to be confident that the rapidly approaching coast is surrounded

PLAN AND SECTION
OF
ENGINE HOUSE
GEDNEY'S CHANNEL
ELECTRIC BUOYS.

Scale: 1/4 inch = 1 Foot.



- | | |
|------------------------------|--------------------------|
| A. Boilers. | F Closet. |
| B. Engines. | G Heater. |
| C. Dynamos. | H Pump. |
| D. Testing and Switch-board. | I Injector. |
| E. Work bench. | K Recording Steam Gauge. |
| | L Lamps |



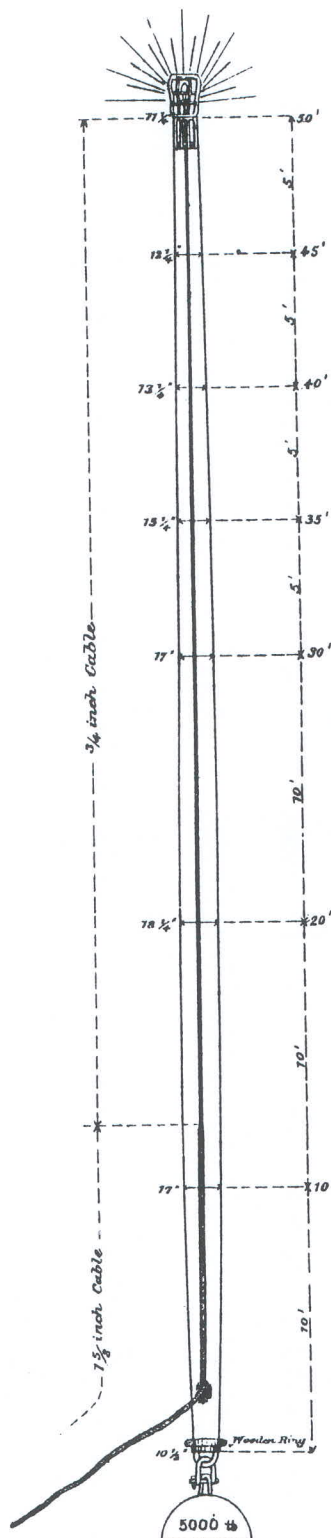
by every safeguard known to science to mitigate the dangers and happily lead him to the desired haven."

The Lighthouse Board was impressed enough with the new system of electric buoys to obtain a Congressional appropriation of \$20,000 in March 1893 for "establishing proper buoyage on the water front of Chicago" in conjunction with the World Exposition held there that year. The board then directed the Inspector of the Third District to light the Chicago water front with lighted buoys for a distance of about 7 miles, from the breakwater near the Van Buren Street dock to the Casino dock on the ground of the World's Exposition. The buoys provided a lighted highway for the steamers plying the area between Chicago and the Casino dock.

The electric buoys, besides being of benefit to the commerce of Lake Michigan, would also illustrate to the multitudes of people visiting the Exposition the plan for lighting harbors and bring the system to the attention of the world.

After considering several alternatives, the Third District personnel decided to use an alternating current and a 31.5 mile long loop of cable. Shunt coils were placed in the buoy heads reducing the voltage of the main current to 100 volts for each buoy lamp.

Thirteen juniper wood spar buoys anchored with 3,300 and 1,800 lb. sinkers (depending on the depth of water, length of the buoy, etc.) were placed along the route one-half mile apart. Edison five inch incandescent lamps of 100 candlepower were fixed to each buoy head (similar to those on Gedney Channel buoys) twelve feet above the water. The first test on June 23, 1893, brought only "a cherry red glow at each lamp." The second test was a failure and the third produced the most candlepower, except, as the District reported, "... the head of buoy #1 nearest the Casino dock displayed balls of fire as big as coconuts, and severe shocks were felt at the switch board. The head of Buoy #1 was later found to be badly burned."

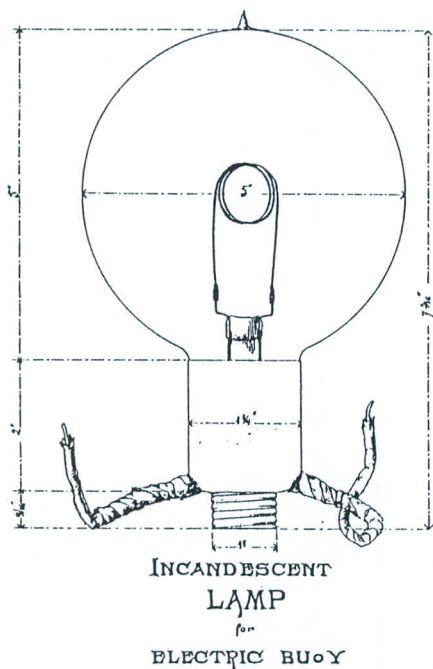


After some experimenting the system was successfully placed in operation on the night of July 1, 1893. The Service remarked in their annual report, "and they remained in brilliant and successful operation nightly during the continuance of the exposition."

Lcdr. West reported, "... As this length of submarine cable is the longest thur far used in the world for electric lighting, the experiments were watched with more than the usual interest by many electrical experts at the World's Fair.

"In view of the new conditions there presented in the field of electrical science, and of the widespread interest manifested, I would respectfully suggest that further experiments be conducted on or about October 10, next, with the present plant, care being taken by Government officers present that the cable is not subjected to undue strain. As the alternating current is the more elastic, and, in the opinion of many prominent experts, the current of the future ..."

In their annual Report to Congress the Lighthouse Board ended their description of the display, "The lighted fairway from Chicago to the World's Fair, through somewhat dangerous shoals, did away with all danger of accident by collision or running upon reefs. In fact, the channel was as well pointed out as the pathway in the streets."



By 1894 the Gedney Channel system had expanded to 11 buoys. But the same problems continued to occur: broken or worn cables, buoys struck by vessels and lamp filaments broken from shock. Each buoy lamp was extinguished an average of 51 nights of the year. The number of vessel transits had climbed to 851 and it was apparent that discontinuing this system would now be difficult, as mariners had come to rely on this lighted highway in the area.

Over the next few years the situation remained fairly stable. Outages still occurred due to allisions, anchors snaring cables, cables eroding or filaments breaking; but the service thought it imperative to maintain this system lighting the way into New York Harbor. The direct current plant was replaced by an alternating current plant; new, heavier cables were installed and different lamps tried.

On April 27, 1898, the system was extinguished after the Spanish Ameri-

can War started, as if the Spanish had the where-with-all to steam into New York Harbor. The system was relighted on September 1.

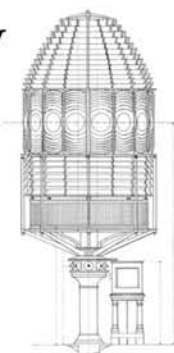
In 1905 improved gas buoys replaced the electric buoys of the Gedney Channel. The new buoys proved themselves to be far less expensive to maintain than the electric spar buoys. Although they were occasionally dragged off station by ice floes in the winter, they sustained little damage and often remained lighted. Then, too, there was no power plant to maintain on shore, nor cables to part or become tangled in an unwary mariner's anchor. It had been a noble experiment which, for a spell, provided the mariner with a lighted highway into New York Harbor.



The electric power house at Sandy Hook, NJ furnished the electricity for the Gedney's Channel buoys. Photo from the 1893 Lighthouse Board Annual Report to Congress.



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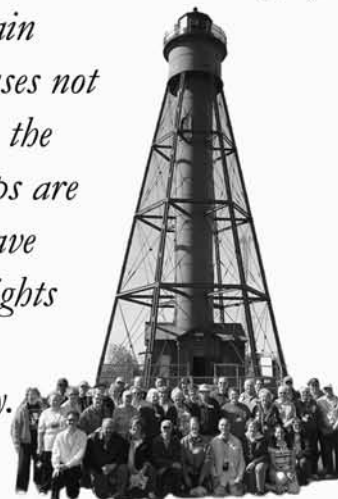
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