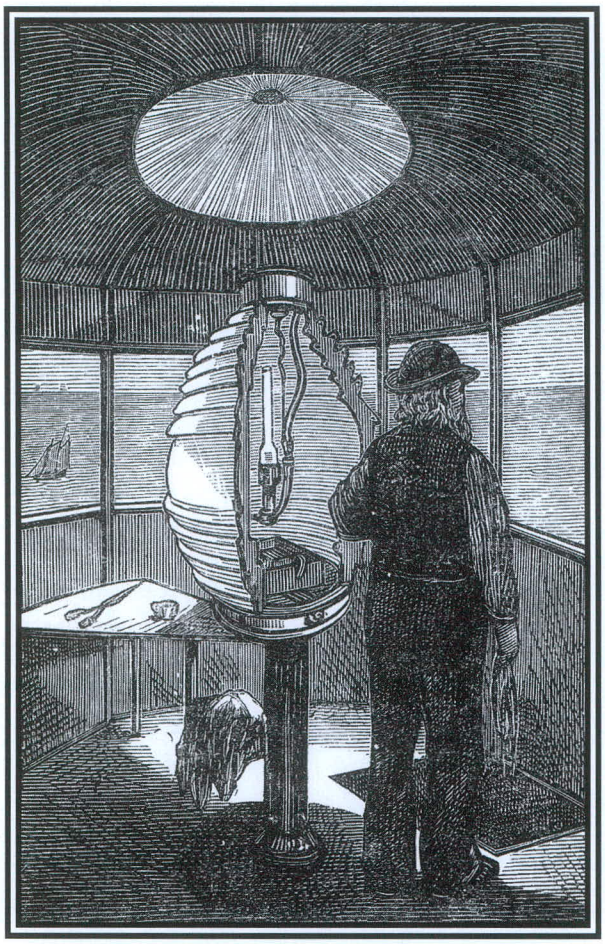
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Early American Lighthouse Illumination

By Thomas A. Tag

Most of the available lighthouse books contain some descriptions of the early lamps and other illumination equipment used in American lighthouses. Unfortunately, these descriptions are just that, a verbal description of objects that are very hard for the average reader to visualize. The goal of this article is to put some flesh on the bones and to give you, the reader, not only descriptions, but also photographs where possible and drawings when necessary of these early American forms of lighthouse illumination.

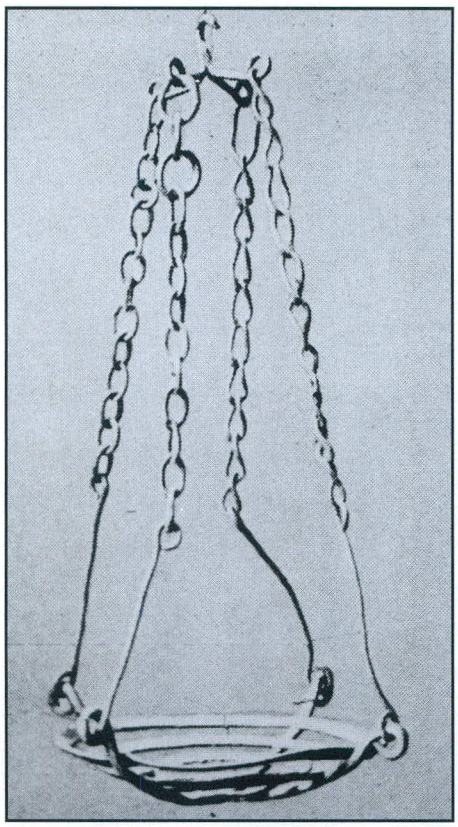
Various modes of illuminating apparatus were used to light American lighthouses over the years. As early as 1673, a pole beacon at Point Allerton, near Boston, was illuminated using "fier bales of pitch and ocum" {sic}, that were burned in open grates or fire baskets, raised to the top of the pole by rope and chain. Although the pole beacon could easily be seen from ships at sea, it was not designed for lighthouse purposes. It was meant to provide an early warning in case of an enemy attack.

The first lighthouse illumination in America came from tallow candles, which were used for several years in the first Boston lighthouse and in most other early 18th century American lights. The keepers usually made the candles on site. Oil lamps, imported or made by local artisans, soon followed. At this time, there were no standard types of lamps in use. However, most lamps had solid-rope wicks made of loosely braided cotton and a common oil reservoir that fed one or more wicks. These lamps initially burned fish oil, seal oil and later whale oil. They used no chimneys or reflectors, and produced a very poor light with some smoke and acrid fumes. As the years passed, three basic types of lamps began to be used: the Common Wick Channel Lamp, the Pan Lamp and the Bucket Lamp. All were sometimes called 'Spider Lamps.'

The Common Wick Channel Lamp, a very old design, was readily available in the early 1700's and probably was one of the first oil lamps used. This style of lamp had from one to eight or more thin, short wicks feeding from a common oil reservoir and for a number of years, various forms of it were used. The Common Wick Channel Lamp was actually designed for use in large rooms in homes, churches and public buildings. Its main disadvantages were its small reservoir for oil, the very poor quality of the light produced and the smoke and smell produced. The oil reservoirs varied in size, but generally held only enough oil for a few hours of use, not nearly enough for continuous use in a lighthouse. When hung from a chain high in a fairly large room, the fumes produced by this lamp were acceptable. But when used in the small-enclosed space of a lighthouse lantern, the smoke and acrid fumes became a problem.

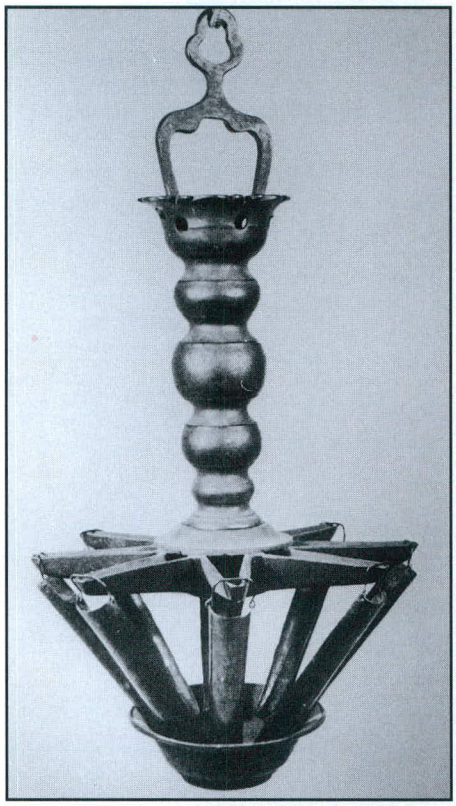
By the 1760's, the Pan Lamp replaced the Common Wick Channel Lamp in some lighthouses. The Sandy Hook lighthouse in New Jersey, built in 1764, is reported to have used two Pan Lamps with a total of 48 oil blazes, hung from the lantern room ceiling by chains. Pan Lamps came in several forms. There were circular and rectangular pans, and a donut-shaped Pan Lamp was used in the early lightships. Pan Lamps with a circular form were also known as Compass Lamps.

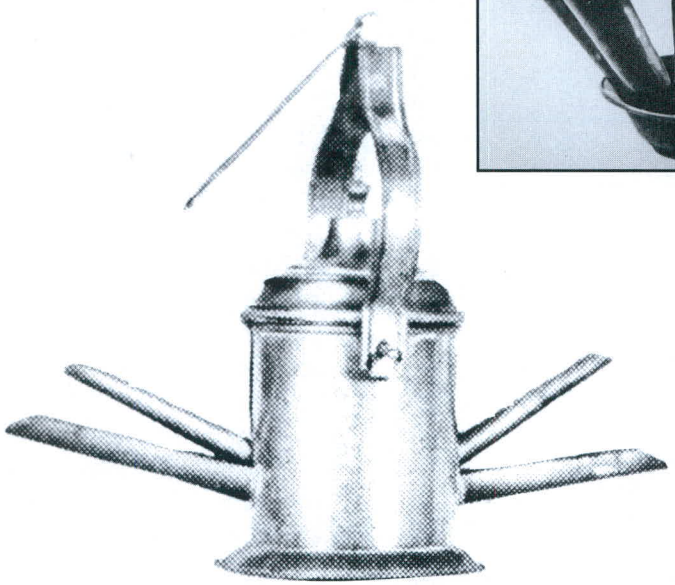
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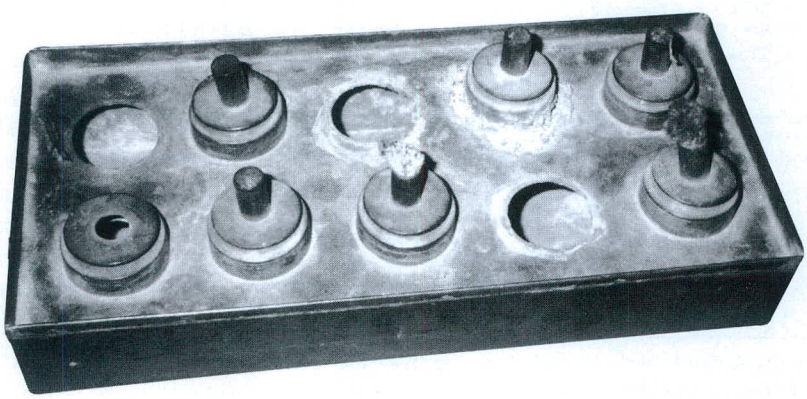


Left — One style of an early fire basket made from wrought iron.

Below — The common eight wick channel lamp. Wicks were placed in the arms that radiate out from the oil cup at bottom. Both illustrations from the author's collection.







The Pan Lamp solved the problem of a limited oil supply and could operate for twelve or more hours on one fill of oil. The Pan Lamp, like the Common Wick Channel Lamp, had multiple rope wicks. The number of wicks varied from two to as many as twenty-four, with eight to ten wicks being very common. The Pan Lamp produced more light than the Common Wick Channel Lamp because individual large diameter wicks were placed nearly side by side across the surface of the metal pan, and the flames could all be seen at the same time. Its main drawbacks were still its relatively low light output, its massive consumption of oil, and the smoke and fumes produced within the lantern room, which at times became almost intolerable.

Pan Lamps were used for a very long time. The early light lists show a Compass Lamp with eight wicks still in use at the Vermilion beacon light in Ohio in 1849. Compass Pan Lamps were the only style of lamp in use on American lightships until the mid 1850's.

The Bucket Lamp had been available for many years and began to be used in lighthouses in the latter part of the 1700's, mainly in the smaller lighthouses, beacon and pier-head lights. The Bucket Lamp was made of sheet metal and was cylindrical in shape, with two or four spouts protruding from its sides. Each spout carried a large diameter rope wick that extended down inside the body of the lamp into the oil. Below each spout was a similarly shaped drip catcher. The Bucket Lamp held up to an eight quart oil supply and could operate for twelve or more hours on one fill of oil. Its main drawbacks were still the very poor light produced, the smoke and fumes, and the problem that some of the flames were hidden from view behind the bucket when it was viewed from specific directions. The Cape Henry light used this style lamp in 1792 and burned fish oil, probably from herring. The use of Bucket Lamps lasted a long time and four were recorded as being in use in 1845 at the Cunningham Creek Beacon light in Ohio.

Above Left — A two-wick bucket lamp. Photo from the author's collection.

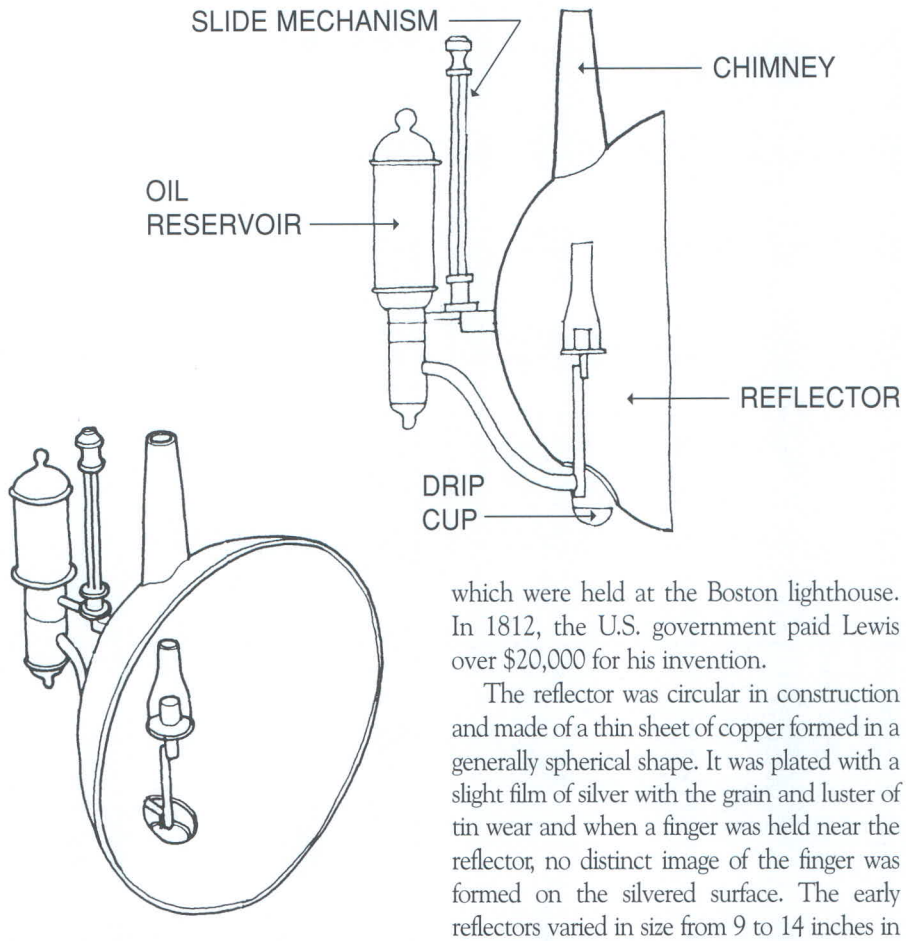
Left — A ten wick pan lamp, missing some parts. This relic is part of the Shore Village collection in Rockland, ME. Photo courtesy of the Shore Village Museum.

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The Argand Lamp

In 1782, Francois-Pierre Ami Argand (1750-1803), a Swiss born physicist living in France, invented the double draft burner, which became known as the Argand oil lamp. Argand's design used two thin metal tubes with one set inside the other. The wick was placed between these tubes and was thus formed into a long hollow cylinder. Air was placed allowed to enter the center of the wick through holes placed in the oil drip-cup attached to the bottom of the wick tubes. Air was also allowed to enter around the outside of the outer wick tube, through holes in the bottom of the chimney holder. Argand's design provided much more oxygen to the flame, more efficient fuel combustion and a much brighter light. Argand also invented the use of a chimney, which helped to provide additional airflow over the wick and protected the flame from outside air currents which could make it flicker.

In 1787, another Frenchman, Monsieur Lange, invented the constricted chimney, which Argand quickly added to his design. The constricted chimney forced the outside air closer to the flame. This action further improved the combustion of the fuel, giving a still brighter flame, which was measured at about seven candle power.



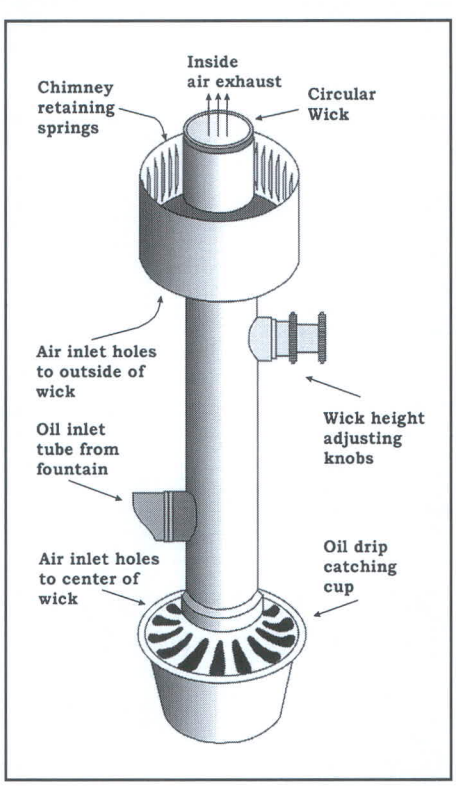
Above — The Argand lamp and parabolic reflector.

The Original Winslow Lewis Design

In 1810, Winslow Lewis, a sea captain who confessed that he knew nothing about lighthouse optics, patented what he called a "magnifying and reflecting lantern" for lighthouse work. His design included a lamp, a reflector and a magnifier.

Winslow was variously characterized by his associates. Some said he provided extraordinary services to his country through his inventions, lighthouse construction and through his efforts in the maintenance of the lighthouses. Others called him an incompetent scoundrel who appropriated many of his inventions from others, produced shoddy construction of lighthouses and minimized any effort or expenditure related to lighthouse maintenance and improvements.

The Winslow Lewis design was crude, but he succeeded in impressing the government through actual trials of the design's performance and low oil consumption,



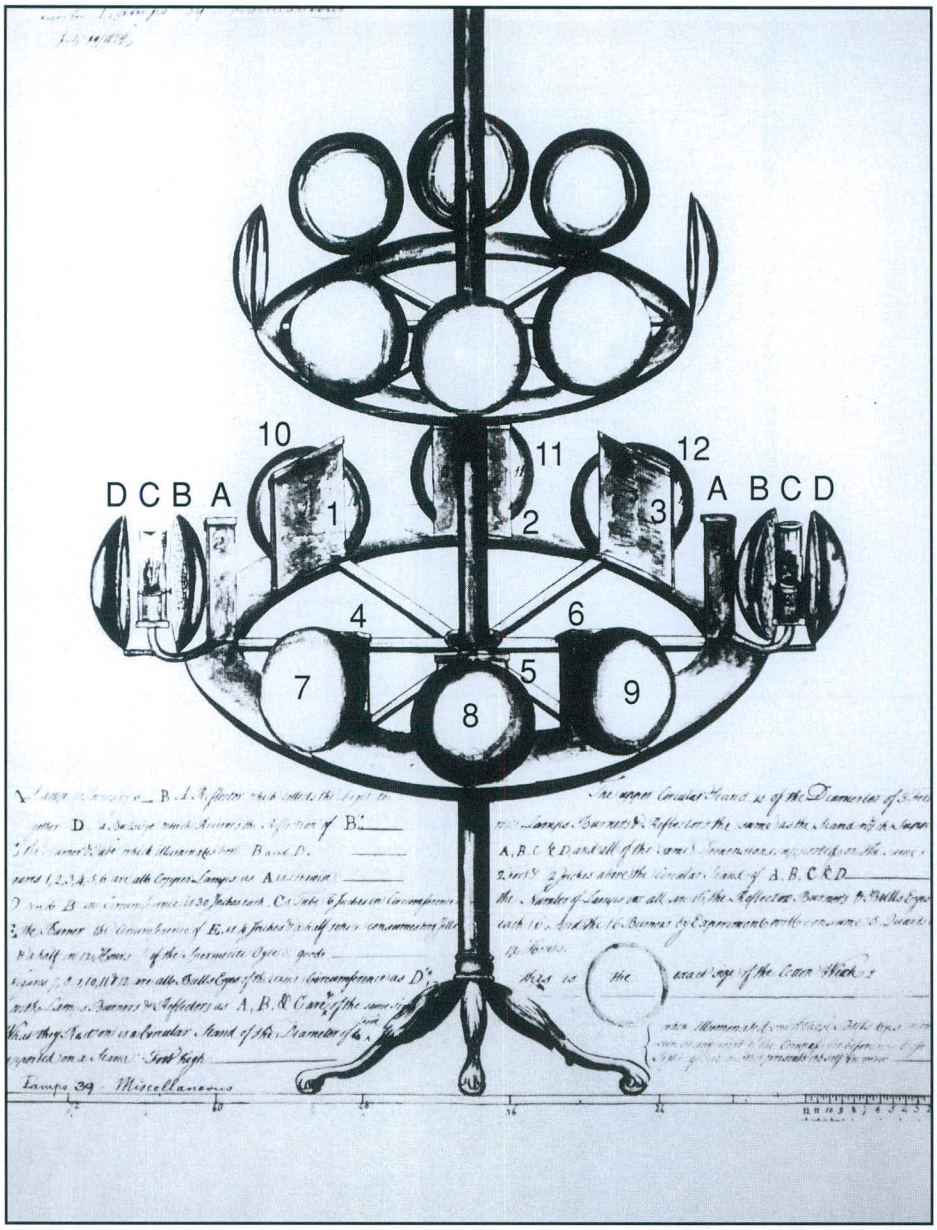
A typical Argand Lamp Burner. Drawing by Author from a Lighthouse Board Drawing.

which were held at the Boston lighthouse. In 1812, the U.S. government paid Lewis over $20,000 for his invention.

The reflector was circular in construction and made of a thin sheet of copper formed in a generally spherical shape. It was plated with a slight film of silver with the grain and luster of tin wear and when a finger was held near the reflector, no distinct image of the finger was formed on the silvered surface. The early reflectors varied in size from 9 to 14 inches in diameter. The larger reflectors were so flimsy that when they were mounted on their wrought iron frame they were sometimes compressed significantly, altering their form and making their reflection capabilities still worse. In early models, the reflector was attached to the front of the oil reservoir and in most cases was set too far from the flame. Therefore the flame was not in the focus of the reflector. A spherical reflector returns the rays of light back upon the flame and it is normal for 50% of the reflected light to be lost in passing through the flame. By accident, the Winslow Lewis design where the flame was too far forward of the reflector focus actually helped to allow more of the reflected light to be used.

The magnifier was made of a cast and polished, plano-convex, semi-transparent glass mass, 9 inches in diameter. Early models were 4 inches in thickness while later models were 2-1/2 inches; all were made of bottle-green glass. The glass was of such poor quality and the basic design placed the lamp so far out of the focus of the lens that the lens was nearly useless. It was said that, "It made a bad light worse." The distance from the back edge of the lens to the center of the flame varied considerably, from about 9 inches to as little as

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Because the writing on patent drawing is very small and difficult to read it has been reproduced below:

A: Lamp 10 inches by 6.

B: A Reflector which collects the light together.

D: A Bulls Eye which receives the reflection of B.

C: The Burner and Tube which illuminates both B and D.

Figures 1,2,3,4,5,6 are all Copper Lamps as A is likewise.

D and B in Circumference is 30 inches each. (Ed: 9.5-inch diameter)

C: A Tube 6 inches in circumference. (Ed: 1.9-inch diameter)

E: The Burner — the circumference of E is 4 inches and a half (Ed: 1.4 inch diameter) which consumes two Gills and a half in 12 hours if the Spermeciti Oyl {sic} be good.

5-1/4 inches. The magnifying lens was only used in association with the nine-inch reflector and was abandoned starting in 1828. Most were gone by 1838, and the last magnifier was removed from the Faulkner's Island Lighthouse in 1840.

The lamp in Lewis' design was a crudely built Argand style lamp with a three-quarter inch burner. The original lamp also used a short glass chimney and a simple woven-cotton lamp wick, which was poorly made, and resulted in inefficient fuel usage.

It was thought that all copies of the drawings for the Winslow Lewis patent were destroyed, and that no physical examples existed of any part of the Winslow Lewis illumination equipment. A few written descriptions exist, some of which have been used above, but these descriptions had previously only been converted into very crude drawings of just some parts of the Winslow Lewis design. Fortunately, a copy of the patent drawings was located and an actual 9-inch lens was found. In addition, several more detailed drawings of the Winslow Lewis design have been created from the written descriptions along with various patent drawings and through observation and photographs of the 9-inch lens.

(Regarding drawing at left) Figures 7, 8, 9, 10, 11 and 12 are all Bull's Eyes of the same circumference as D's, with Lamps, Burners and Reflectors as A, B, and C are and of the same size. What they rest on is a Circular Frame of the diameter of 4 feet supported on a stand 3-foot high.

The upper Circular Stand is of the diameter of 3 feet with Lamps, Burners and Reflectors the same as the stand which supports A, B, C and D, and all of the same dimensions supported on the same stand 2 feet and 2 inches above the Circular Stand of A, B, C and D.

The Number of Lamps in all are 16, the Reflectors, Burners and Bull's Eyes are each 16, and the 16 Burners by experiment will consume 5 quarts in 12 hours.

This is the exact size of the Cotton Wick. (Ed: 3/4-inch diameter)



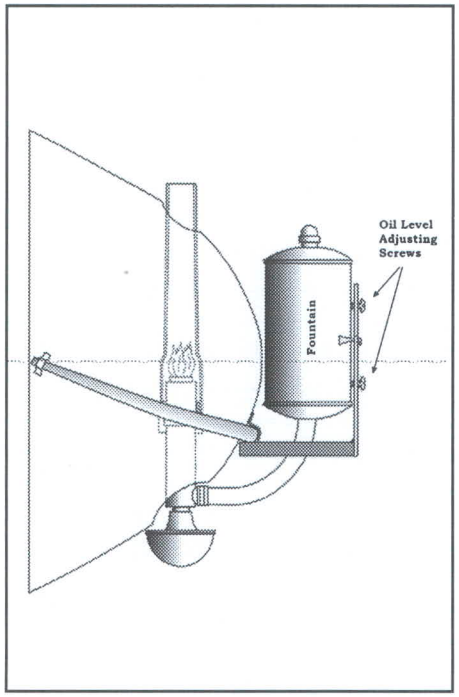
When illuminated, one of these Bull's Eyes may be seen at any point of the compass. Before you lose sight of one, another presents itself in view.

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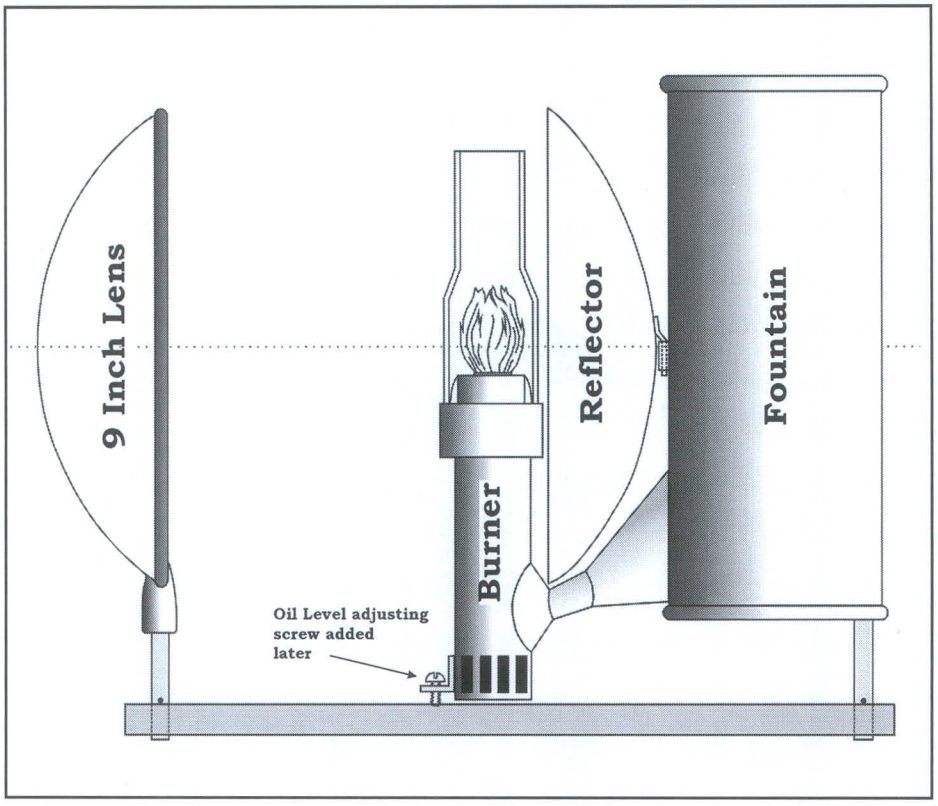
The original description and drawings of the Winslow Lewis patent were destroyed in a fire at the Patent Bureau on December 15, 1836. It was reported that 5th Auditor, Stephen Pleasonton, did not keep a copy of the patent drawing. However, the drawing shown on the previous page was found in the collection of the Smithsonian Institution. Its original source is unknown, but was probably from one of the copies often furnished by the Patent Bureau for examination or litigation. The drawing was made on paper that was dated to 1796, and there are good indications that it is a copy of the actual patent drawing for Patent 1305.

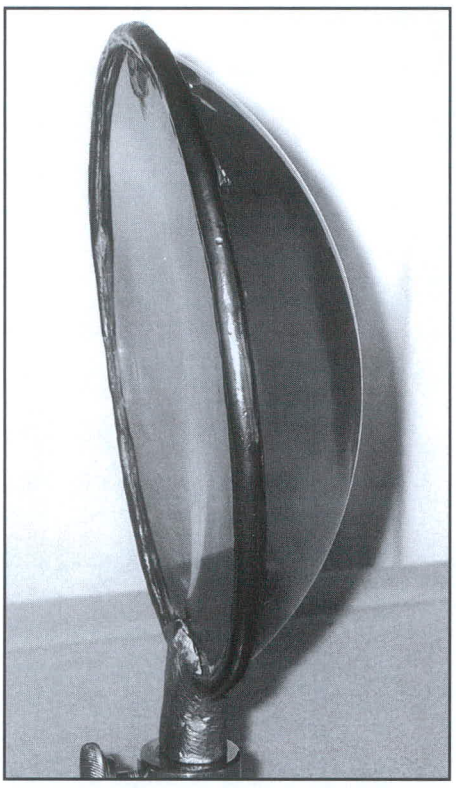
The original patent drawing varied somewhat from the actual design that was produced. In the production design, shown at right, the magnifying lens is held by a copper ring and is attached to a hard copper 3/8-inch square shaft. This shaft fit into a square hole in the chandelier and was held in proper vertical height by a metal pin that fit through the shaft. The lamp was mounted in the same fashion, and its oil level was adjusted by tipping the lamp forward and backward. This tipping was accomplished by placing wooden shims under the lamp burner and later by the addition of an oil level adjusting screw.

The lamps with larger reflectors were mounted differently and had oil level adjusting screws on the chandelier in a mounting plate behind the lamp fountain, as shown below.



Left — Winslow Lewis – Benjamin Hemmenway Lamp and Reflector in Chandelier mounting, circa 1834-1844. Drawing by author from Patent 3692, and descriptions in 25th Congress, 3rd Session, Doc. 24, pp. 46 and 27th Congress, 3rd Session, Doc. 183, pp. 42, 44. Note: this drawing is based mostly on verbal descriptions and may not reflect the exact design.





Above — Winslow Lewis Lamp, 9-inch Reflector and 9-inch Lens, circa 1810-1818. Drawing by author from descriptions in patent drawings 1305 and 2901-X, in 25th Congress, 3rd Session, Doc. 24, pp. 22, 37-39 and from an actual lens assembly.

Left — An original Winslow Lewis 9-inch lens made circa 1818. Photograph from author's collection of the Lens at the Buffalo and Erie County Historical Society.

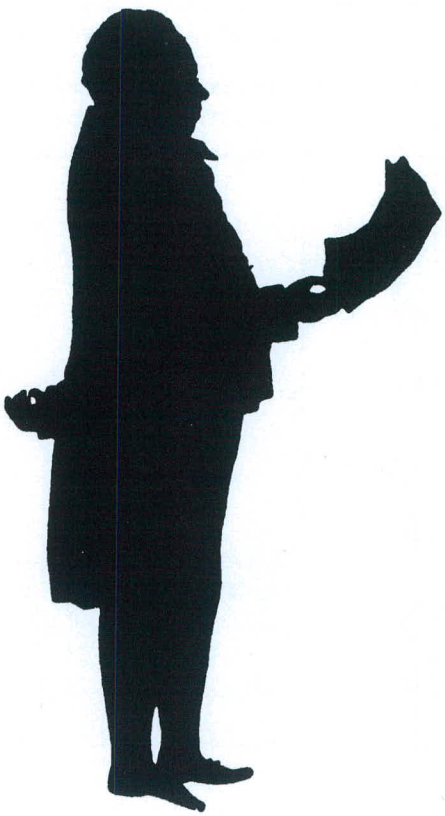
Winslow also proposed the use of tin oil butts to store the lamp oil for each lighthouse. The oil butts were made of tinned iron, painted thoroughly, and came in two sizes of 15- and 90-gallon capacity. They were a major improvement over the wooden casks formerly used, and were said by the Lighthouse Board to be; "an economical method of keeping the oil, and losses from leaks rarely occur." They were one of the few items Winslow Lewis supplied that were well made.

Nearly all of the American lighthouses from 1812 to 1840 used the Winslow Lewis reflector and lamp design, and most continued to use the design until about 1858. Winslow Lewis also reported that he supplied the first reflector lamps for lighthouses used in Denmark and in Nova Scotia.

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Some of the charges in the Report of I.W.P. Lewis of February 24, 1843

I.W.P. Lewis was a nephew of Winslow who was asked to make a survey of the American lighthouses on the New England coast by the Treasury Department in 1842. His scathing report caused quite a political stir in Washington and contributed to the establishment of the Lighthouse Board ten years later.



Some of the charges made by I.W.P. Lewis describe the Winslow Lewis design and its origins as follows: "In 1812 our Government purchased, at the price of $20,000, a patent right for illuminating their lighthouses, which patent was styled 'magnifying and reflecting lantern' . . . and was a rough copy of the English method then in use. It is believed to have been copied from the apparatus at the South Stack lighthouse, of Holyhead, in the Irish channel, the patentee having visited that establishment in 1809, soon after its being put into operation. Although a patent was granted for this apparatus, (the original type of which is herein traced back to the year 1784, and was the combined invention of Argand and De Borda) yet it would seem, from the style of the patent, that the claim was made for some peculiar magnifying and reflecting property of the lanterns. However this may be, the simple fact of concealing the lamps from view behind a lens of green bottle glass, four inches thick through the axis, implies entire ignorance of the properties of artificial light, as well as of its refraction. It is but a few years since these bull's eyes (for, to call them lenses is a misnomer) were removed from our lighthouses . . . It has been publicly asserted, (by the favored individual who rejoices in the title of patentee of this branch of industry) that lighthouse reflectors are not optical instruments, nor in any way connected with that science; and certainly this assertion is most fully corroborated, so far as the American lighthouse establishment is concerned; for, among the more than seven hundred specimens measured during this inspection, it would be slanderous to say that any one of the number claimed relation with science, and but little with art."

Response to the Report of I.W.P. Lewis by Winslow Lewis of April 14, 1843

Winslow had to defend his reputation and responded to I.W.P. Lewis' assertions as follows: "In 1807, I first commenced my experiments in illuminating lighthouses. The first exhibition was in the cupola of the State House, all subsequent to that were in Boston lighthouse. In June, 1810, I took out my patent. In July, I fitted up and lighted with my lamps and reflectors one of Thatcher's Island lighthouses. In September following, I went to England, not in 1809, nor until after I had taken out my patent, fitted up and lighted one of Cape Ann lighthouses on my plan. To show what I did at that early period, I annex the following, taken from the public documents, and records of Congress, which prove, that the light I produced at that period, could be seen as far, if not farther than any light produced since, notwithstanding the ridicule of I.W.P.L., with his bull's eyes."

Captain R.R. Crocker, in his letter dated December 24, 1837, confirmed that Winslow Lewis took the design of the lantern and reflectors from the South Stack light in Holyhead, England. In a letter dated January 9, 1838, Winslow Lewis also confirmed that he knew that the English used reflectors at Holyhead in 1810, although he always claimed he did not know until after he filed for his patent. Lewis also admitted that he commanded a ship in the Boston to Liverpool trade from 1796 to 1808. In this route he would have visited several of the ports in England, then using reflectors and lamps in lighthouses.

The Winslow Lewis Argand lamps burned whale oil which came in two styles, a summer strained oil that was thicker and cheaper, but worked well in the summer months, and a winter strained oil that was further refined and more expensive. There was a problem with the oil congealing into a nearly solid mass in weather below about 35 degrees, even when using winter strained oil.

In order to prevent the oil from congealing in cold weather, the keeper was required to maintain a warming stove in the lantern room during the winter months. In addition, a copper tube was added with a tunnel mouth over the chimney of the lamp. The source of this invention was hotly disputed. David Melville claimed that he invented the principal of the heating tube in 1817 and had told Winslow Lewis about it. Winslow Lewis claimed he alone invented the oil heater. We will leave it to the reader to decide whose claim is correct. The following specification was written and notarized by David Melville in 1817. Winslow Lewis wrote the patent description in 1818. The only significant difference appears to be the use of the word "tunnel" vs. "funnel."

David Melville Oil Heater, description March 7, 1817

"Specification of a new and useful improvement made by the subscriber in the lamp known by the name of Argand's Lamp, for lighthouses, manufactories, stores, &c. the object of which improvement is to obviate the difficulty of keeping the oil in a fluid state in the winter season, in exposed situations, so that summer strained oil may be burned in the coldest weather without difficulty.

The principle of the improvement is to communicate heat to the oil in the fountain of Argand's lamps, from the flame of the same lamp; which he has ascertained can be effected in several ways with great facility.

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1st by a tube of copper or other metal with a trumpet formed, or funnel mouth being inverted over the flame of the lamp (above the tube glass if one is used) and the tube connected with it, passing in at the top of the fountain of the lamp, extending nearly to the bottom, and passing out again at the top: the heat of the flame will pass in at the funnel end, and through the tube in the fountain and off at the other end. The heat communicated by this means to the oil in the fountain, will keep it in a fluid state in the coldest weather, and in the most exposed situations, to such a degree that summer strained oil may be used in the winter season without difficulty."

Description for Patent Number 2901-X, January 23, 1818

Letters Patent

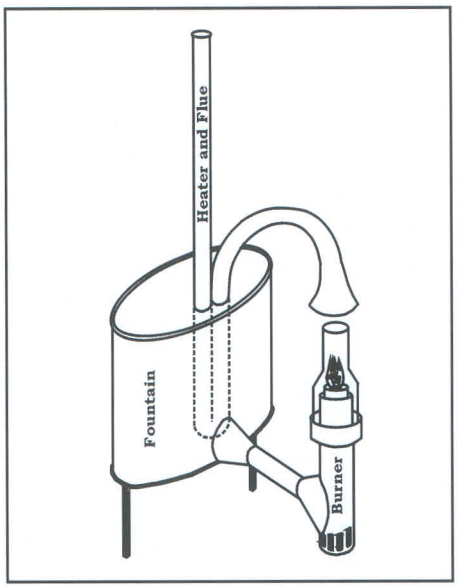
The schedule referred to in these Letters Patent and making part of the same sustaining a description in the words of the said Winslow Lewis himself for his improvement in Lamps.

As I make use of the common Argand Lamp I need not here describe it. My improvement consists of a copper or any other metal tube, with a tunnel mouth, which is placed over the chimney of the Lamp. It then passes through the top of the fountain to the bottom and then is turned up and is led back through the top of the fountain. The heat and smoke passing into the tunnel end will go through the tube and are led off at the other end through the fountain. The heat of the blaze thus passing through the oil in the fountain will keep it tepid or warm in the coldest weather, by which means summer strained oil, will possess every advantage of winter strained. This mode of warming the oil I claim as my peculiar improvement and for which I desire my patent.

Witness

Wm. Elliott
J.M. Varnum *Winslow Lewis*

The last lighthouse to use the Winslow Lewis 9-inch reflector, without a lens, was located at Warwick Neck, Rhode Island, and the last 9-inch lens was removed from Faulkner's Island light.



Left — Winslow Lewis Patent Number 2901-X. Drawing by author from patent drawing.

Below — The Warwick Neck Lighthouse in Rhode Island. U.S. Lighthouse Society photo.



Reflector Sizes produced by Winslow Lewis and his suppliers

SIZE	STYLE	SOURCE
9 inch	Most with 9 inch lens, Spherical	Light List 1839
10 inch	No lens, Parabolic from die	Light List 1854
12 inch	No lens, Parabolic from die	Light List 1854
13 inch	No lens, Spherical until 1835	Light List 1839
14 inch	No lens, Spherical until 1835	Light List 1839
15 inch	No lens, nearly Parabolic	Light List 1839
16 inch	No lens, nearly Parabolic	Light List 1839
16 3/4 inch	No lens, Parabolic from die	Light List 1849
18 inch	No lens, nearly Parabolic	Light List 1839
21 inch	No lens, Parabolic from die	Light List 1849

Note: When the lights were inspected and the diameter of the reflectors were actually measured, they often varied from the stated diameters by up to 1/2 inch.

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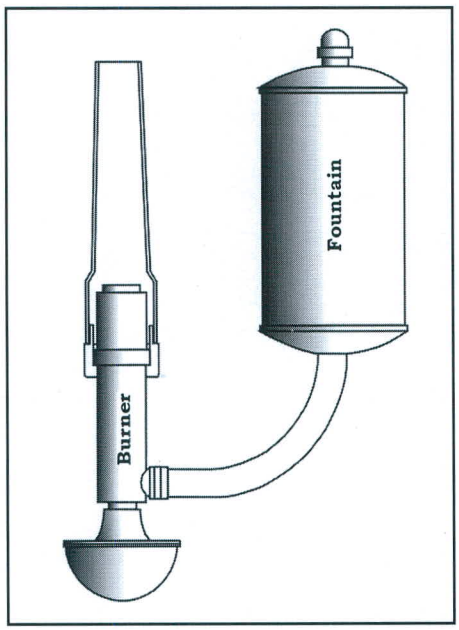
Other Lamps in use in the early 1800's

There were other styles of lamps being used in small beacon lights and for pier-head pole lights during the early 1800's. The wooden lantern shown right was used at a Rhode Island pier-head, and used a small flat wick oil lamp. The lamp was probably made locally. As stated before, Pan Lamps and Bucket Lamps continued to be used in many of the smaller lights until the early 1850's.

Winslow Lewis' later improved designs

Reflectors

Winslow Lewis converted from a basically spherical design to a nearly parabolic design in 1835, and Benjamin Hemmenway, a coppersmith and manufacturer of lamps, began making all of the lamps for Lewis. In 1840, Lewis had an iron die made based on a true parabolic form with a three-inch focus. This die was used to produce reflectors from that time forward. In 1842, the die was checked by R.H. Eddy, Civil Engineer, and reported by him as follows: "I find it corresponds as nearly to a paraboloid of three-inch focal distance as I believe it possible to be mechanically produced."



Patent drawing for Patent Number 3692, August 7, 1844. Drawing by author from original patent drawing.

The very small 9-inch reflectors were mounted behind the lamp, with the lamp being out of the reflector's focus (see drawing at top of page 20). The mid-sized reflectors were designed with the lamp at or near the focus of the reflector. This required the reflector to have cut out scallops at the top and bottom edges, to allow for the correct placement of the lamp and chimney. The larger reflectors were also designed with the lamp at or near the focus of the reflector and required the reflector to have holes in the top and bottom to accommodate the lamp and chimney (see drawing at bottom of page 20).

In 1839, the Henry N. Hooper Co. of Boston began building parabolic reflectors and lamps that were exact copies of the then current English reflector design. They were installed in several lighthouses by I.W.P. Lewis, but were not accepted for general use. Later, about 1843, the Hooper & Co. reflectors and lamps began to be used in additional lighthouse locations.

The Hooper & Co. reflectors and lamps were a significant competitive challenge to Winslow's design. Winslow reacted to their initial development by obtaining the iron die to improve his reflectors and by 1844 Winslow and Hemmenway significantly improved their lamp design as well (see bottom left).

By 1850, only the 14-, 15-, 16- and 21-inch reflectors were still in production. The 16- and 21-inch sizes were used for new installations. The 14- and 15-inch sizes were used mostly for repair purposes. Benjamin Hemmenway continued to supply most of the lamps and reflectors used by the Lighthouse Service into the 1850's.

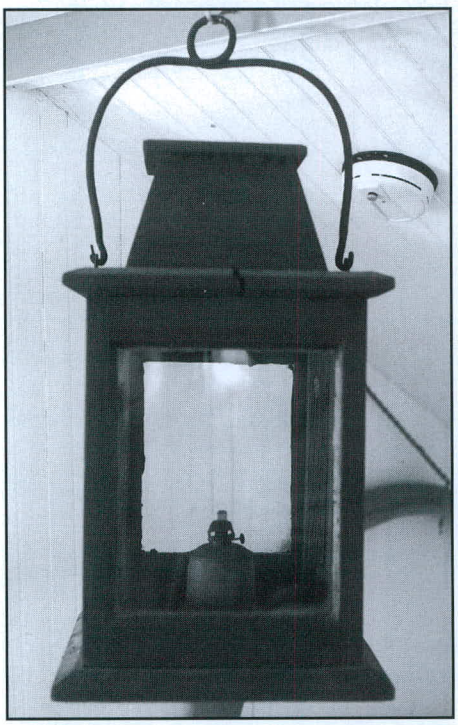
Winslow specified that the reflectors were to be polished with Tripoli Powder. It was later found that Tripoli Powder was too abrasive and quickly wore the silvered surface away. However, Winslow refused to change to a better polish because of the cost. In 1852, the Lighthouse Board finally outlawed the use of Tripoli Powder.

Chimneys

The glass chimneys were the most defective of the supplies provided by Winslow Lewis. They were irregular in shape, size, length and thickness. The original lamp used a short glass chimney, and several sizes of chimneys were later used. The New England Glass Co. made most of the chimneys for Lewis. Sometimes the chimney supplied was too short for the larger sizes of reflectors. The use of a short chimney caused smoke and soot to collect around the upper chimney hole in these reflectors. George Bache, U.S. Navy, reported that the reflector surface could be injured "by the friction required to free it from lamp black deposited owing to the shortness of the tube glasses." If the chimneys were irregular in shape, the flame often came nearer to one side than the other, causing unequal heat, and consequent breakage. If they were unequally thick, they again were not uniformly heated by the flame and were often cracked or broken.

Winslow Lewis and Benjamin Hemmenway Lighthouse Lamp, Patent Number 3692, August 7, 1844

This design was produced to further answer the competitive challenge from Hooper & Co. In this design, the burner tube was attached to the fuel tube extending from the oil-fountain by a threaded coupling. This allowed the burner tube to be easily removed for cleaning or replacement. A second change involved the use of an easily replaceable iron thimble at the top of the wick tube. This design allowed easier cleaning and periodic replacement. Winslow Lewis had long been faulted for not using a silver tipped



Pier-head pole lantern circa 1820. Photograph from author's collection.

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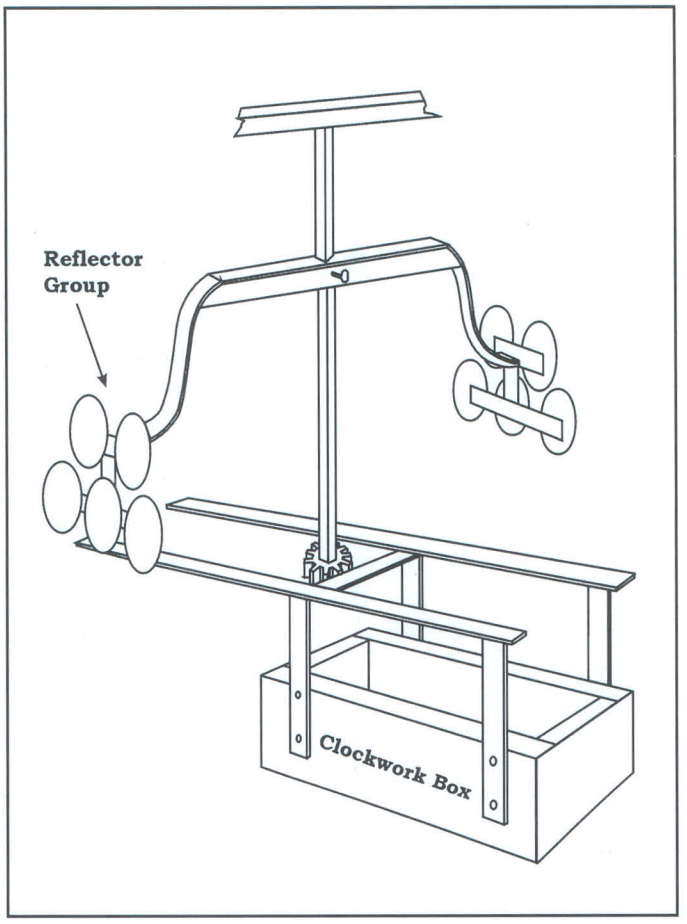
burner tube as was commonly used in European lighthouses, and the new iron thimble design was supposed to resolve the problem. The burner was not silver tipped because of the cost and according to Stephen Pleasonton, who headed the Lighthouse Service for the Treasury Department, "An experiment was made with burners tipped with silver, and found not to answer." The third change involved an improvement in the design of the chimney holder that allowed the metal wick holder tube to be turned for adjustment without effecting the chimney.

Winslow Lewis Lamp Chandeliers

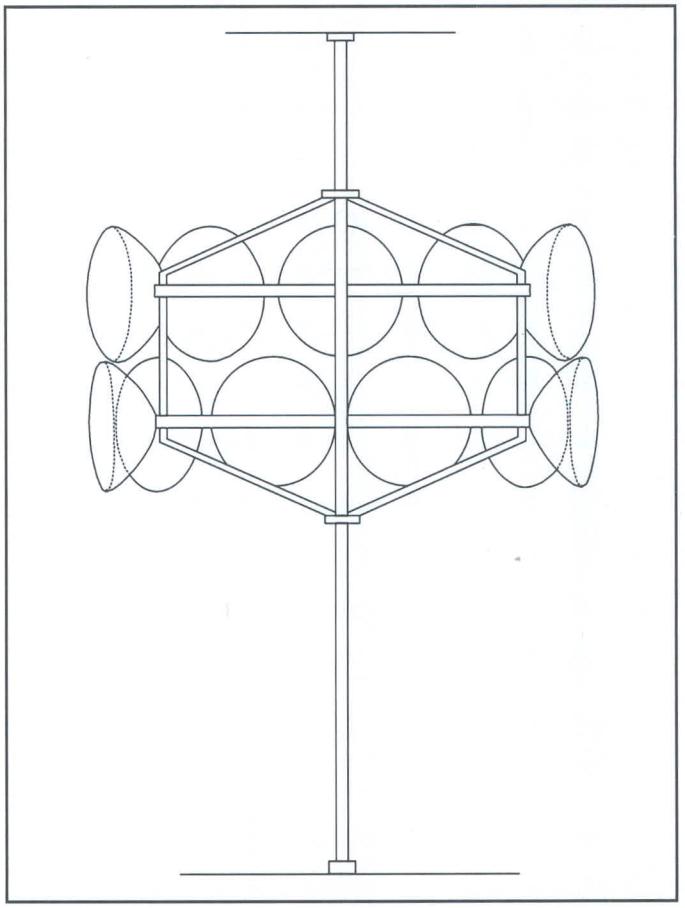
The lantern rooms were so small that the keepers had great difficulty walking between the chandelier and the outside windows. The fixed and revolving chandeliers were both capable of being rotated, to allow the keeper to stand in the doorway of the lantern room and turn the chandelier to bring each lamp to him for filling and cleaning. The keeper often failed to return the fixed chandelier to its correct position and sometimes one or more reflectors were left facing the land or the lantern room door.

Clockworks for rotation of the Lamp Chandelier

Winslow Lewis contracted with Simon Willard, a famous Boston clock maker, to build all of the rotation machinery he used for his rotating lights. Simon Willard built a total of about 40 clockworks for Lewis' revolving lights. He continued to make the clockworks until 1839 when he retired. In the period from 1839 through 1850, Benjamin F. Willard, Simon's son, continued to provide and repair the clockworks. The early clockwork was described as follows: "The lighting apparatus consists of ten lamps, with the same number of parabolic reflectors and plano-convex lenses, supported upon two copper tables, which have the machinery for producing their revolutions attached. The lamps are divided into two clusters, and are so arranged upon the tables that each cluster of five lamps will display its light for a certain period during each revolution.

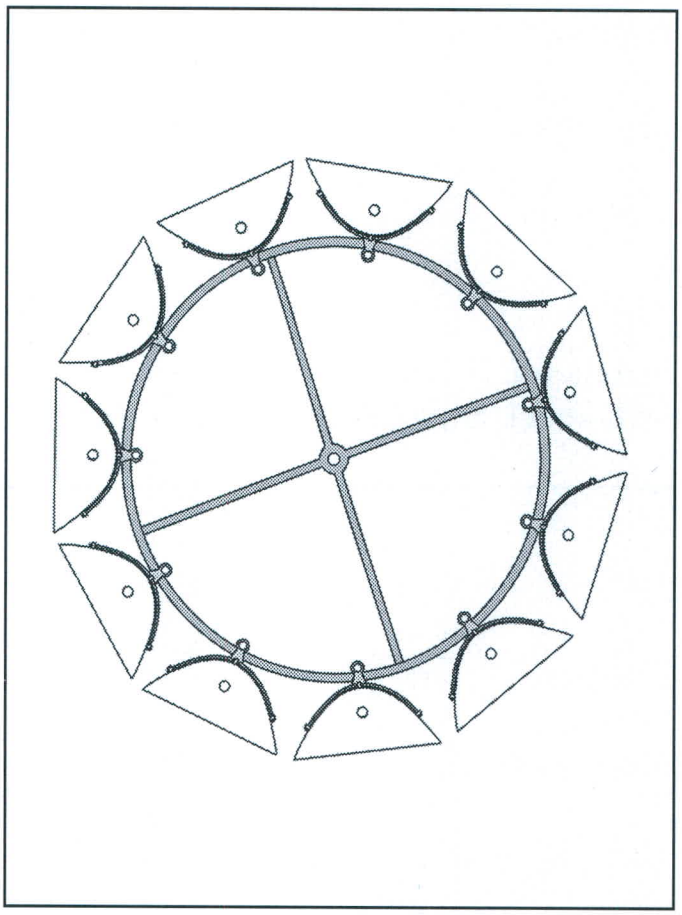


Revolving Lamp Chandelier, Small Model with two groups of five reflectors and clockwork box. See Patent 1085, February 20, 1839. Drawing by author.

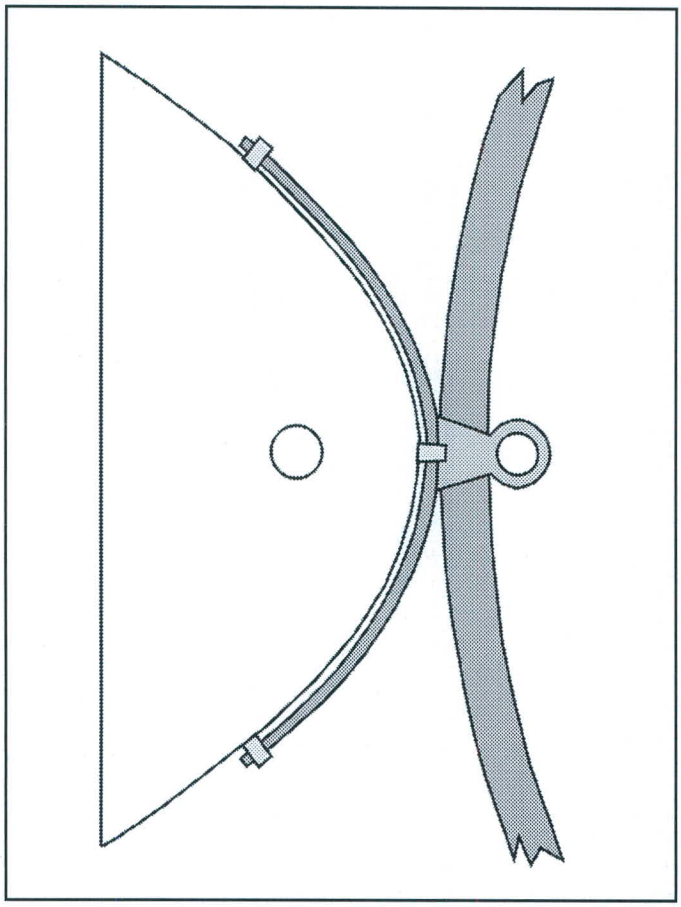


Fixed Lamp Chandelier using 21-inch diameter reflectors with 3 3/4-inch focal length. Designed for use at Carysfort Reef Light, circa 1849. Drawing by author.

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Chandelier with 21-inch Reflectors and attachment to the frame. Proposed for use at Carysfort Reef in 1848. Drawing by author.



21-inch Reflectors showing attachment to the Chandelier frame. Proposed for use at Carysfort Reef in 1848. Drawing by author.

The motive power of the machinery is a weight of 228 pounds, attached to a rope which is wound over a horizontal barrel; this barrel is connected with a spindle by means of a wheel and pinion, and upon the spindle the tables are placed: motion is in this manner communicated to the tables, and it is regulated by the revolution of a series of vanes, which are connected with the spindle by means of horizontal wheels and pinions.

The clockwork itself was a high quality design made by an expert clockmaker. However, in typical Winslow Lewis fashion, the chandelier frame and pivot shaft with its bearings and drive gears were of poor quality, as attested to in the following description:

W.J. Grayson, the Superintendent of Lights for the Charleston District, reported in 1843 on the new chandelier rotation mechanism installed at the Charleston light as follows. "The new clock, furnished by Mr. Lewis, has not performed well. The frame containing the lamps rests and revolves on a spindle, resting on a metal plate; and it wears so rapidly, as to embarrass the movement of the light. I will endeavor to attach so much of the old clock to the new, as to remedy the defect."

Attachment of the Reflectors to the Chandelier

In the original Winslow Lewis design, the reflectors had a hook soldered to the back that slid down into a bracket attached to the front of the fountain of the lamp (see drawing). The lamp also had two metal shafts projecting downward that fit into two holes in the circular chandelier tables.

By the 1840's, chandelier designs were more complex. Stephen Pleasonton stated that, "the lamps and reflectors are attached to the chandeliers by rings and solid yokes, made to the proper dimensions for perfect adjustment with screws, &c., and provided with catches or slots to prevent the keeper from losing the adjustment."

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After the Lighthouse Board took over in 1852, the design was further improved with a one-inch rack and pinion burner, rod heater and by using still more accurate parabolic reflectors. The mounting to the Chandelier was also improved. One thumbscrew was used to firmly attach both the lamp and the reflector to the Chandelier. This design was used by the Lighthouse Board beginning about 1860 for channel, range and beacon lights, and continued to be used into the early 1900's.

Winslow Lewis Lighthouse Lanterns

Winslow Lewis also designed the lighthouse lanterns to house his illumination equipment. The basic design was again copied from an early English model. The Lewis lantern typically used small window panes of 10 by 12 inches and usually had special outrigger bracing from the sides of the lantern to the edge of the lantern gallery and railing.

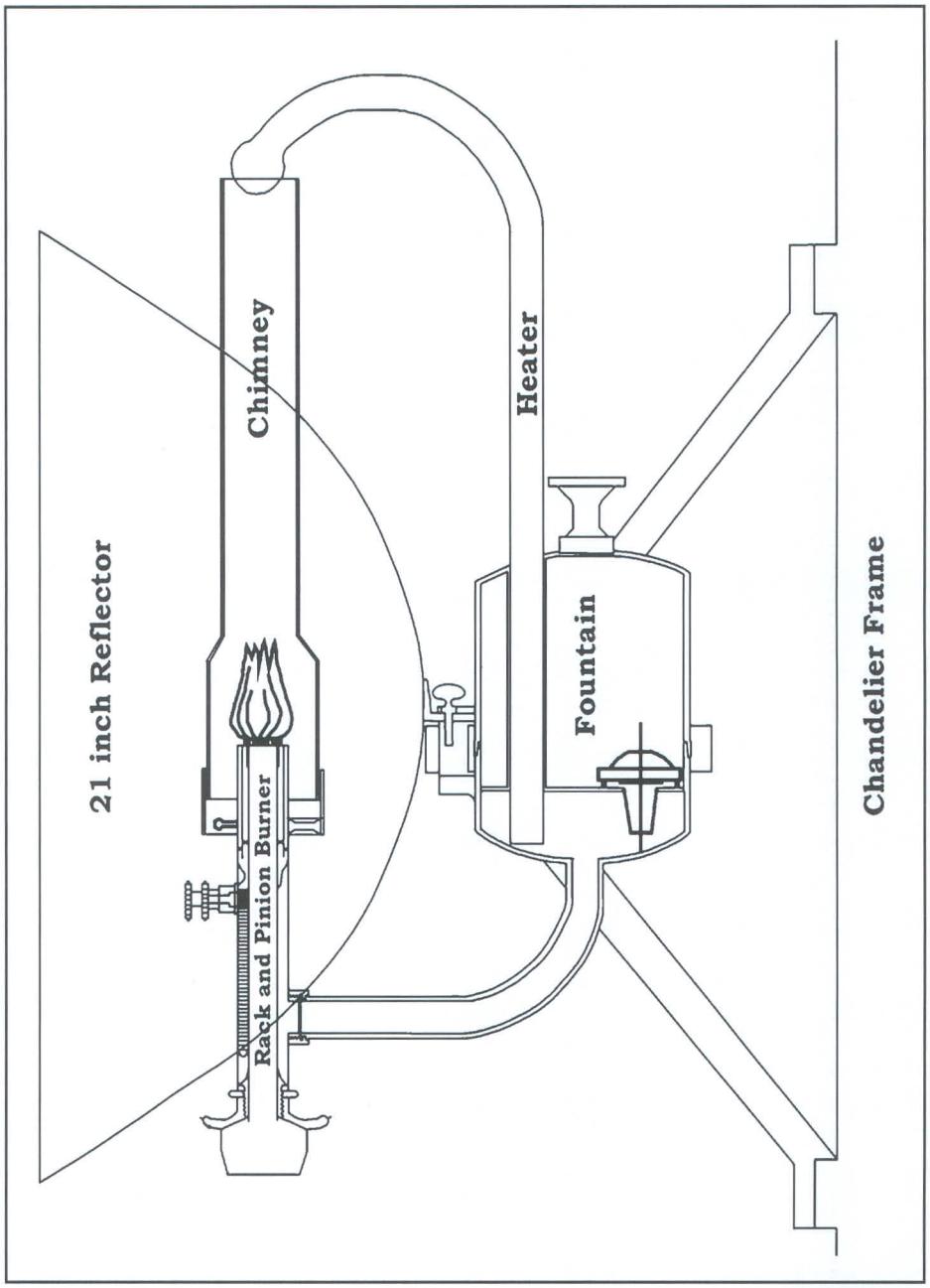
The Lighthouse Board reported on Winslow's lantern design in 1852 as follows: "The lanterns are, as a general rule, of improper dimensions, constructed of ill-adapted, and in the end, not economical materials, without professional or scientific skill; and, in many instances, not suited to the use for which they are designed. There is no proper system of ventilation for lanterns. The means said to be employed for ventilating are wholly inadequate, and contrary to true scientific principles."

The actual specifications for the Selkirk lighthouse lantern written in 1837 read as follows:

"On the tower to be a wrought iron frame lantern, of octagon form, the posts of which to be one and a half inches square, to pass through the deck four feet and to be bolted to the posts of the tower.

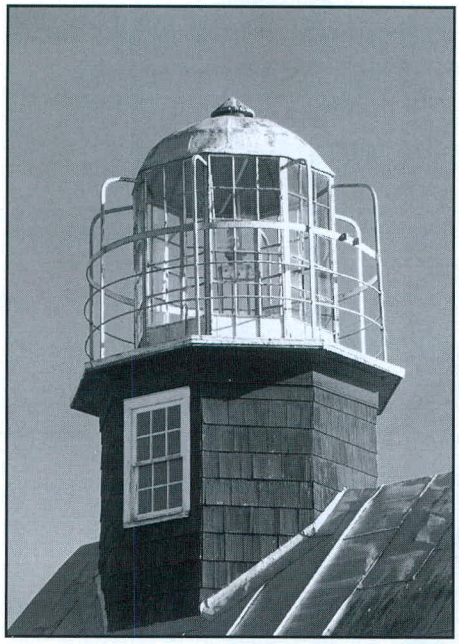
The height and diameter of the lantern to be sufficient to admit an iron sash into each octagon to contain 18 lights (Ed. window panes), 9 by 12 inches, to be glazed with double glass from the Boston manufactory except the lower tier, which is to be filled with sheet copper of at least thirty two ounces the square foot, the rabbits of the sashes to be three quarters of an inch deep, with holes drilled in the top and bottom of each square to admit iron or copper pins to secure squares of glass and copper, exclusive of the putty.

Lighthouse Board improved design using a one-inch burner with a rack and pinion wick adjustment.



Winslow Lewis – Benjamin Hemmenway, style Argand Fountain Lamp and 21-inch Reflector showing Chandelier mounting with lamp as modified by the Lighthouse Board. Drawing by author from drawing in Management of Lens Apparatus and Lamps 1899.

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Lantern room at Selkirk Lighthouse, NY, built in 1838. Photograph from author's collection.

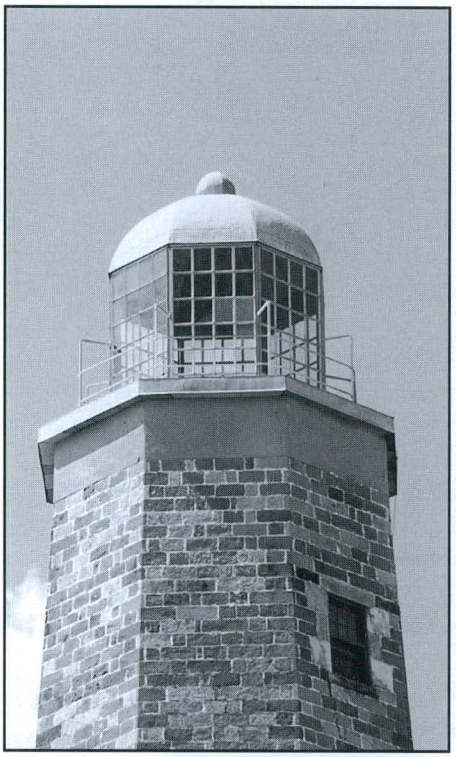
In one of the octagons an iron framed door covered with copper of thirty ounces to the square foot, to open on the outside, and to shut tight into the rabbits of the frame, to have strong wrought iron hinges and strong turned iron buttons to confine it when closed.

The top of the lantern to be a dome formed by 16 iron ribs or rafters concentrating in an iron hoop or neck four inches wide and nine inches in diameter, covered with copper of thirty ounces to the square foot, each sheet to embrace three of the ribs and to be riveted thereto with copper rivets and to extend down and rivet on the piece that forms the base of the dome, which is to be four inches wide.

On the dome to be a traversing ventilator, two and a half feet long and fifteen inches diameter to which is to be secured a copper vane three feet long and twenty inches wide.

The seams where the sheets of copper join in covering the dome to be substantially brazed or soldered, and the dome ventilator and vane to be constructed and finished in a workmanlike manner.

The lighthouse to have an electric rod or conductor or lightning rod of iron, three quarters of an inch in diameter, to be secured to the dome, tower and dwelling by proper stays and bolts, to extend in height at least four feet above the top of the ventilator or vane, and in depth at least four feet into the earth on an angle of about forty-five degrees receding from the dwelling.



Lantern room at Old Cape Henry Lighthouse built in 1791. Photograph from author's collection.

The dome of the lantern, both inside and outside of the posts and window sashes and the railing, to be painted twice over black, the inside of the lantern white.

Separate proposals will be received for fitting up the said lighthouse within two weeks after it shall be built with patent lamps and reflectors, tin butts for keeping oil, and all necessary apparatus, in the same manner as the lighthouses of the United States have been usually fitted up - Lamps and Reflectors the same as at Horse Island Lighthouse, viz: 8 with 2 spare lamps.

The whole to be approved by the Superintendent, and payment then to be made."

Jacob Gould
Superintendent of Lighthouses on Lake Ontario, New York
September 6, 1837

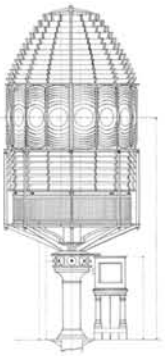
In 1839, I.W.P. Lewis made a number of improvements in the design of the lantern. He increased the size of the windowpanes and reduced the size of the sash frames. He also improved the lantern ventilation system. These changes were not immediately adopted by Winslow Lewis and were not generally implemented by him until 1843.

In 1843, Edward Curtis, the Superintendent of Lights for the District of New York, reported on the latest work of Winslow Lewis on the lantern at the Sandy Hook light as follows: "In most of the lanterns in this district, the sizes of the glass used are 10 by 12, and 12 by 14 inches, and, in many cases, of indifferent quality; while the bars in which it is set are entirely too large. An improvement in this respect has been effected in the new beacons, which clearly shows the advantage of using large plate glass of the best quality. The lanterns in these beacons have been glazed with plate glass, 32 by 33, and 18 by 24 inches in dimension."

The Lighthouse Board takes over

In 1852, Congress created the Lighthouse Board to oversee the lighthouses in America. Immediate and drastic changes were made in lighthouse illumination. It appears that the Lighthouse Board went out of their way to remove and destroy every vestige of the Winslow Lewis designs. They were so thorough in their quest that there is not a single example of a Winslow Lewis lamp, reflector or clockwork remaining, and only one remaining example of his lens and only four remaining examples of his lantern room design.

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Thomas Point Shoal Lighthouse, MD

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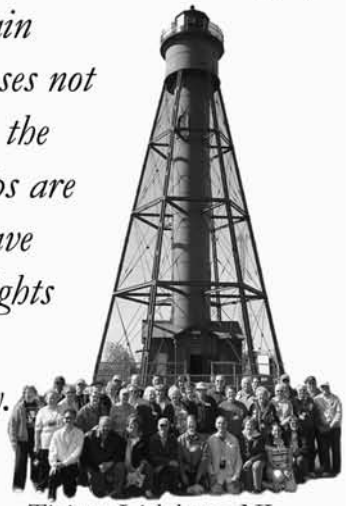
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