

# Who Invented the Fresnel Lens?

By Thomas A. Tag



One might think this is a trick question, similar to “Who’s buried in Grant’s Tomb?” There really was a question about the inventor of the famous lighthouse lens. From 1822, when Augustin Fresnel first published his paper *Memoire sur un Nouveau Systeme d’Eclairage des Phares*, Sir David Brewster, in Scotland, claimed that he was the true inventor, and his claims were not fully resolved until after his death in 1868. This story will discuss the various claims made by Brewster and the counter arguments made by Alan, David, Thomas Stevenson and others. When we are finished we will know who invented the Fresnel lens.

If an inventor wishes to claim ownership of an idea or element of a design, he must show that he, and he alone, developed the idea, and that he memorialized his invention through a written record that can be dated. A critical element in this process is priority or precedence. Precedence is the ability to show that the proposed new design was defined by the inventor prior to the use of the same element in someone else’s design.

The inventor can build on the works of others by adding new elements or by redefining the purpose or structure of the original work, but he must give proper credit to the owners of every element of the original work, taking credit for only those portions he develops.

The design of the Fresnel lens included elements from a number of sources. The first person to develop ideas about a powerful lens was the Count de Buffon in 1748. Buffon was trying to create a large lens to use the sun’s rays for heating or burning various chemicals. Chemistry, in those days, often involved the use of high temperatures to burn chemical elements or to cause reactions in various compounds.



Count de Buffon

The first use of lenses in lighthouses had occurred in England in the late 1700s and in America in 1810, but all had been failures due to the loss of light from the thickness of the glass in the lens and due to the poor quality of the glass itself. These lenses were also excessively heavy due to the thickness of the glass.

In order to solve the weight and thickness problems, Fresnel’s first lens proposal drew upon the designs of Buffon and Condorcet, although Fresnel was totally unaware of their designs at the time. These designs were proposed in the 1700s, but never constructed because it was not technically possible to grind the single piece of glass as required by Buffon or to make the one-piece rings proposed by Condorcet. After Fresnel’s design was complete, he was informed that Buffon and Condorcet had previously proposed similar designs. The following are the proposals of Buffon and Condorcet:

## Proposal for Lens Construction by the Count de Buffon in 1748

“I then endeavored to devise some means of overcoming this difficulty, (that of the too great thickness of the glass) and I found a simple and easy manner of diminishing the thickness of the lenses to any desirable extent without sensibly diminishing their diameter and without lengthening their focal distance.

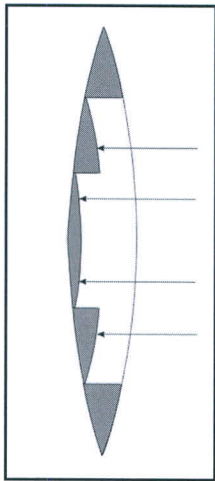
“This consists in cutting my piece of glass into steps. In order to make myself better understood, let us suppose that I wish to diminish to one inch the thickness of a glass lens which is twenty-six inches in diameter, has five feet focal distance, and is three inches thick at the center. I divide the exterior curved surface of the lens into three parts, and move each of these parts toward the center of curvature until there remains but the thickness of one inch in the center of the lens, a step being formed on each side by moving the corresponding parts an equal amount. Then, by making a second step, I reach the extremities of the diameter, and have a lens in steps, (*à echelons*), which has about the same focal distance, the same diameter, and is only about one-third as thick as it was at first, which is a great advantage.

“If a piece of glass *four feet in diameter by two and one half inches thick* be first molded and cut into steps (*echelons*) for a focal distance of eight feet, I have estimated that, leaving it even one and one half inches thick at the center of the lens and the same at the interior edges of the steps, the heat from it (used as a burning glass) will be to that of the Palais Royal lens, as 28 is to 6, without taking into account the effect due to the difference of thickness, which is very considerable, and which I cannot estimate in advance.

“This kind of refracting mirror is in every



respect the most perfect of its kind; and even if we reduce its diameter to three feet and its thickness to fifteen lines, (a line is equal to 0.091 of an inch), at the center and six feet focal distance, which will render its fabrication much less difficult, a degree of heat can be produced which is at least four times as great as that of the most powerful lenses known. I dare say that this echelon mirror would be one of the most useful instruments in physics. I invented it more than twenty-five years ago, and all scientists with whom I have spoken about it desire that it should be made. It will be of great service in the advancement of science; and applying a heliometer to it we could conduct at its focus all chemical operations as easily as in the fire of a furnace,"



A lens ground back in the style Buffon proposed. Drawing by the author from drawing by Buffon.

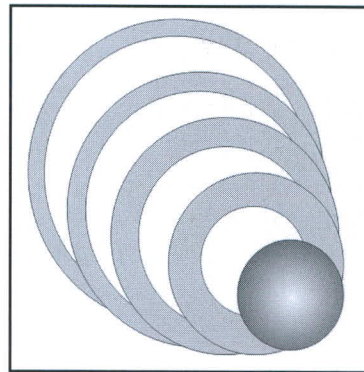
### Proposal for Lens Construction by the Marquis de Condorcet in 1788

"Soon after he [Buffon] suggested the idea of one lens of echelons, no longer requiring the enormous masses of glass which are difficult to find and to work, absorbing the least quantity of light, because ordinary lenses could never have that small a thickness, and finally offering the advantage of correcting a big part of the spherical aberration. This lens, suggested in 1748 by Buffon, was not executed until more than thirty years later by the Abbé Rochon, with enough success to show that it deserves the preference over the ordinary lenses. One can even compose these lenses of echelons from several pieces; one would get more than ease in the construction, and a large



Marquis de Condorcet

reduction of expense, the advantage they have could give more size, and of using, as required, a small or large number of rings, and of thus obtaining in the same instrument different degrees of strength." - From his praise of Buffon.



Condorcet's proposed one-piece lens rings. Drawing by the author

### Sir David Brewster's Contribution to Lens Design and Construction in 1811

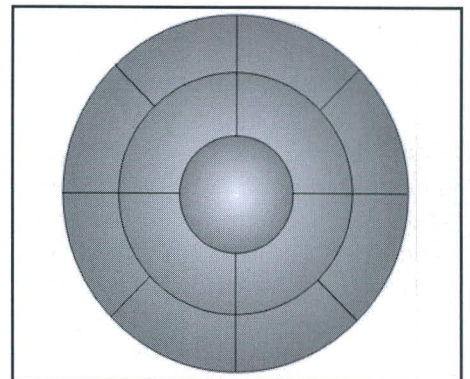
Unknown to Fresnel, Sir David Brewster, in Scotland, had also worked on the design of an instrument that could be used by chemists to produce great heat from the rays of the sun. In 1811, Brewster wrote a description of his "Burning Sphere" in the *Edinburgh Encyclopedia*, which was published in 1812. In this article Brewster described the work of Buffon and stated that while Buffon's lens would have been very useful, it could not be produced, on

any significant scale, due to its design. The only known lenses to have been produced based on the Buffon design were a lens made by the Abbé Rochon, which was only twelve to fifteen inches in diameter, and another lens by Isaac Cookson, which was nearly 30 inches in diameter.

Brewster apparently did not know about the ring design proposed by Condorcet at the time he was completing his own design for a burning lens. Condorcet's rings would have been easier to construct in small sizes, but would have been nearly impossible to manufacture in larger sizes. No lens based on Condorcet's design is known to have been produced.



Sir David Brewster at age 43. Drawing from Royal Gallery of Scotland.



Brewster's Polyzonal lens made of segments of rings. Drawing by the author from a drawing by Sir David Brewster in the *Edinburgh Encyclopedia* – 1812.

Brewster proposed a true built-up burning lens made of steps [Buffon's design] the steps being formed into separate rings [Condorcet's design] as well as his own final design change

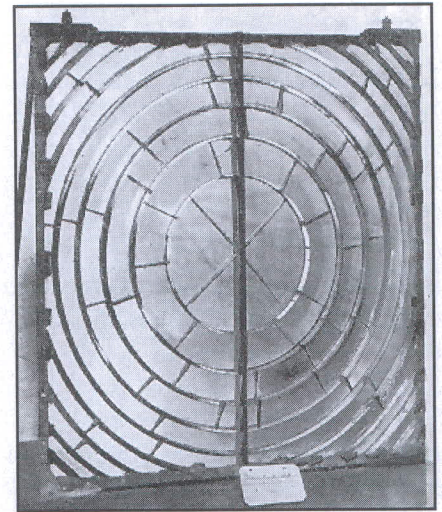




Fresnel At age 37. Drawing from *Oeuvres Completes d'Augustin Fresnel*.



Fresnel's polygonal bulls-eye lens flash panel (early in 1821). Photo from *Centenaire D'Augustin Fresnel*.



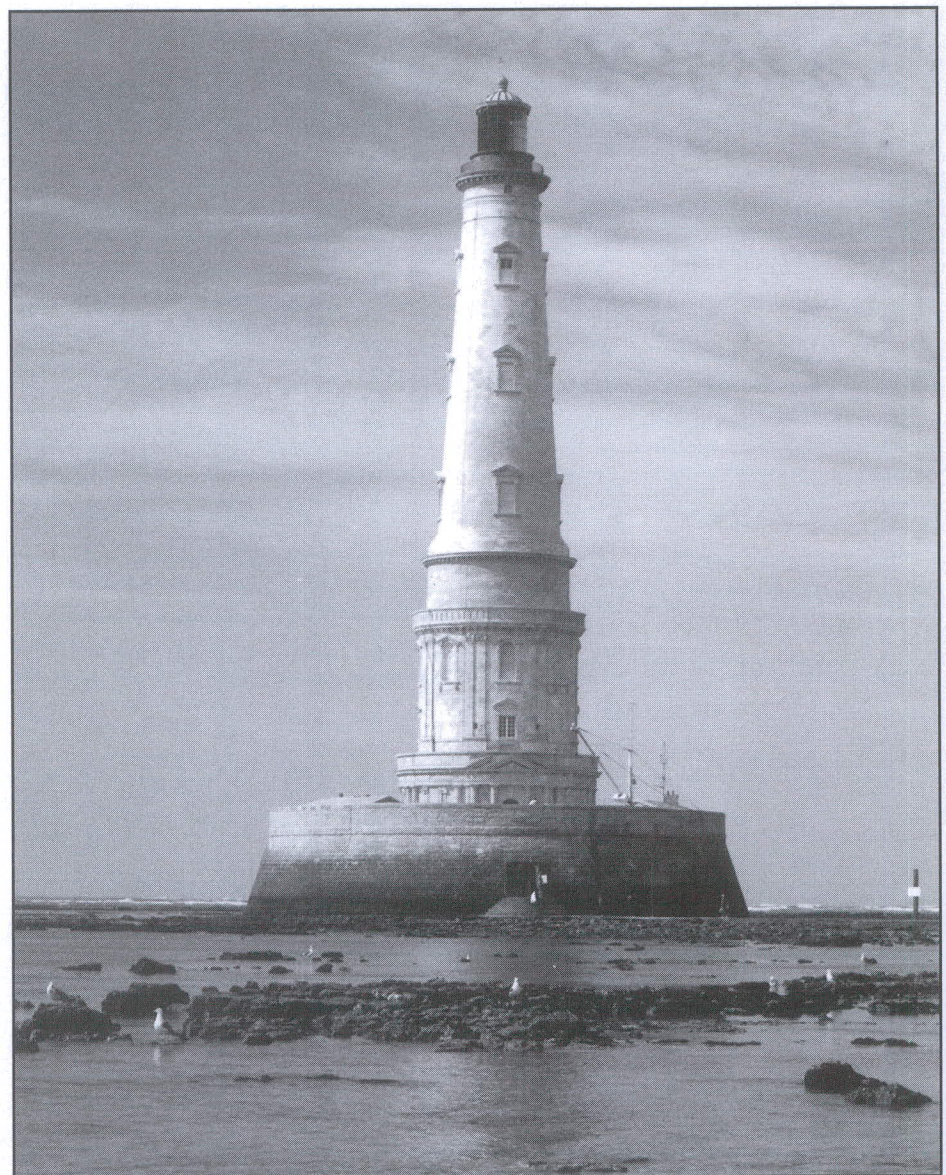
Fresnel's circular bulls-eye lens flash panel (later in 1821). Photo from *Centenaire D'Augustin Fresnel*.

of breaking the rings into easily manufactureable segments. Brewster named his design the polyzonal lens. However, Brewster's design was never produced as a burning instrument.

### Proposal for Lens Construction by Augustin Fresnel, August 1819

Augustin Fresnel was totally unaware of the burning instrument lens proposed by Sir David Brewster. Fresnel used information from his own scientific work on optics, and created a bulls-eye lens panel, which he first proposed in writing in 1819 and produced in early 1821. It was made with segments of rings just as Brewster had proposed, except Fresnel's design was actually produced and was specifically designed for use in lighthouse illumination. Fresnel named his design the "Annular Lens." At first, his design used lens elements made from polygonal segments of glass created by the Parisian optician François Soleil, and assembled with fish glue. He chose polygonal segments of glass, instead of curved segments, because he thought they would be far easier and less costly to produce. After the first bulls-eye panel was made, Monsieur Soleil determined that he could make curved lens segments for nearly the same cost, and the design was converted to a truly circular lens panel by late 1821.

During 1822, Fresnel worked on completing his design for a flashing lens using eight of his circular bulls-eye flash panels, and released his second paper, *Memoire sur un Nouveau Systeme d'Eclairage des Phares*. Finally in 1823, the finished first-order lens was installed by Fresnel, in the Cordouan lighthouse



The Cordouan Lighthouse at the mouth of the Gironde River, France. Completed in 1611, the upper two-thirds were added at the end of the 18th century. Ainsley Dixon photo.



in France.

## The Brewster vs. Fresnel Controversy

The controversy began in late 1821 shortly after Sir David Brewster was told by Robert Stevenson that the French were developing and testing a new system of lighthouse illumination based on the use of lenses and a large multi-wick lamp, both designed by Augustin Fresnel. Brewster discussed his design for a burning sphere from 1812 and told Stevenson that Fresnel's design was just the converse of his burning sphere design.

In October 1822, Brewster received a copy of Fresnel's *Memoire sur un Nouveau Systeme d'Eclairage des Phares*. In 1823, Brewster wrote an article in the *Edinburgh Philosophical Journal*, "On the Construction of Polyzoal Lenses and Mirrors of Great Magnitude for Lighthouses and for Burning Instruments." Brewster claimed that he first discussed dioptric lighthouse lenses with Robert Stevenson after Stevenson received a letter from Colonel Colby outlining Fresnel's activities in France, which he says occurred between 1818 and 1820. [Ed: Even though Brewster had received a copy of Colonel Colby's letter dated November 1, 1821 from Robert Stevenson, he still said the

date of his discussion with Stevenson was between 1818 and 1820].

Brewster also stated relative to his design: "This curious property of diminishing the spherical aberration, does not belong to the method of forming the steps adopted by Buffon; and Monsieur Fresnel, in whose lenses the steps have the same position as in those of Buffon, seems also to have overlooked it." [Ed: Brewster seems not to have understood the work Fresnel produced and wrote of, to correct for spherical aberration in his design].

Over the next few years, Brewster repeatedly claimed other parts of Fresnel's design as his own. Many important engineers and others in the lighthouse community chose sides in the controversy. Naturally those in Great Britain tended to side with Brewster and those in France and elsewhere tended to side with Fresnel. Throughout his life it was said that Brewster could never stand opposition of any kind to his ideas, and he became even more adamant that the design was his. He began to claim still earlier dates for his discussions with lighthouse authorities, especially with Robert Stevenson in Scotland. When Robert Stevenson rebuffed his claims and showed Brewster's mistaken dates, Brewster simply continued to make the same claims. It was said, even by his own daughter, that Brewster was, "always thoroughly and singularly unconscious of any fault in himself." Finally in 1834, Brewster was able to bring the subject before Parliament in Great Britain. He did not win

direct recognition for the design of the lighthouse lens, but was satisfied that his claims had been reviewed by the highest authorities.

The controversy was now dormant and remained so until 1859 when Thomas Stevenson wrote a book *Lighthouse Illumination: Being a Description of the Holophotal System and of Azimuthal-Condensing, and Apparent Lights, with Other Improvements*.

In the original release of this book, Stevenson states:

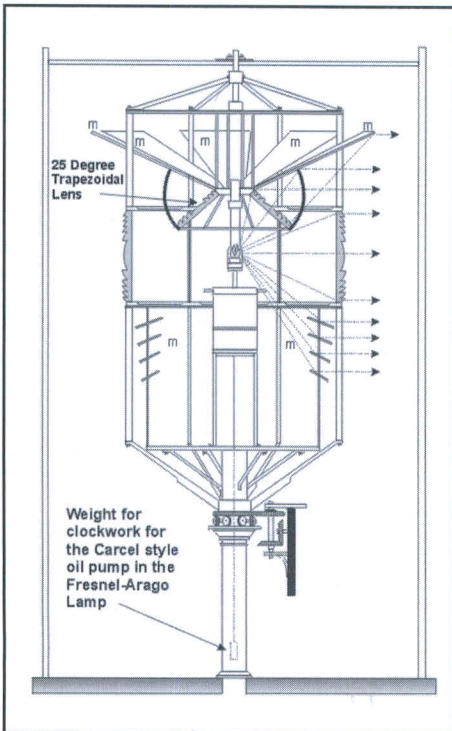
"In 1812 Sir David Brewster published in the *Edinburgh Encyclopaedia* a design for lighthouses, which is in some respects more perfect than those which are to be afterwards mentioned. He originally proposed this optical arrangement for burning purposes."

In the re-release of this book a few months later, Stevenson states:

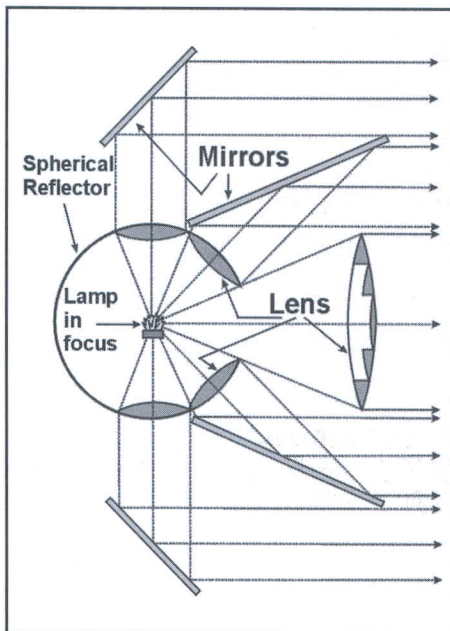
"In 1823 (In the first copies of this book and elsewhere, this date was given as 1812, on the authority of papers in the "Edinburgh Transactions" and "Edinburgh Philosophical Journal". Having accidentally discovered that this date was erroneous, I immediately cancelled the first copies of this book, and published the present issue.) Sir David Brewster published in the *Edinburgh Philosophical Journal* a design for lighthouses, which is in some respects more perfect than those which are to be afterwards mentioned. He originally proposed this optical arrangement for burning purposes in 1812."

After reading the re-release, Brewster became incensed! He wrote an Article in the *North British Review*; Vol. 31, No. 62 and also wrote a memorial to the Treasury, *Memorial on the New System of Dioptric Lights, Invented and Introduced by Sir David Brewster*. He again claimed Fresnel's design was, in fact, his and made grievous personal attacks on the recently deceased Robert Stevenson and on Alan Stevenson. This led to attacks and counter attacks lasting for the next nine years. The controversy was only settled with the death of Sir David Brewster in 1868.

The following timeline of significant events will give the reader a better understanding of the controversy, and what was being claimed by both sides.



Fresnel's First First-Order Lens. Drawing by the author.



Brewster's Sphere Converted for Lighthouse Use. Drawing by the author.



## Brewster - Fresnel Controversy Timeline

- 1748 – Buffon proposed to grind back a single slab of glass to form a burning lens.
- 1780 – The Abbé Rochon built a Buffon style lens 12-15 inches in diameter.
- 1788 – Condorcet proposed a lens of rings and correction for spherical aberration.
- 1812 – In the *Edinburgh Encyclopedia*, Brewster proposed a lens for burning made from pieces of rings, which he named the Polyzonal Lens, and a burning sphere with reflecting mirrors and refracting lenses.
- 1815 – Brewster sent a copy of his *Edinburgh Encyclopedia* containing his article on burning instruments to the Library of the Institute in France.
- 1818 – Robert Stevenson wrote an article on lighthouses for Brewster's *Edinburgh Encyclopedia* in October 1818 and did not mention the use of lenses, which should have triggered action by Brewster, if Brewster had spoken to Robert Stevenson previously about the use of lenses in lighthouses or if Brewster realized, at the time, that his "Burning Lens" could have been used in lighthouses.
- 1819 – Fresnel's first paper proposed a lens made from pieces of rings, which he named the "Annular Lens," and a concentric-multiple-wick lamp for use in a lighthouse. The Fresnel system was named the Dioptric Lens System. Dioptric means that light is refracted, or bent, into a parallel horizontal beam.
- 1821 – On November 1, 1821, Colonel Colby wrote to Robert Stevenson informing him of Fresnel's lens and lamp designs and experiments in France.
- 1821 – After receipt of Colby's letter, Robert Stevenson discussed dioptric lenses with Brewster for the first time, and was told of Brewster's 1812 proposal. Robert Stevenson misplaced Colonel Colby's letter.
- 1822 – On July 29, 1822, Augustin Fresnel released his paper *Memoire sur un Nouveau Systeme d'Eclairage des Phares*. His paper described his complete system of lighthouse illumination using lenses. It also gave full credit to Buffon for his contributions. Fresnel also made numerous mentions of his design principals to correct for spherical aberration within his lens design.
- 1822 – In November 1822, Brewster and Stevenson each received a copy of Fresnel's *Memoire sur un Nouveau Systeme d'Eclairage des Phares*.
- 1822 – In December 1822, Robert Stevenson found the misplaced Colonel Colby letter dated November 1, 1821, and sent a copy to Brewster.
- 1823 – Brewster wrote an article in the *Edinburgh Philosophical Journal*, "On the Construction of Polyzonal Lenses and Mirrors of Great Magnitude for Lighthouses and for Burning Instruments." Brewster claimed his design was used by Fresnel although Fresnel apparently did not know of Brewster's design.
- 1824 – Robert Stevenson visited the lighthouse at Cordouan, France, and purchased a Fresnel bulls-eye lens panel for experimentation in Scotland.
- 1825 – The bulls-eye lens panel purchased by Robert Stevenson arrived in Scotland.
- 1826 – On January 13, 1826, Brewster wrote a letter to the Commissioners of Northern Lights explaining the great advantages of introducing his polyzonal lenses into lighthouses.
- 1826 – Robert Stevenson took the Fresnel bulls-eye lens panel to London where it was shown at the Tower of London to Trinity House and others.
- 1827 – Brewster requested and received the Northern Lighthouse Board's permission to have a double-convex-bulls-eye lens panel made from flint glass for experimental purposes by Mr. Gilbert, an optician in London. The lens was delivered in October 1827.
- 1827 – Brewster wrote an article in the *Transactions of the Royal Society of Edinburgh*; Vol. 11, 1827, "On the Construction of Polyzonal Lenses, and Their Combination with Plain Mirrors, for the Purposes of Illumination in Lighthouses." Brewster gave a proof copy to Robert Stevenson for review and Stevenson refused to approve it because of Brewster's claims of priority over Fresnel for the invention of the dioptric lens. Robert Stevenson wrote to Brewster saying: "I have only again to state that I had no other object in view than to correct inaccuracies which seem to have crept into it (your paper), and to get you to reconsider passages in which you make me a party to your disputes about priority of invention, and place me in a point of view which I never expected at your hands."
- Brewster again claimed that he first discussed dioptric lighthouse lenses with Robert Stevenson after Stevenson received the letter from Colonel Colby outlining Fresnel's activities in France, which he says occurred between 1818 and 1820 [Ed: The letter was dated November 1, 1821, and Brewster again conveniently forgot that he had been given a copy of the letter.]
- 1827 – Brewster communicated with Trinity House, in England, and with the Ballast Board, in Ireland, recommending the use of lenses in lighthouses, and showed his flint-glass lens to the Elder Brethren of Trinity House.
- 1831 – The Northern Lighthouse Board requested the Isaac Cookson Glass Company of Newcastle, England to make a dioptric lens for testing. The lens was made from a single slab of glass as Buffon had proposed.
- 1833 – In February 1833, the Northern Lighthouse Board held a trial, which Brewster and other important persons attended. They tested the one-piece lens from Cookson, the flint-glass lens from Brewster, the Fresnel lens bought from France, and their current reflectors. It was found that the French lens was comparable with the lens made by Cookson and was superior to Brewster's flint-glass lens. The French lens produced light equivalent to seven of the best Scottish reflectors.
- 1833 – Brewster wrote an article in the *Edinburgh Review of April 1833*, on "The British Lighthouse System," and stated that from 1812 on, all of the lighthouse boards in England, Scotland, and Ireland were responsible for the shipwrecks and deaths that occurred because they did not implement his system of lighthouse lenses as described in the *Edinburgh Encyclopedia* in 1812.
- 1834 – Brewster pushed Parliament to review the operation of the lighthouse authorities in England, Scotland, and Ireland. A Parliamentary Committee was appointed and held hearings on the subject.
- Committee Question-2102: "Taking the whole scope of your



information into account, would you say a better plan could be devised for lighting a lighthouse than with the Argand reflectors and sperm oil?"

Robert Stevenson: "According to the present state of my information, I consider the system we now follow the best, though it may turn out otherwise upon the actual trial in the light of Inchkeith, now about to be made." [Note: the trial was to be of a complete Fresnel lens in the Inchkeith tower].

Committee Question-2424: "Then you consider that for small lights, under the number of 17 reflectors, you would not use economically or usefully the French lenses?"

Alan Stevenson: "I think not."

Committee Question-2425: "But that where there were a greater number you would?"

Alan Stevenson: "Yes; but some practical experiments are yet to be tried. Sir David Brewster recommended another lens, which is also in the room. He claims the merit of having first suggested the method of building the lens, but Mr. Fresnel, of Paris, first executed the suggestion; and the lenses made in Paris are of much superior workmanship to that made here under Sir David Brewster's directions. I tried the London lens, built after Sir David Brewster's plan; the Newcastle lens, in one piece; and the French-built lens, in the Observatory at Edinburgh; and I found very little difference in the measurements of the focal distances of their separate parts in so far as the French and the Newcastle lenses were concerned. The Newcastle consists of one piece, but it is so ground as to be formed in a centre lens and zones, which have their foci meeting in one point."

Committee Question-2426: "Is not that the case with Sir David Brewster's lens?"

Alan Stevenson: "That is the case with Sir David Brewster's lens, but it is constructed in a different manner. I find no difference between the French and the Newcastle lens, or very little; but Sir David Brewster's lens has not been so accurately made, either in the grinding or the joining, I cannot say which; but in one or two cases, instead of a single spectrum of a white color, we had four separate spectra surrounded by prismatic colours."

1835 – Brewster wrote an article in the *Edinburgh Review*; Vol. 61, No. 123, April 1835, "Parliamentary Report on Lighthouses" reviewing the conclusions of the Parliamentary Committee. In this article it is shown that Brewster did not know about the existence of Fresnel's cylindrical-fixed lens although it was now 11 years after its development.

1835 – Scotland's first Fresnel lens, built by Isaac Cookson Co., was installed in the Inchkeith Lighthouse.

1836 – England's first Fresnel lens, built by Isaac Cookson Co., was installed in the Start Point Lighthouse.

1859 – Thomas Stevenson wrote a book *Lighthouse Illumination: Being a Description of the Holophotal System and of Azimuthal-Condensing, and Apparent Lights, with Other Improvements*. He soon after published a correction giving Fresnel total credit for the lens design.

1859 – Brewster wrote an article in the *North British Review*; Vol. 31, No. 62 and also wrote a memorial to the Treasury, *Memorial on the New System of Dioptric Lights, Invented and Introduced by Sir David Brewster*, in both of which he claimed that he spoke to

Robert Stevenson about Dioptric lenses for lighthouses in 1815 or 1816 and told him about the article on burning instruments in the *Edinburgh Encyclopedia* and how it applied to lighthouses. In this document Brewster also claimed that Condorcet never talked about correcting spherical aberration.

Brewster also said that his paper of 1823 said that he pointed out [to Robert Stevenson] in 1818 or 1820, "as he had often done before", that his article in the *Edinburgh Encyclopedia* contained a proposal for lighthouse lenses.

1859 – David and Thomas Stevenson wrote a reply to Brewster's memorial, *Reply to Sir David Brewster's Memorial to the Lords Commissioners of Her Majesty's Treasury, on the New System of Dioptric Lights*, where they refuted nearly all of Brewster's claims and challenged him on 7 specifics.

- 1 - That the article on burning instruments published by Brewster in 1812 in the *Edinburgh Encyclopedia* contained no proposal to employ Dioptric lenses in lighthouses, while Brewster said it did.
- 2 - That Brewster said that he spoke to Robert Stevenson in 1818 or 1820 about Dioptric lenses and later altered the dates to 1815 or 1816.
- 3 - That Brewster published that Robert Stevenson first contacted Brewster about the use of Dioptric lenses and later said that Brewster made the first contact.
- 4 - That there is no publication describing the use of Dioptric lenses and mirrors in lighthouses prior to that published by Augustin Fresnel in 1822.
- 5 - That Brewster did not state the true grounds for Robert Stevenson's objections to Brewster's paper published in 1827.
- 6 - That Brewster denied that Condorcet spoke about correcting spherical aberration, when Condorcet did discuss it.
- 7 - That Brewster charged the Northern Lighthouse Board with neglect because they did not take action to use his invention of Dioptric lenses for use in lighthouses after 1812, and the charge was false.

1860 – Brewster wrote a reply to the Stevenson's challenges.

- 1 - He admitted the 1812 proposal for a burning instrument did not mention illumination or lighthouses.
- 2 - He admitted that the dates of 1818 or 1820 were wrong for his discussion of Dioptric lenses with Robert Stevenson.

As to the dates of 1815 or 1816, Brewster stated that he found a letter from himself to the Northern Lighthouse Board member Sir William Rae as follows:

Edinburgh, 30th March 1826

My Lord,

I should reckon it a particular favour if your lordship could give me the honour of a few minutes' conversation with you on the new lenses, &c., which I have during the last ten years been pressing upon the consideration of Mr. Stevenson, for adoption by the Lighthouse Board.

I have the honour to be, &c.  
(signed) D. Brewster  
The Right Honourable  
The Lord Advocate

He stated that the words 'during the last ten years' when subtracted from the date of the letter indicate that he had brought the subject to the attention of Robert Stevenson in 1815 or 1816.



3 - He admitted that he first said Stevenson contacted him and then later he said he contacted Stevenson first. He said Stevenson just wanted all the credit for himself and that he [Brewster] did not care enough to protest and had, at first, let Stevenson say he contacted Brewster. [Ed: It was later shown in Brewster's own documents that Stevenson contacted Brewster.]

4 - Brewster admitted that there was no publication proposing the use of Dioptric lenses in lighthouses before Fresnel's *Memoire* in 1822.

5 - Brewster claimed that he did not remove any of the items that Robert Stevenson had requested him to remove from his paper in 1827.

6 - He admitted that Condorcet spoke about spherical aberration.

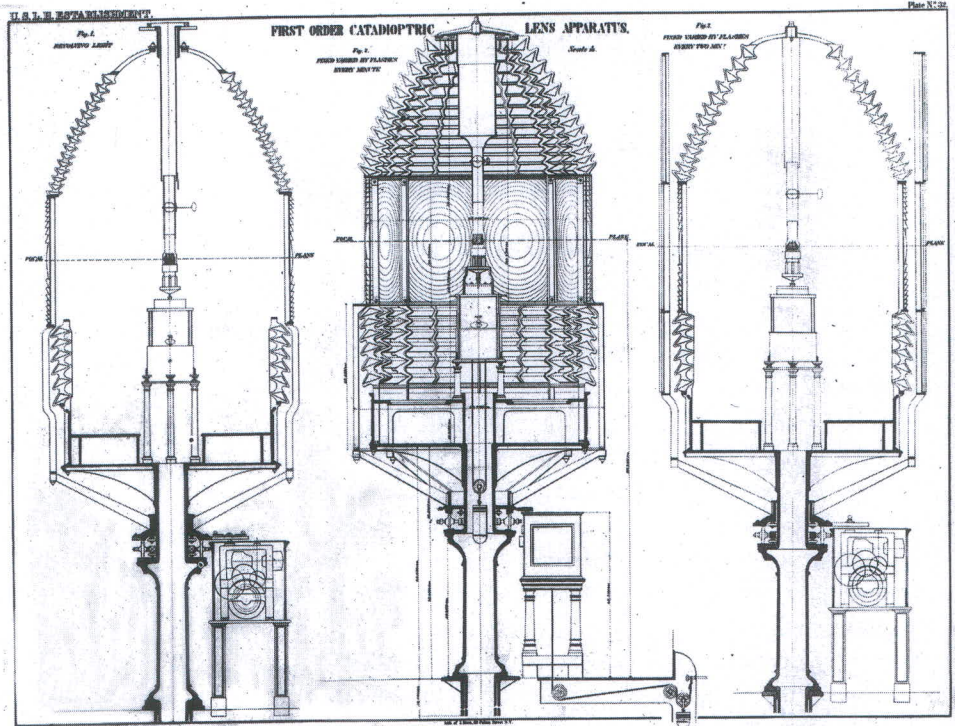
7 - Brewster still claimed priority over Fresnel for the invention of his Polyzonal lens and that the lighthouse authorities had refused to implement his system for many years.

1860 – David and Thomas Stevenson wrote an answer to Brewster's reply, where they refuted Brewster's responses to points 2, 3, 5 and 7 of the seven specific challenges.

1867 – Brewster wrote, *The History of the Invention of the Dioptric Lights and Their Introduction into Great Britain*, in which he claimed that he spoke to Robert Stevenson about Dioptric lenses for lighthouses in 1816, 1818, 1819 and 1820 [Ed: he dropped the claim to have talked about it in 1815] and told him about the article on burning instruments in the *Edinburgh Encyclopedia* and how it applied to lighthouses.

1867 – In August 1867, the government of Great Britain refused all recognition of Sir David Brewster's claims for the invention of the Fresnel lens.

1868 – On February 10, 1868, Sir David Brewster died and the controversy passed with him.



So, to answer the question of, “Who really invented the Fresnel lens?” Most of the answer can be found in the concise answer written by David and Thomas Stevenson in 1860, which reads as follows: “The truth of the case is simply stated. Sir David Brewster, when he wrote the article “Burning Instruments” in 1812, had no more idea of the application of polyzonal lenses to lighthouse illumination, than Buffon had in 1748, or Condorcet in 1788, when they proposed their improvements for burning-glasses. Fresnel commenced his investigations in 1819, and published his description of the *Dioptric System of Lighthouse Illumination* in 1822. His invention was communicated by Colonel Colby to Mr. Robert Stevenson, and Mr. Stevenson communicated it to Dr. Brewster, when, as he himself expresses it, he [Dr. Brewster] immediately pointed out that it was the converse of what he had already proposed for burning-glasses. [Ed: This happened very late in 1821.] But the communication with Mr. Stevenson, on which Sir David Brewster seems to place so much weight, is in reality, of no importance, as Fresnel published in 1822, and Sir David Brewster did not publish until 1823, in consequence of having received a copy of Fresnel's publication.” In addition R. S. Westfall made a telling comment in his review of one of Brewster's writings. “Fresnel... created a revolution in optics; Brewster conformed his work to the existing system and created the kaleidoscope.”

Sir David Brewster should definitely be credited with the design of a lens formed in steps and made from pieces of rings. His design preceded Fresnel's by eight years. However, his lens was designed for burning – not lighthouses, and was never actually produced.

He should also be given credit for the use of extension mirrors and lenses beyond the bulls-eye lens. However, again his design was to concentrate incoming heat, and not for the converse of controlling outgoing light.

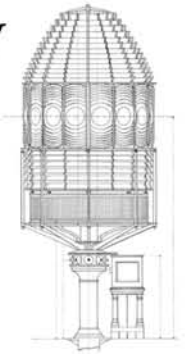
Augustin Fresnel designed both lenses and mirrors to concentrate and control light specifically for use within a lighthouse. His designs were produced and he proposed a complete system of illumination for lighthouses. In 1819, over three years before Brewster formally proposed his design as being applicable to lighthouses and over two years before Brewster proposed his design verbally to Robert Stevenson, Fresnel had already produced a dated, written document outlining his design.

While there were many contributors to Fresnel's designs, the final product can only be identified by one name – The **FRESNEL** Lens.





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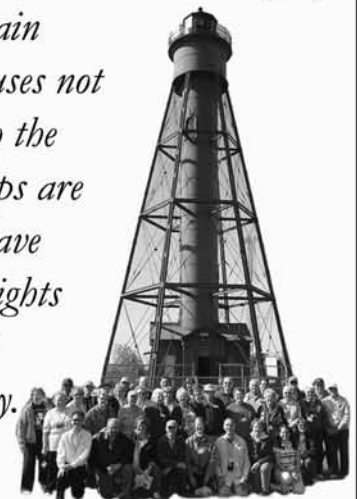
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*Tincum Lighthouse, NJ*