

# BELL ROCK

## THE 200<sup>TH</sup> ANNIVERSARY OF A SIGNIFICANT LIGHTHOUSE

By Thomas A. Tag

### Introduction

The year 2006 marked the beginning of an important anniversary in the history of famous lighthouses. Two hundred years ago, in 1806, the design, development plans and construction authorization for the Bell Rock Lighthouse in Scotland were approved. This story covers the developments during 1806 and the early history of the Bell Rock. Future stories are planned for each of the years of 2008 through 2012, which will describe the happenings at the Bell Rock two hundred years previously as this famous lighthouse was built.

### Location



Bell Rock was originally known as the Inchcape Rock, which in Gaelic means "Island Headland." It later became known as the Bell Rock due to the legend that sometime prior to 1600 the Abbot of the

Abbey of Aberbrothock (now known as Arbroath) had a bell, mounted on a buoy and actuated by the wave action of the sea, placed near the rock to warn seamen. As the legend goes, the bell worked well and saved many lives, but a pirate named "Sir Ralph the Rover" came to the rock one day and removed and sank the bell in a deliberate act to dishonor the Abbot. Sometime later, this same pirate was returning from a voyage of plunder and as he turned toward the Firth of Forth on a foggy night his ship crashed upon the Bell Rock and was lost with all hands.

The Bell Rock is located 11 miles offshore from Arbroath, Scotland in the North Sea. It is in the main shipping channel to the entrance of the Firth of Forth when approaching from the northeast and heading for Edinburgh. It is also in the shipping channel for the Firth of Tay when heading for Dundee. The Bell Rock is a reef made of very hard rock that



Map from *An Account of the Bell Rock* by Robert Stevenson showing Bell Rock in relation to the Firth of Forth and Dundee.

lies 4 feet above water at low tide and 12 feet underwater during high tide. The main portion of the rock is 427 feet long by 230 feet wide with a lesser portion extending an additional 1,000 feet to the southwest.

### History of the Approval for Construction

In 1793, the first call for a lighthouse or some other warning structure on the Bell Rock was made by British Admiral Cochrane, although no action was taken. However, the Northern Lighthouse Board heard of the request and Robert Stevenson,

the Engineer to the board, first visited the Bell Rock in the year 1794. He was not able to land on the rock due to the sea conditions and only observed the rock from some distance away.

In 1799, a major storm occurred that lasted for three days. This storm forced many ships to put into ports both north and south of the entrance to the Firth of Forth because the ship captains were too afraid to go near the Bell Rock in such stormy conditions. While no ships were sunk on the rock, its dangers caused great expense and no ships could reach Edinburgh during this period. After the storm



request to the Treasury and the Board of Trade to provide a loan for the construction in the amount of £ 25,000.

Mr. Hamilton, a member of the NLB board, was sent to London in April 1806 along with Robert Stevenson who would provide technical backup should it be required, and the lawyer for the board. They met with officials of the Treasury and the Board of Trade and were given assurances that a loan could be provided if approved by Parliament. At this point Mr. Hamilton returned to Scotland, while Stevenson along with the NLB Lawyer stayed in London.

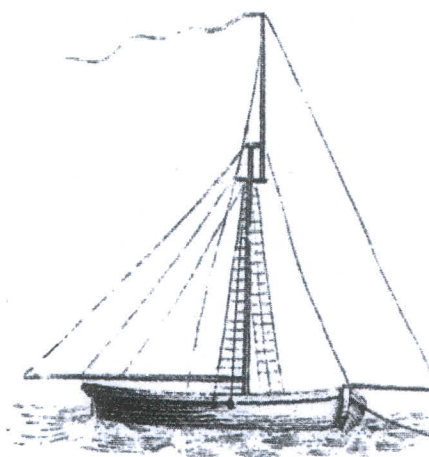
The NLB asked Henry Erskine, Lord Advocate of Scotland, to prepare a bill for Parliament outlining the need for the £ 25,000 loan along with permission to build the lighthouse on Bell Rock. He prepared the bill and sent it to the NLB lawyer in London where it was presented to the Treasury and the Board of Trade. By early June, Robert Stevenson and the lawyer were still trying to get approval for the loan. Finally on June 7, 1806, Lord Auckland, President of the Board of Trade, decided that he would support a loan and Sir Joseph Banks also urged its necessity. With this critical support the bill was placed before the House of Com-

mons. Robert Stevenson and John Rennie were called into Parliament and interviewed relative to the proposed lighthouse design and potential costs.

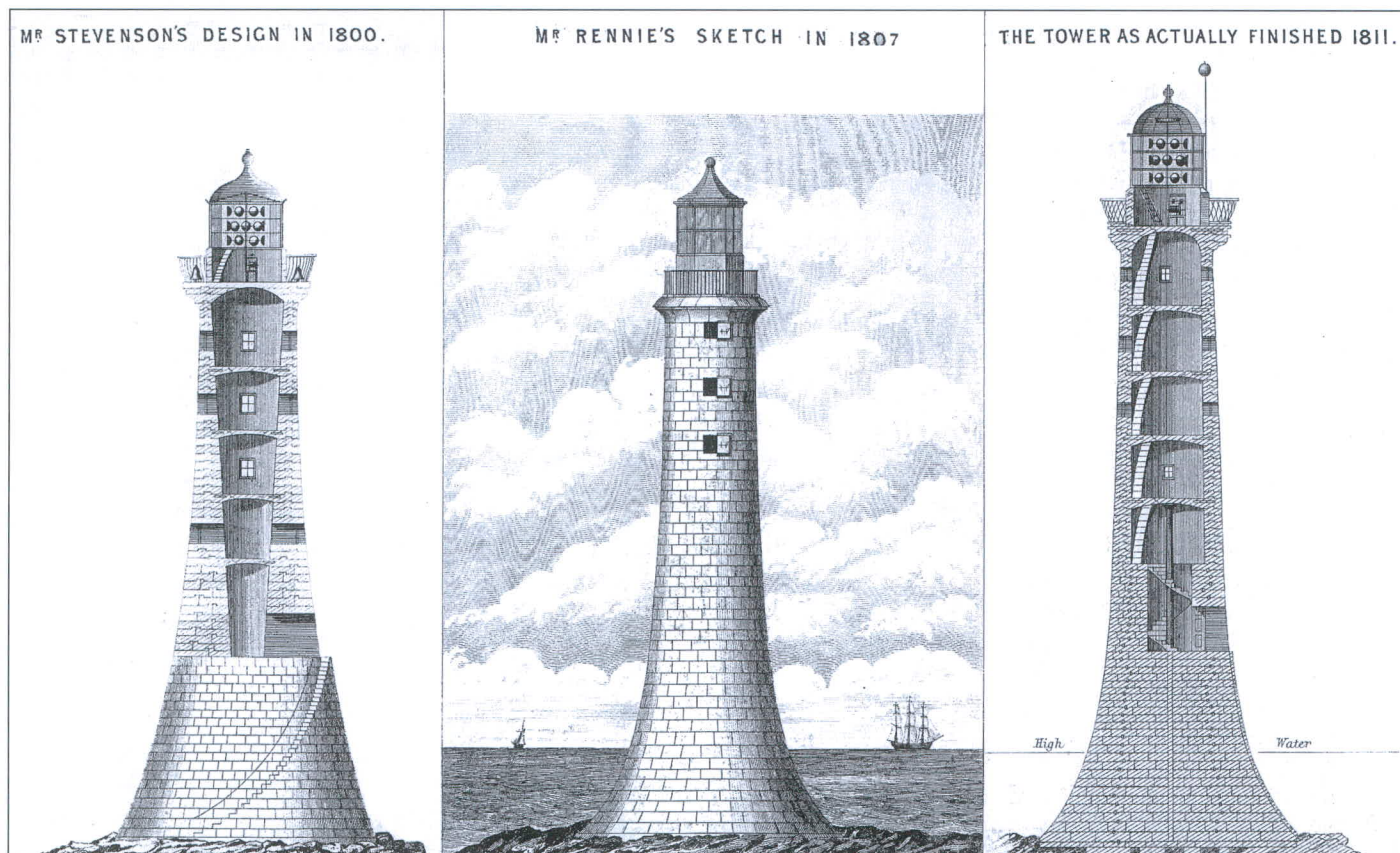
The bill passed the House of Commons on July 16, 1806, and was then sent to the House of Lords where it also immediately passed. Thus the loan for £ 25,000 was provided over a three year period and permission was given for construction to begin as soon as practical.

Robert Stevenson returned to Scotland and immediately began preparations for construction to begin early in 1807. His first step was to purchase a boat suitable to provide sleeping space for the construction crew and to act as a floating lighthouse near Bell Rock during the construction. It happened that a Prussian dogger, a type of fishing vessel, had been captured by the British Navy and was to be sold in Leith harbor. The NLB purchased the vessel and renamed it *Pharos* and began fitting it out as a floating light.

A year from now you can read the next installment about the happenings at the Bell Rock during the year 1807.



Right – The *Pharos* before refitting. Drawing from the author's collection.



Comparison of Stevenson's Design with Rennie's Design and the Actual Tower. Drawing from the author's collection.

# BELL ROCK — PART II

## THE 200<sup>TH</sup> ANNIVERSARY OF A SIGNIFICANT LIGHTHOUSE

By Thomas A. Tag

### Introduction

The year 2006 marked the beginning of an important anniversary in the history of famous lighthouses, the 200th anniversary of the building of the Bell Rock Lighthouse in Scotland. See *The Keeper's Log* Volume 23, Number 2 for the story of what happened during the year 1806. This story covers the developments two hundred years ago, in 1807, when the first construction began upon the Bell Rock to create a temporary beacon on the rock and to begin the excavation of the foundation for the main lighthouse. Future stories are planned for each of the years of 2009 through 2012, which will describe the happenings at the Bell Rock two hundred years previously as this famous lighthouse was built.

The first step was to set in place a floating light near the rock so that light dues could begin to be collected to partially fund the construction, *Pharos* was the name given to this lightship. In 1806 a foreign dogger fishing vessel had been captured and then purchased by the Northern Lighthouse Board (NLB) in Scotland. In March of 1807, this ship was refitted into a floating light. Robert Stevenson designed special lanterns that could be placed around each of the *Pharos'* two masts. Each lantern had ten lamps with reflectors in a circle around the mast. The *Pharos* was designed to act as a lightship (the first in Scotland) and to provide sleeping quarters for the work crews working on the Bell Rock.

The *Pharos* was finally ready for sea on July 9, 1807. It was put on station near the Bell Rock in early August and began operating as a floating light on the night of September 15, 1807 after proper notice was given to the seafaring community by the NLB.

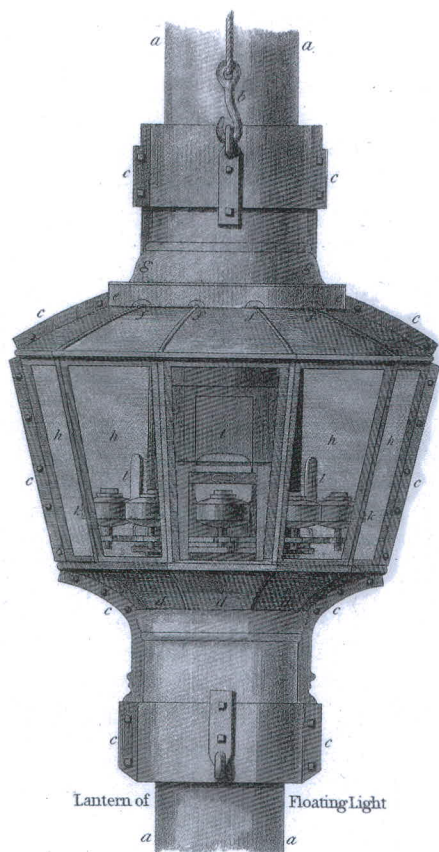
Since the *Pharos* was to remain perma-

nently on station while the Bell Rock Lighthouse was being built, another ship, the *Smeaton*, was needed to carry work crews to and from Arbroath Harbor. The *Smeaton* was also used to bring supplies for the workmen and to carry the building stones out to the rock. In addition, several small boats known as praams were built to off load the finished building stones and carry them to the specially prepared landing site on the rock.

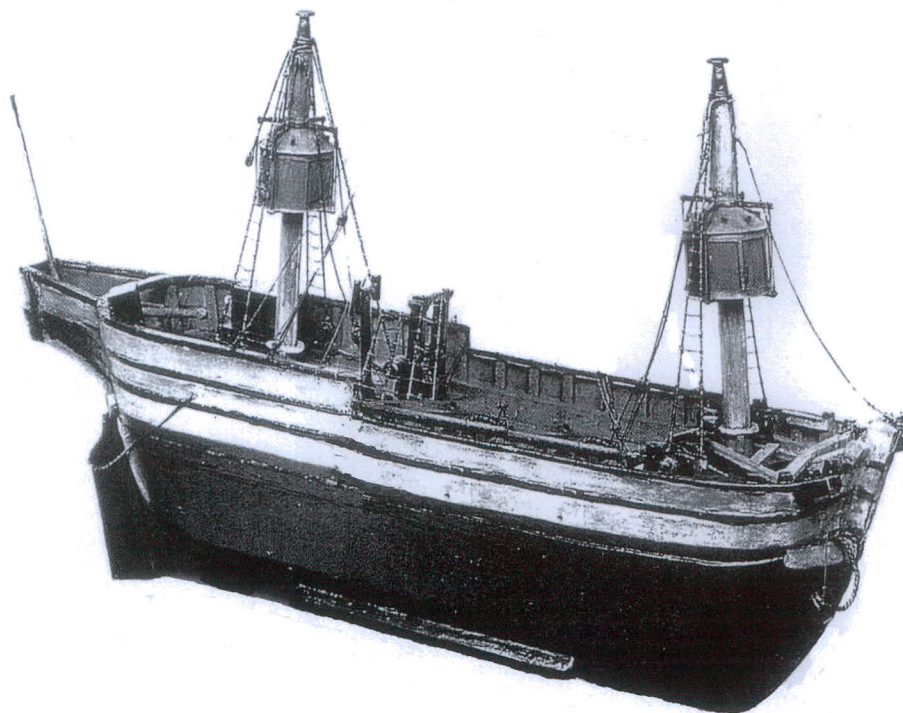
A quarry was located where stone could be procured for the lighthouse construction; a major work yard was set up near the harbor at Arbroath where the stones could be cut to size and a platform was built allowing each course of stone to be test assembled before movement to the Bell Rock itself.

The sloop *Smeaton* was built by the NLB during the spring of 1807 and was launched in June. She was fitted out and made ready for work at the rock by the first of August 1807.

The first visit to the Bell Rock for 1807 occurred on August 7 when an inspection was made by Robert Stevenson and his construction

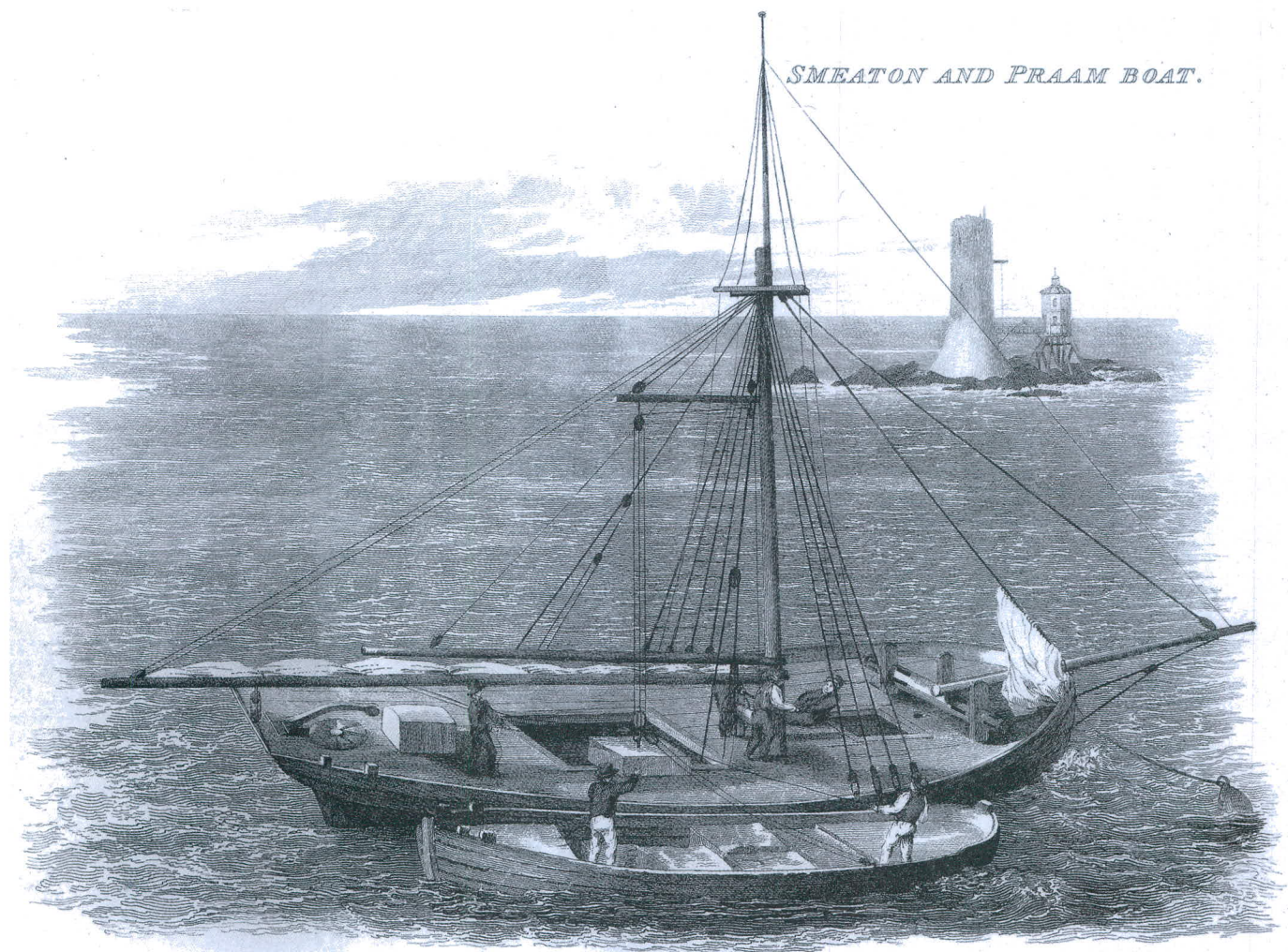


Lantern of Floating Light



Representation of the *Pharos* after refitting with lantern. Photo from the author's collection.

Lantern design for a floating light. Drawing from *Account of Bell Rock*.



**The Smeaton and a pram boat. Drawing from the *Account of Bell Rock*.**

foreman. Later, the foreman selected 14 stone masons from the group working at Arbroath who were assigned to begin the stone cutting work on the rock itself. Any man who agreed to work on the rock also had to agree to stay a minimum of four weeks before returning to shore. The first work boat to the rock left on Monday, August 17, 1807. The work party consisted of a total of 24 men who would work on Bell Rock. This included Robert Stevenson and the foreman as well as the stone masons, a blacksmith and others. The work actually began at 5:30am on August 18, 1807. When the men were all on the rock for the first time they gave out three hearty cheers to pronounce that construction was about to begin. The first task this day was to begin boring holes into the rock for the main beams that would support the beacon house that was to be the first thing built on the rock. A group of men was also assigned to drill holes so that the blacksmith's forge could be firmly attached to the rock.

A number of the men who arrived upon the rock that day were seasick from their first

night aboard the *Pharos*. These men were told to pick dulse, a form of seaweed common on the rock, and eat it. The dulse quickly calmed the seasickness.

After only a few days the noise of the forge and the blacksmith sharpening the workmen's tools, drove all of the seals from the Bell Rock and surrounding areas.

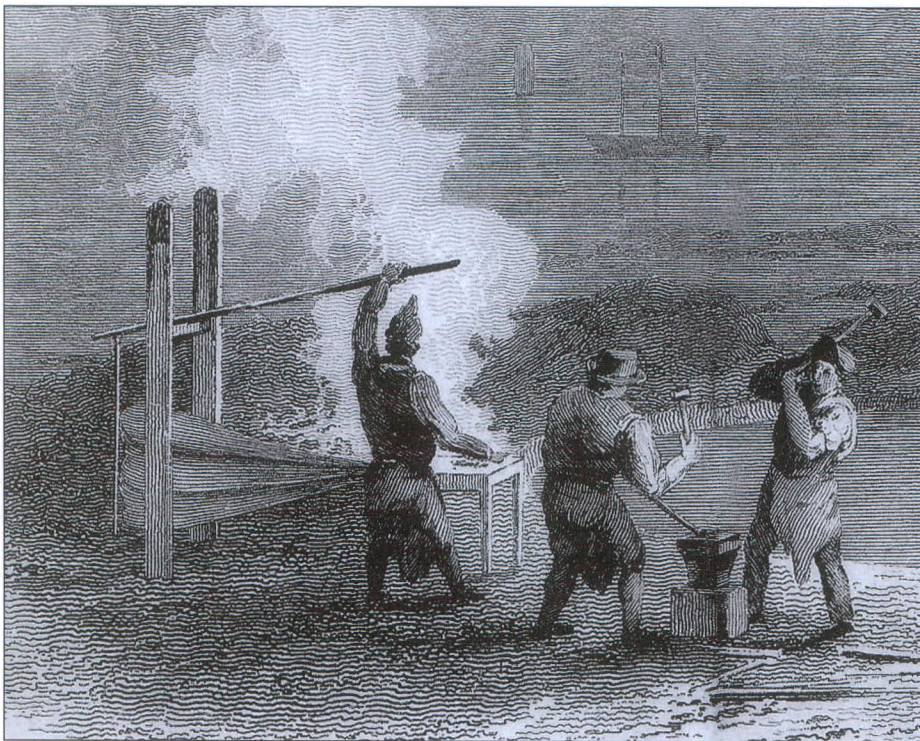
It was soon found that the *Pharos* floating light rode poorly in the sea causing much seasickness among the workers. The constant rolling of the *Pharos* also caused great difficulties when the men were trying to board the long boats for the trip to the rock and also on their return for the night. However, by the end of August 1807 the men had all become expert rowers.

Robert Stevenson determined that work should continue on the rock on Sunday. This was contrary to the normal custom where no work was performed on the Sabbath day. Robert first held prayer services aboard the *Pharos* and then explained to the men that their task was for humanity and the sooner

accomplished, the more seamen who would be saved from peril. He stated that under these circumstances he felt that work on Sunday was justified. All but four of the men agreed and worked on that first Sunday. Later, all of the men were won over and began to work seven-day weeks whenever it was possible to land upon Bell Rock. In fact, they became so dedicated to the work that they often worked until the returning tide water was above their knees before returning to the *Pharos* for rest.

During the first weeks of work on the rock the holes for the framing beams of the beacon house were completed. The beacon was designed to provide an additional light to augment the floating lights on the *Pharos*. The beacon house was to be supported on six main beams that were each anchored into the rock. This was accomplished by boring holes (actually slots) that were seven inches wide by two inches tall with the slot to be eighteen inches deep into the rock.

A major storm began on August 24, 1807 and lasted for five full days. No work could be



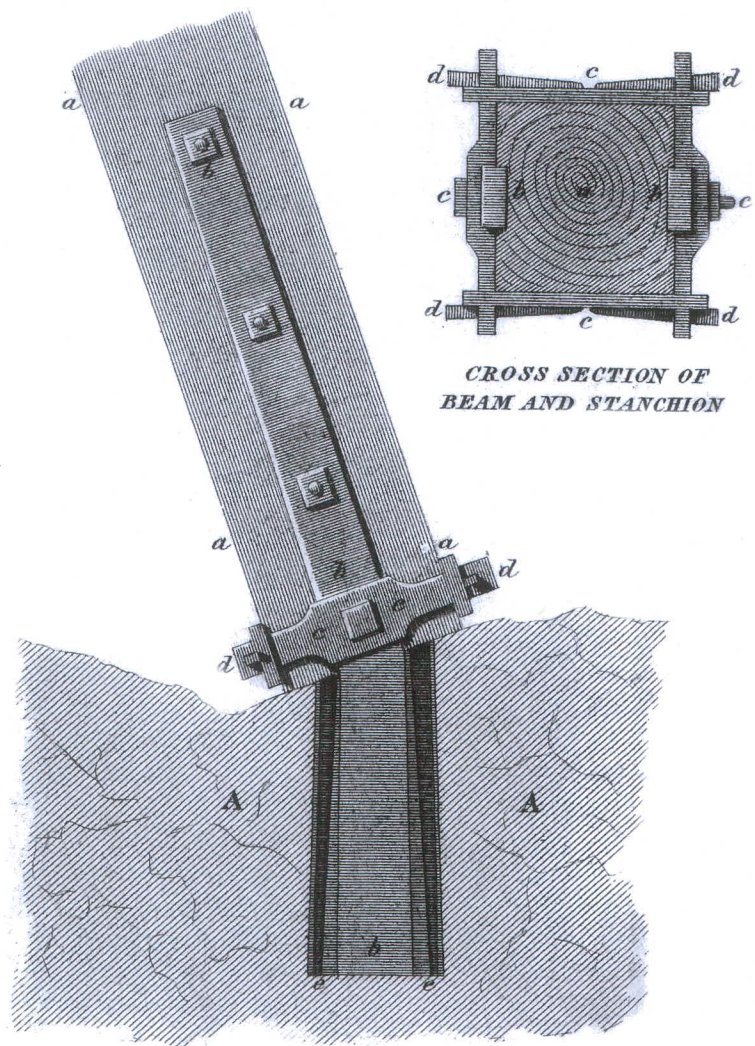
The blacksmith's forge on Bell Rock. Drawing from *Account of Bell Rock*.

done on the rock during the storm. The storm also caused much consternation among the workers and continuous seasickness amongst nearly all aboard the *Pharos*. Finally on August 30, the men were able to return to the rock. At this time, Stevenson decided to split a few men from the beacon project and to begin excavation of the circular base foundation hole for the lighthouse itself.

On September 1, six granite blocks were brought to the rock in a first experimental attempt to land blocks upon the rock from the sturdy pram boats. Several experiments were made testing the praams, the block removal cranes and the teamwork of the block landing crew and foreman.

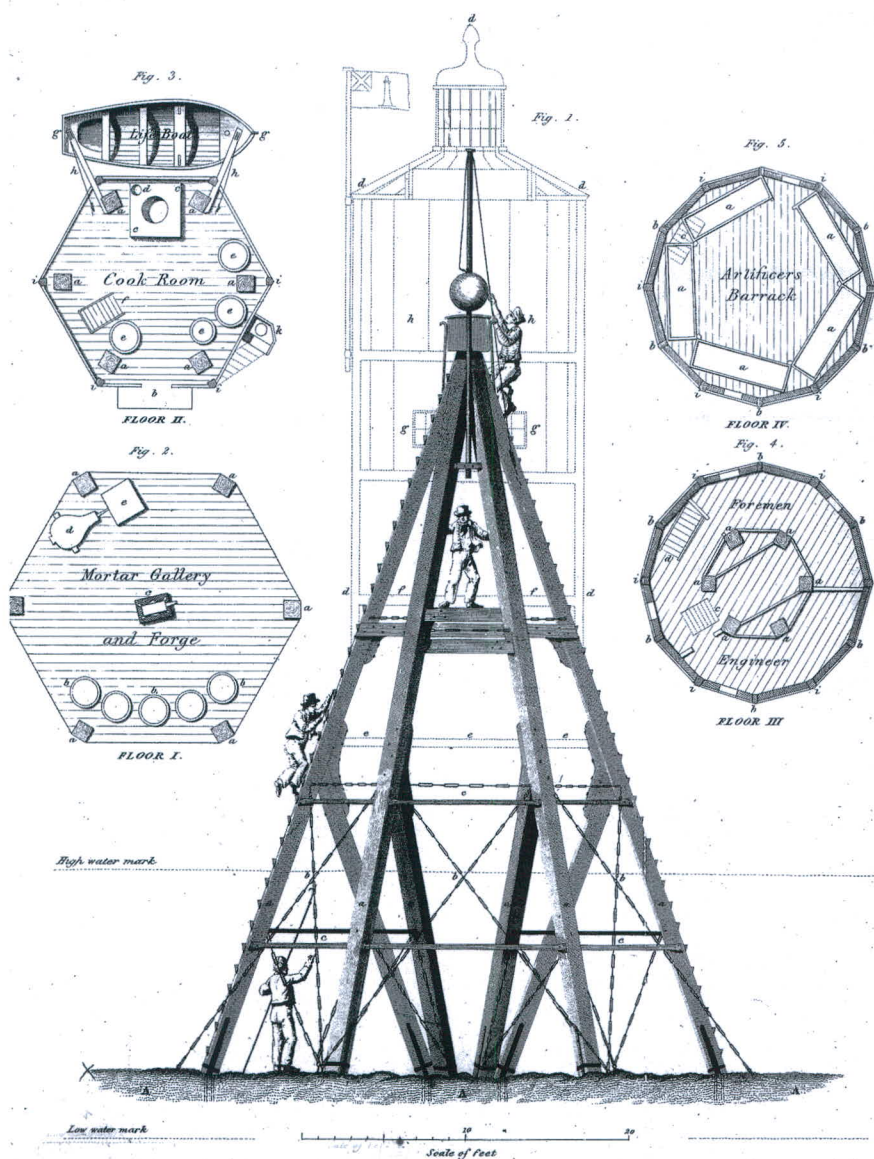
On September 2nd, the first major incident occurred on the rock. Shortly after the men reached the rock, the *Smeaton* broke her moorings and went adrift. The sailors aboard tried to raise the sail and return to the vicinity of Bell Rock, but had drifted so far away that they could not reach the rock again before the tide rose and drowned the workers. Robert Stevenson and the thirty-one workers then on the rock had not noticed the loss of the *Smeaton* and it was only as the time approached to leave the rock that all realized they were in serious peril. They had two boats, but could not carry more than twenty-four of the men. The normal routine was to use the two boats to carry the men to the *Pharos*.

However, on this day additional workers had come from the *Smeaton* and were to return there. These men would surely be drowned as the tide returned. By a great stroke of luck the packet boat from Arbroath was nearing the rock at this moment on its way to deliver supplies and mail to the *Pharos*. The captain of the packet realized the peril of those upon the Bell Rock and made his way near the rock where the two boats at the rock could reach his ship and return for the remaining men. This accident greatly concerned the men and on the following day eighteen of the men refused to go to the rock. Stevenson understood the men's concern and decided to go to the rock with just six men to continue work. He felt that if the men were not pushed into work that they would return of their own will in a day or two. He was correct and by the third day after the incident all were again working on the Bell Rock.



CROSS SECTION OF BEAM AND STANCHION

Stanchions connecting the main beams of the beacon house framework to the rock. Drawing from *Account of Bell Rock*.



The framing beams for the beacon house. Drawing from *Account of Bell Rock*.

On September 5th, a storm started that lasted for several days. The storm was so violent that the *Pharos* floating light broke adrift losing all her anchors. It was decided that the *Pharos* should be moved to a different location near the rock where she could be partially protected by the rock itself from storm damage. This was accomplished on September the 18th. Later in the same day, the *Smeaton* arrived at the rock from Arbroath. She was towing the six main framing beams for the construction of the beacon house. Each of these beams was sixteen inches square and fifty feet long.

On September 20, Robert Stevenson ordered a total of fifty-two men to the rock. The additional men were required during the erection of the main beams for the beacon. A crane was set up and the first beam was anchored to the rock with metal stanchions and wedges that were driven into one of the

slots previously bored into the Bell Rock. The base of the beam was then bolted between the metal stanchions with the bolts running through both stanchions and completely through the beam. By the end of the day four of the six main beams were in place. The tops of the beams were connected together with mortise and tenon joints and rings of iron.

During the next day the two remaining main beams were put in place and by the 23rd all of the additional support beams and chains were also added. This allowed the workers to construct several platforms at various heights on the beacon supports. On September 26, the blacksmith's forge and bellows were moved to the bottom platform and the men ate a meal for the first time on the Bell Rock.

The beacon house now began to take shape and additional items were moved to it for safety. This allowed the workers to stay on the rock for

up to sixteen hours at a time greatly increasing the amount of work accomplished.

The major construction for this season was now nearing completion. The number of men on the rock was cut to twenty, split into two groups. One group worked to enclose the beacon and add other refinements to it such as a storage location where bread and water were kept from that time onward. The second group continued to cut away the stone for the foundation hole for the main lighthouse. This work had thus far resulted in a circular hole fifty-feet in diameter and several inches deep.

On September 29, Robert Stevenson returned to Arbroath for the first time since August 17. While in Arbroath he visited the work yard area where the stones were dressed, and found that the test platform held nearly all of the finished stones for the first course. About ten stones remained to be completed for this course. Unfortunately the stone quarries were having difficulty producing the large stones needed for the construction and Stevenson was forced to begin looking for other sources for the large stones. This lack of sufficient quarry capacity would be a major concern during the winter months of 1807-1808.

Stevenson returned to Bell Rock and by October 4th the exterior of the beacon house was completed. On this day the flag of the Northern Lighthouse Board was first flown from the completed beacon.

On October 5, John Rennie and his son were brought to the area of the rock for the first time and the next day they landed on the rock to observe the final construction day of the season. Rennie was very pleased with what had been accomplished. Several men were left at the rock and over the next few days they cleaned up the area and made it ready for the winter months. Robert Stevenson returned to Edinburgh with John Rennie.

Finally on November 22, Stevenson visited Bell Rock for the last time in 1807. He found that over the last month the chains that helped to tie the support beams of the beacon together had loosened, but no other damage was found. He decided that during the 1808 season he would replace the support chains with additional wooden beams to resolve the issue. He left the rock on November 22 and this was the last event of the 1807 work season. The floating light *Pharos* remained on station and light dues continued to be collected from passing ships to pay for the construction.

# BELL ROCK — PART III

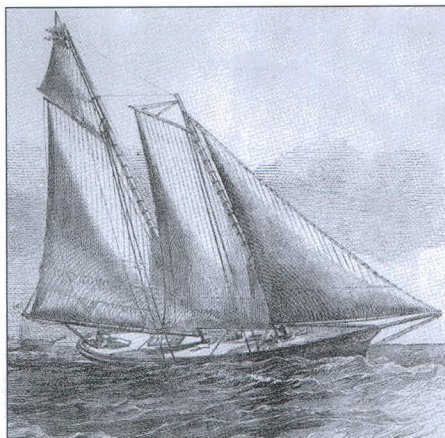
## THE 200<sup>TH</sup> ANNIVERSARY OF A SIGNIFICANT LIGHTHOUSE

By Thomas A. Tag

### Introduction

The year 2006 marked the beginning of an important anniversary in the history of famous lighthouses, the 200th anniversary of the building of the Bell Rock Lighthouse in Scotland. See *The Keeper's Log* Volume 24, Number 2 for the story of what happened during the year 1808. This chapter covers the developments two hundred years ago, in 1807, when the first construction began upon the Bell Rock to create a temporary beacon on the rock and to begin the excavation of the foundation for the main lighthouse. Future stories are planned for each of the years of 2009 through 2012, which will describe the happenings at Bell Rock two hundred years previously as this famous lighthouse was built.

**I**n 1807 problems had occurred at Bell Rock due to the lack of enough tender ships to assure the safety of the construction crew and the delivery of the needed supplies and equipment at the rock. The Commissioners of Northern



Drawing of the schooner *Sir Joseph Banks*. From the author's collection.

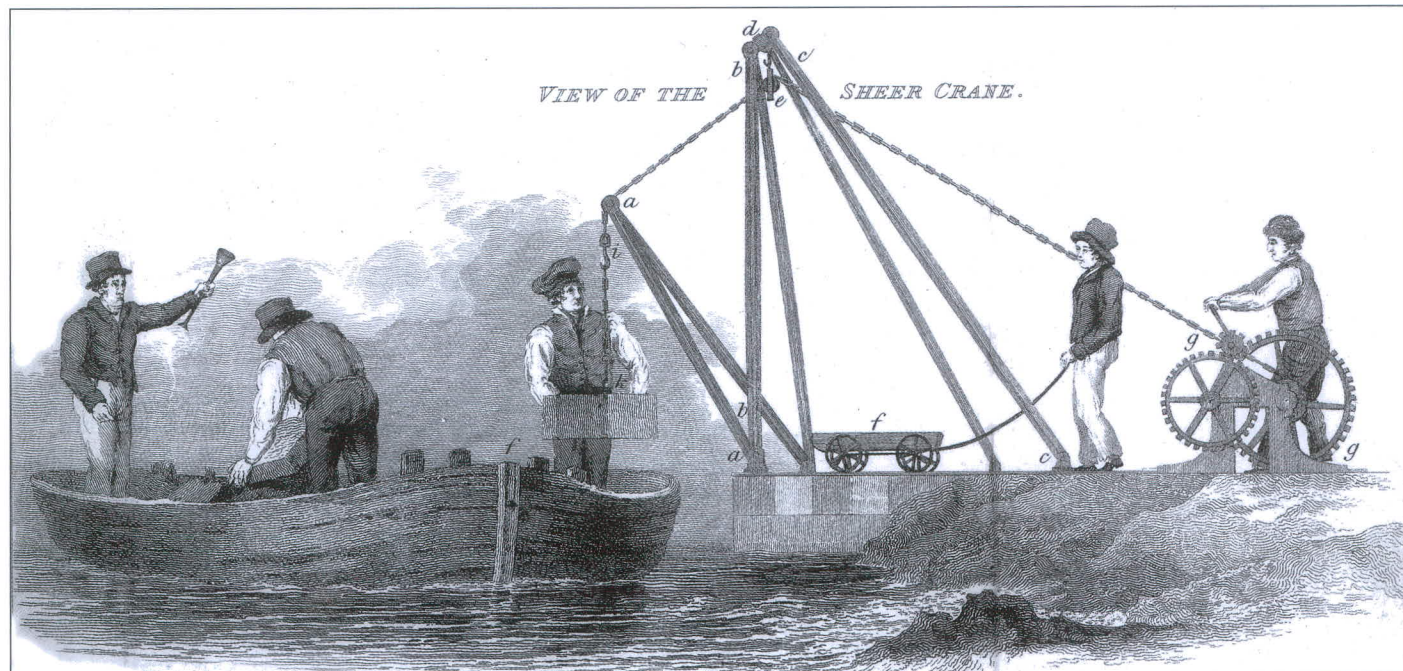
Lights decided that an additional tender would be necessary and Robert Stevenson was ordered to procure an appropriate vessel at the port of Arbroath. Stevenson purchased a small schooner on January 18, 1808 and began the job of fitting her out to meet the needs of the service. It was decided to name the schooner *Sir Joseph Banks* in honor of the man who had gotten the loan for the construction of the Bell Rock Lighthouse approved by Parliament.

Stevenson also had three new Praam boats made for the transfer of finished stones to the Bell Rock. Each of these boats was twenty-eight feet in length and eight feet six inches in width by two feet in depth. Associated with the Praam boats was a Stevenson modified triangular or "Sheer" crane used to move the finished stones from the boat onto the rock.

Stevenson also designed a cast-iron railway that was to be erected upon the rock for the transfer of stones from the Praams to the building site. The railway consisted of four foot sections of rail supported by vertical cast-iron stanchions anchored into the rock.

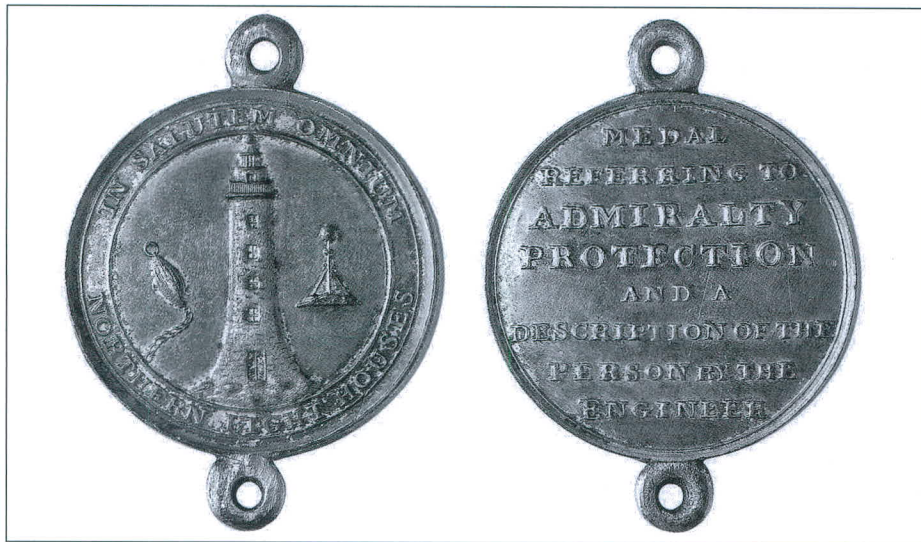
With the large amount of heavy lifting of stones anticipated on the construction site, Robert decided that a new style easily movable crane would be needed. He invented what he called the "movable beam crane" and had three produced for use on the site.

The first trip to Bell Rock for the year 1808 occurred on March 30 and the first landing was on the following day. The temporary beacon was found to be in good con-



Praam boat and the sheer crane. Drawing from *The Account of the Bell Rock*.





Left – The protection medal issued to avoid workers being impressed into wartime Naval service. Photos from the author's collection.

sure of rum and they began their first work of the season with three hearty cheers while the lighthouse flag was raised above the temporary beacon. At the same time there were sixty men working at the Arbroath yard on shore, continuing to finish the stones for each course and to test fit them together on the assembly stage in the work yard.

The first task at the rock was the removal of the buildup of seaweed and barnacles in the foundation pit for the tower that had been started during the previous year's work. The pit was now several inches deep, but

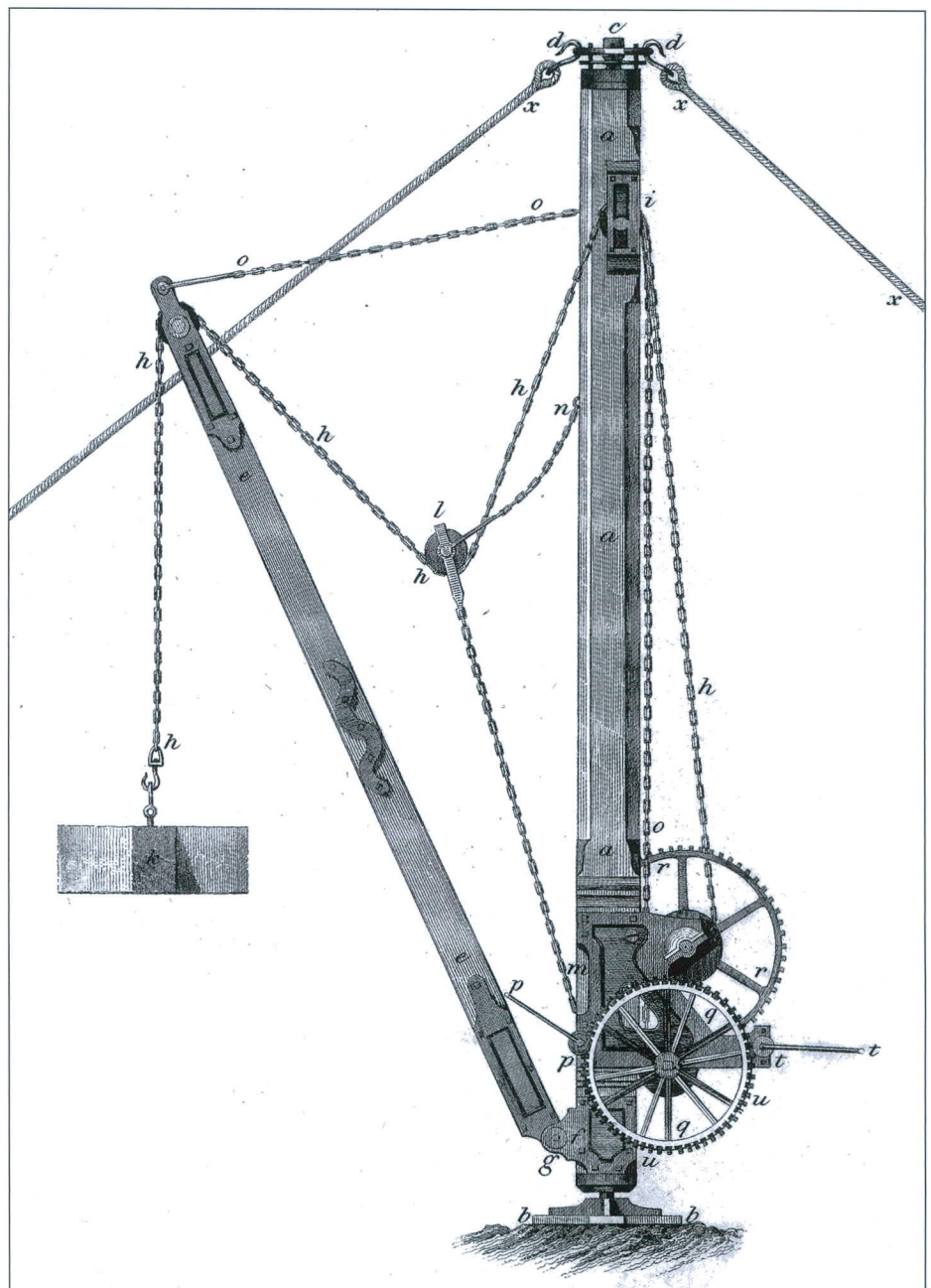
dition having weathered the winter storms well. In 1807, Stevenson had decided to replace the support chains of the beacon and he took measurements for the creation of cast-iron bar supports and then returned to Arbroath to have them produced.

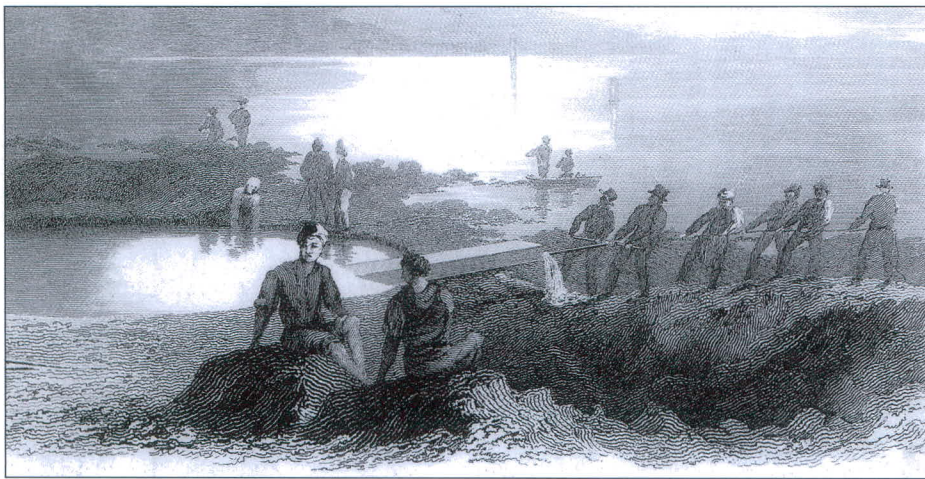
The current war with France caused the activation of the Impress Service in the local ports, including that at Arbroath. With five vessels now employed in the service of the Bell Rock construction, the impress gangs became a serious problem for the Commissioners of Northern Lights. The commissioners requested that the Admiralty allow the protection of the thirty-five most important seaman on the project. Without this protection the men could be forced into military service by the impress gangs at any time. The Admiralty agreed based on the national need for Bell Rock Lighthouse.

The impress officers were extremely rigid in the execution of their duties and this required the careful identification of each of the thirty-five seamen the board wished to be protected. It was decided that each of the men should carry on his person, a special protection medal designed by the Commissioners of Northern Lights along with a written description of the man himself and his position within the Bell Rock Service.

The *Sir Joseph Banks* visited the rock for the first time on May 20, 1808 to deliver supplies. Actual construction on the rock began on May 26th when fourteen men were transported to the rock along with the foreman and Robert Stevenson. When they arrived on Bell Rock they were each given a mea-

Right – The movable beam crane. Drawing from *The Account of the Bell Rock*.





Pumping out the foundation pit. Drawing from *The Account of the Bell Rock*.

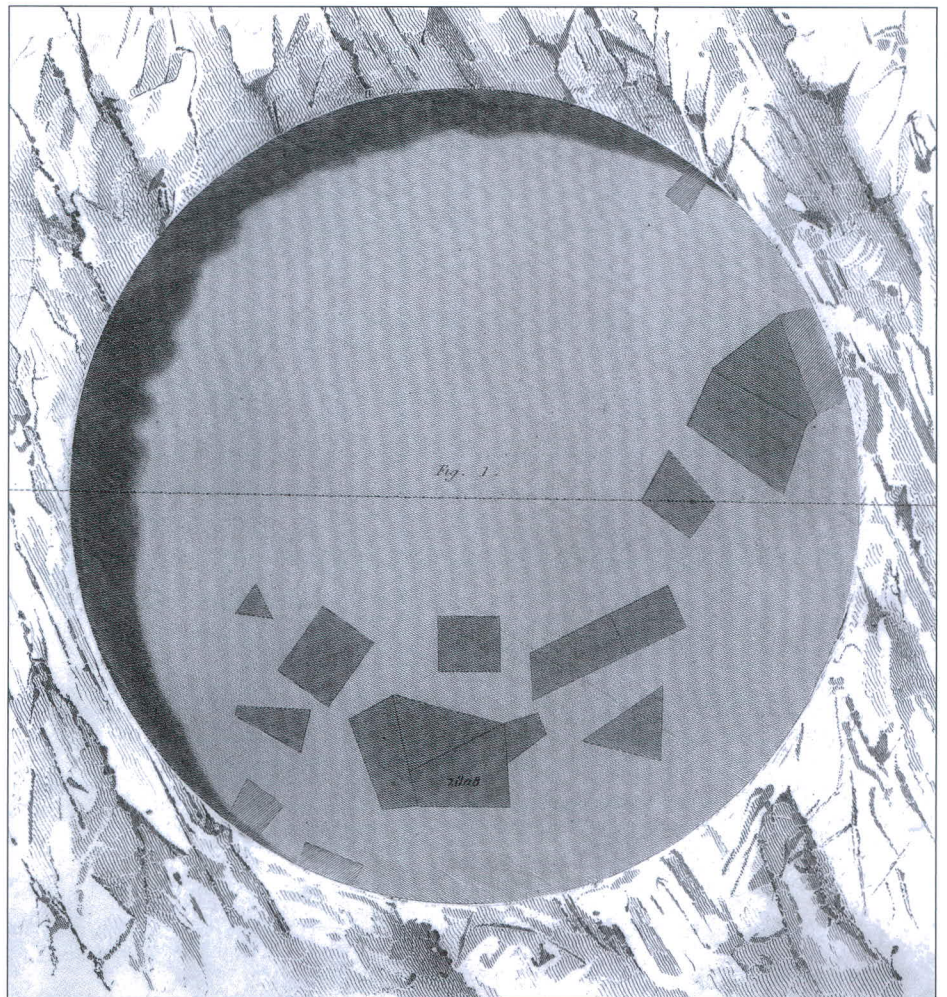
needed to be cut further into the rock to a minimum of at least fourteen inches of depth across the entire surface of the foundation. Before work could begin at the start of each shift, the sea water had to be pumped from the pit using a twelve-foot long hand-operated wooden pump. On May 30th the first parts of the cast-iron railway were brought to the rock and temporarily stored in the beacon house. By this time there were twenty-eight workmen on the rock each day.

As the foundation pit was cleared, thousands of stone chips were produced that had to be removed. They could not be just thrown into the sea because they would invariably be swept back into the pit through the action of the sea. Therefore it was decided that the chips and slivers of stone should be swept up, collected, and thrown into the hold of the tender *Smeaton* where they were then taken back to the port of Leith. When these stone chips arrived in Leith they became prized souvenirs for the seamen and general public. Robert Stevenson even remarked that had they been taken to Edinburgh they could easily have been sold at a significant profit.

Back in Arbroath the tower stones were rapidly being completed. On June 4 the first complete course was finished and fitted into position on the test platform. Two days later a group of thirty-four workers sailed for the rock to continue the assembly of the railway and to further deepen the foundation pit for the lighthouse.

On June 14 the first course of stones was removed from the test platform and prepared for eventual shipment to the Bell Rock. The work at the rock was progressing rapidly with a major portion of the railway now affixed to the rock and the foundation pit nearing completion.

Two tenders loaded with sixty-two workers left Arbroath on Monday, June 20, 1808 for the rock. By this time the men were working both day and night whenever the sea was at low tide. Night work was accomplished through the use of torch lights placed around the foundation pit.



The foundation pit with specially-cut void filling stones. Drawing from *The Account of the Bell Rock*.

On June 27 a test was made to see if a tender could be brought close enough to the landing spot on Bell Rock to allow the direct off loading of the tower stones. This test failed and it was decided that the stones would be off loaded into a Praam boat and then the Praam boat would bring the stones to the rock where they could be off loaded onto the railway cart.

By June 30 the railway had been completed for over one hundred feet of its eastern branch and the foundation pit had been excavated to its needed depth in most locations with little stone remaining to be removed. On shore, the second course of stones was nearly complete on the test platform and stones for many other courses were completed or in progress.

On July 6 the foundation pit had been completed and measurements were taken of the areas of the pit where cracks and voids needed to be filled. The smaller voids were filled with cement and the larger voids were

to have special stones fitted to fill the void and allow a smooth finished floor in the pit. The pit was now forty-two feet in diameter and from fourteen inches to two feet deep into the Bell Rock.

On July 10, 1808, the first of the special foundation stones arrived at the site and they were placed into the pit with great ceremony. Prayers were read and three great cheers were given by the men. One of these stones was marked with the year to commemorate the occasion. However, each of these stones required hand fitting to match the specific crack or void they were to fill. This hand operation had to be done on the floor of the pit and took many days to complete. On shore work continued and nearly all of the stones in the first four courses were now complete.

The last of the special stones was completed and set in position on July 26, which made the pit ready to receive the stones of the first course. On July 28 the *Smeaton* was loaded with some of the stones for the first course and set sail for Bell Rock. She arrived in the early afternoon and part of her cargo was landed upon the rock and moved via the railway to the foundation pit where the movable crane was used to place each stone into its final position on the floor of the pit. Each stone had two tree-nail holes bored through it in a vertical direction. After the stone was set in position drills were used to continue

these holes vertically down into the floor of the pit and long oak rods (tree-nails) were driven down through the stone into the pit floor and set into the holes with wooden wedges. In addition each stone was formed with external dove tail flanges that fit into its neighboring stones. The combination of the dove tails and tree-nails created a very solid layer of finished stones. On the next day the last twelve of the remaining stones in the first cargo were off loaded from the *Smeaton* and placed into position.

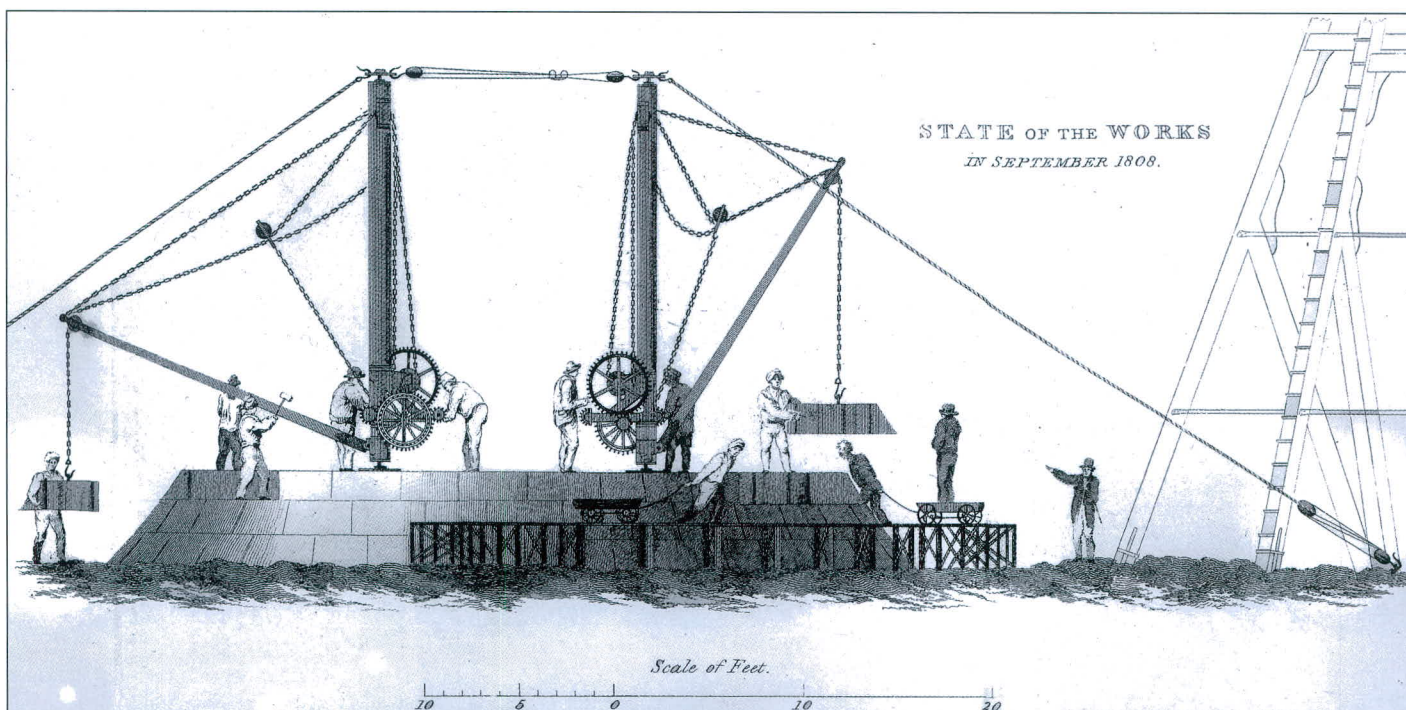
On August 12, 1808 the last of the 123 stones in the first course was placed into the pit and tree-nailed to the rock. On shore the second complete course had been finished and was being moved down to the harbor for eventual transfer to Bell Rock. By August 20 the first stones of the second course began movement to the Bell Rock and by the 27th all of the 136 stones in this course had been moved and placed in position. By September 9 the third course had been completed on shore and the first ten stones of this course were laid that night upon the Bell Rock and affixed to the second course stones with tree-nails. By September the tenth, the foundation stones in the first two courses had reached a height where it was no longer necessary to pump out the sea water before beginning each work shift. The water could be cleared with the use of a few bailing buckets.

In addition to the construction of the tower, work was in progress on the finishing of the framing of the upper portion of the beacon house. At the same time, other workmen were finishing the remaining outer portions of the cast-iron railway.

By September 21, most of the stones for the third course were in position. Unfortunately that day brought disaster when a young 18 year old seaman, James Scott, was killed in an accident. He was mooring a workboat to the ring of a buoy whose chain had caught on a rock and had been partially pulled under water. As he pulled the hawser through the buoy ring its mooring chain released and the buoy came exploding from the water hitting him in the head and overturning his boat. He drowned before anyone could reach his body.

The final seventeen stones of the 141 in the third course were laid that day and the work for the 1808 season was nearly complete. On September 25 all work stopped and the remaining men were removed from the Bell Rock.

Finally, on October 31, 1808, Robert Stevenson made a last trip to the rock for an inspection and found all in good order. On shore work continued during the remainder of 1808 on the completion of finished stones for the fourth and other remaining courses.



State of construction on Bell Rock at the end of September, 1808. Drawing from *The Account of the Bell Rock*.

# BELL ROCK — PART IV

## THE 200TH ANNIVERSARY OF A SIGNIFICANT LIGHTHOUSE

By Thomas A. Tag

### Introduction

The year 2006 marked the beginning of an important anniversary in the history of famous lighthouses, the 200th anniversary of the building of the Bell Rock Lighthouse in Scotland. See *The Keeper's Log* Volume 25, Number 2 for the story of what happened during the year 1808. This story covers the developments 200 years ago, in 1809, when construction continued upon the Bell Rock to complete the main lighthouse. Future stories are planned for each of the years of 2011 through 2012, which will describe the happenings at Bell Rock 200 years previously as this famous lighthouse was built.

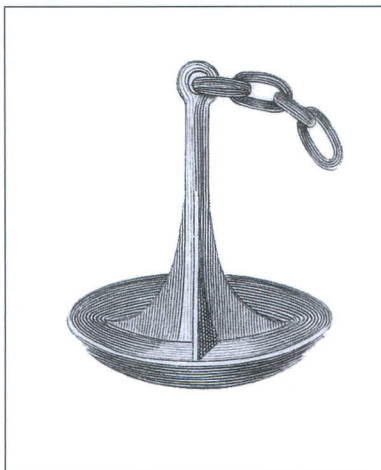


The first landing at the Bell Rock in the year 1809 occurred on January 20 when Robert Stevenson sent a team of men to the rock. They were checking for winter storm damage and found that part of the cast-iron railway that had been built during 1808 had been damaged. Parts of the railway were missing and a 100-pound piece was found at the opposite end of the rock. Some of the chains holding the temporary beacon house to the rock were found broken or pulled from the rock and a 2,500-pound piece of loose rock was found thrown up by the waves and onto the Bell Rock. The workers refastened the chains and gathered the parts of the railway that could be found. The weather was too bad for any continued work on the rock and the workers returned to Arbroath after an hour on the rock.

During February the ninth full course of stones for the tower was completed and placed in position on the test platform in Arbroath. By the end of the month most of the tenth course was also completed.

On March 8, 1809, a team of men was sent to the Bell Rock to try to break up the 2,500-pound stone that had been found in January. At the same time it was found that the anchors of the floating light had slipped

several times and Robert Stevenson decided that a new anchor design was required. He worked for some time and designed the first "mushroom anchor" that has now become the standard anchor style for lightships.



The mushroom anchor design of Robert Stevenson. Drawing from *The Account of The Bell Rock*.

The Northern Lighthouse Board also determined during March that an additional ship was needed to carry supplies to the Bell Rock. They purchased a sloop similar to the Smeaton and named the new ship the *Patriot*.

By April 20, the weather had improved sufficiently to allow the tender *Sir Joseph Banks* to land at Bell Rock carrying 15 workers who were assigned to clean up the work area. They found the rock cluttered with debris from winter storms. The debris was quickly cleared. They also worked to replace missing pieces of the railway and to strengthen the beacon house. On May 1, Robert Stevenson arrived at the rock for the first time this season. He assessed the railway and cleanup and decided that work on the tower could start by the end of the month.

On Saturday, May 27, the first major work on the tower began when 36 men arrived at the rock and gave a hearty cheer to start the work for the season. The work progressed steadily and the men could stay in the beacon during high tide, allowing them to quickly return to work as the tide fell.

Eleven men were left on the rock for the night on June 1, when a severe storm hit the area. By morning the wind had raised into such a gale that no ship could approach the rock to remove the men. These 11 men were trapped upon the rock for several days.

Back in Arbroath, the stone masons had completed the full 16th course of the tower and had placed it on the test platform. By June 4, the gale had subsided and the workers could be relieved. The tower construction was progressing at a steady state with the laying of 12 to 20 stones per day. On June 27, a total of 33 stones were laid in a single day, and on that day an additional 66 stones were landed upon the rock. At this time eight full courses of stones had been completed of the tower.

On July 8, for the first time, the tower was complete enough that the seawater no longer washed over it at high tide. This eliminated the cleanup process that had had to be done at the start of each work period, greatly speeding up the construction. In addition, a rope walkway was fashioned that connected the lowest platform of the beacon tower to the top course of the lighthouse tower. As each course was completed, this rope walkway was raised to allow the workmen direct access from the beacon tower to the light-



Robert Stevenson. Photo from the author's collection.

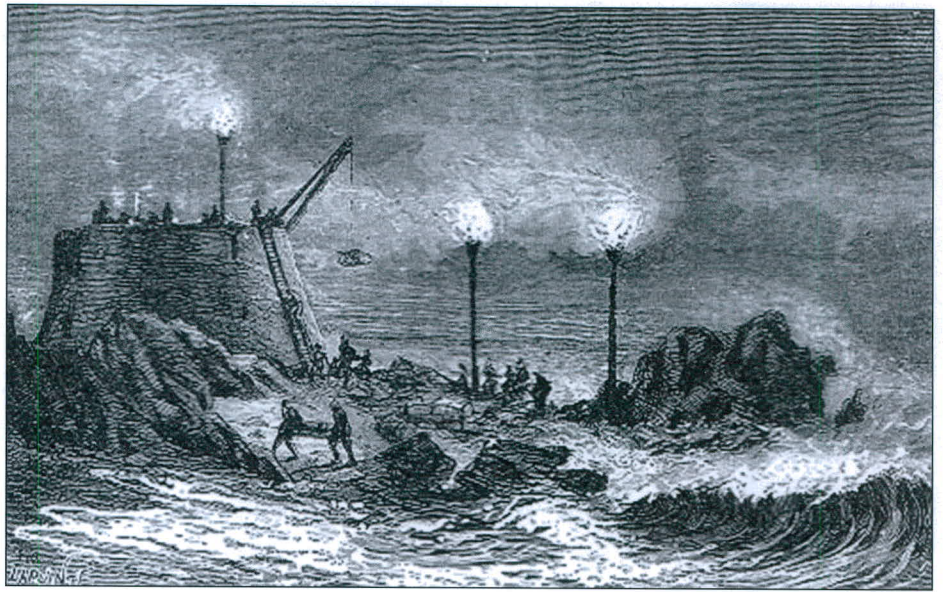
house tower. At this point the lighthouse tower stood about 13 feet above the rock and on July 12, the 11th complete course of the tower was laid.

By August 10, twenty-six stones of the 20th course were landed on the rock and these were laid the same day. Work was now in progress both day and at night. The work in the dark was facilitated by the use of torches placed around the work area.

On August 25, work for the 1809 season had to be stopped with the laying of the 24th course of the tower because all completed stones had been laid. The upper surface of the tower was now 31 feet 6 inches above the surface of the Bell Rock.

On August 30, a number of artificers returned to the rock for a final cleanup before winter. They brought with them new cast-iron supports for the beacon tower. The cast-iron supports were quickly installed and greatly strengthened the beacon.

During the period from September through mid-November various trips were made to the Bell Rock to complete the con-



**Above: Work by Torchlight.** Drawing from the Author's Collection.

**Below: The appearance of the Bell Rock Lighthouse at the end of 1809.** Drawing from *The Account of the Bell Rock*.

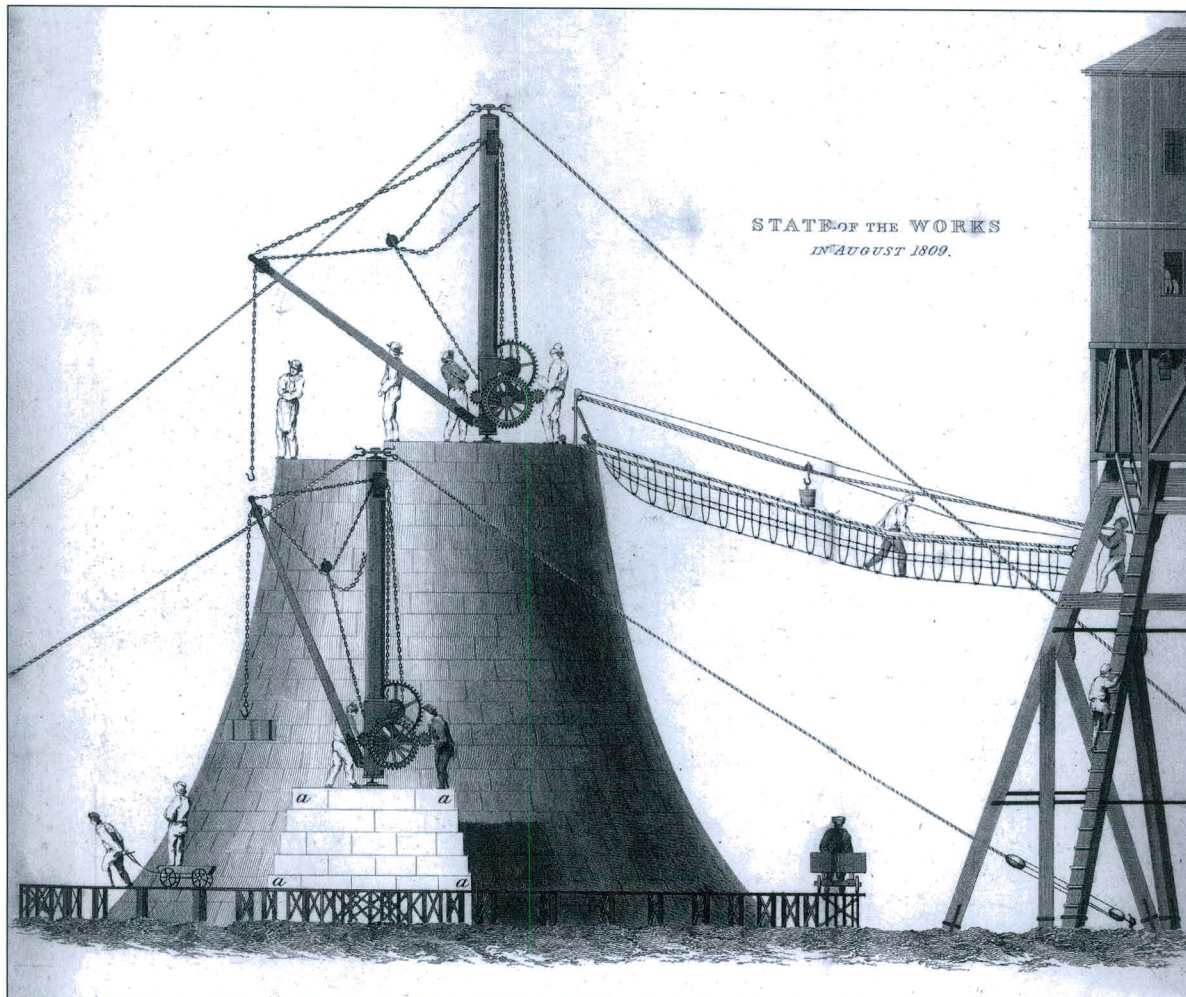
struction of the cast-iron railways and to remove the forge and other heavy items from the rock for the winter.

On November 22, a tender brought five workmen to the rock. When they landed they found that one of the unloading cranes had been severely damaged when the waves

raised a stone from the deep that crushed the front leg of the crane.

Finally, on December 14, the last trip of the season was made to the Bell Rock to secure all items on the rock. The tender also brought winter provisions for the floating light, and the workmen repaired the leg of the damaged crane.

A year from now you can read the next installment about the happenings at the Bell Rock during the year 1810, when the tower is completed.



# BELL ROCK — PART V

## THE 200TH ANNIVERSARY OF A SIGNIFICANT LIGHTHOUSE

By Thomas A. Tag

### Introduction

The year 2006 marked the beginning of an important anniversary in the history of famous lighthouses, the 200th anniversary of the building of the Bell Rock Lighthouse in Scotland. For the past several years, we have been exploring the events during each year of construction 200 years ago. See *The Keeper's Log*, Volume 26, Number 2 for the story of what happened during the year 1809. This is the final chapter of the story, covering the developments in 1810 and 1811, when construction continued upon the Bell Rock and the lighthouse was completed. As you read this, it is almost exactly 200 years since the Bell Rock Lighthouse was lighted for the first time in 1811.

### Events of 1810

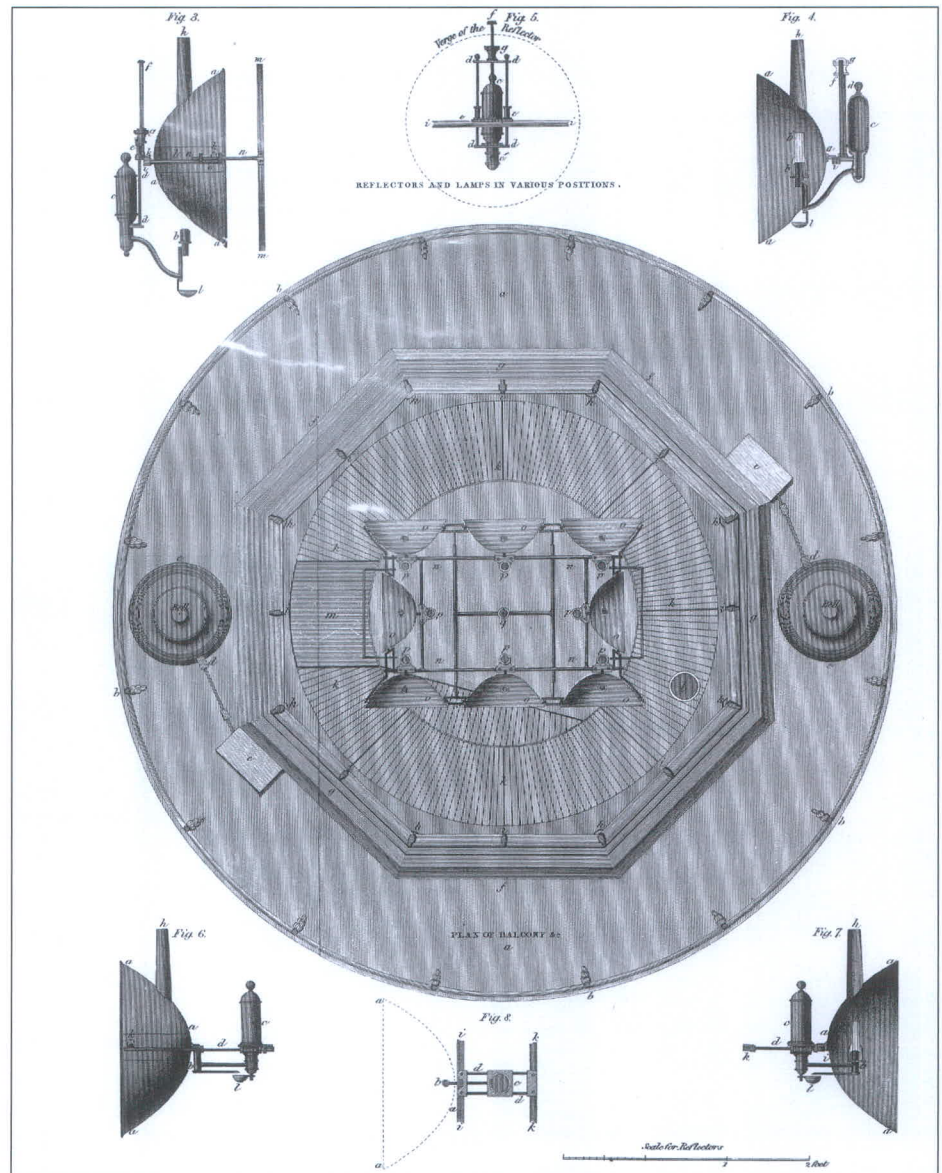
The first trip to the Bell Rock was made on January 5, 1810, to assess and clean up any damage from winter storms. The rock was again visited during March, and it was found that three large boulders had been thrown up onto the rock by the sea with some minor damage to the iron railway used to carry the finished stones from the landing area to the lighthouse where they could be laid.

By April of 1810, the 44th course of stone had been cut and was finished in the yard at Arbroath, ready to be sent to the Bell Rock when the construction season began later in April. The lantern and parabolic reflectors were under construction in Edinburgh. Also in Arbroath, special stones made of very hard liver-stone from the Craigeith Quarry were procured and sculptured to form the floor of the lantern and the parapet and cornice of the tower.

Robert Stevenson was worried that the light of the Bell Rock would not be distinctive from the other lights in the area. There were many fixed lights within the area, and several nearby lights also used the flashing principle. He therefore decided to use flashing with color to distinguish the light from the Bell Rock.

In the spring of 1810, many trials of different colors were made from the lighthouse at Inchkeith, which was observable from Stevenson's home. It was found that only the color red was easily distinguishable. During the trials, ruby-red shades were placed in front of the reflectors and their light could easily be seen at a distance of eight miles from the lighthouse. One problem with the

use of color for a characteristic concerned the use of color at the Flamborough Head Lighthouse. It was located some 170 miles to the south and used a triangular frame with one side red and two sides white, giving a red-white-white characteristic. Stevenson chose to solve the problem by using a rectangular frame, showing red-white-red-white as the Bell Rock's characteristic.



View of the reflector chandelier from above. Note reflector views in each corner. Drawing from *Account of the Bell Rock*.

It was decided that the barracks and lighthouse should be connected with a strong wooden bridge instead of the ropewalk used in 1809. Plans were prepared for the bridge during March of 1810, and on April 18 the first work crew landed on Bell Rock and began the construction season. On board the tender were the main beams for the new wooden bridge. The bridge construction was completed on April 28.

On May 1, Stevenson set sail from Leith bound for the rock. One of the first accomplishments of this season was to be the fitting of the new balance crane that had been designed by Stevenson. The crane was brought to the rock and carefully lifted to the top of the unfinished tower where it would be used throughout the final construction of the tower. As the tower progressed in height, the crane would be continuously moved higher and higher to allow it to lift the stones of each new course.

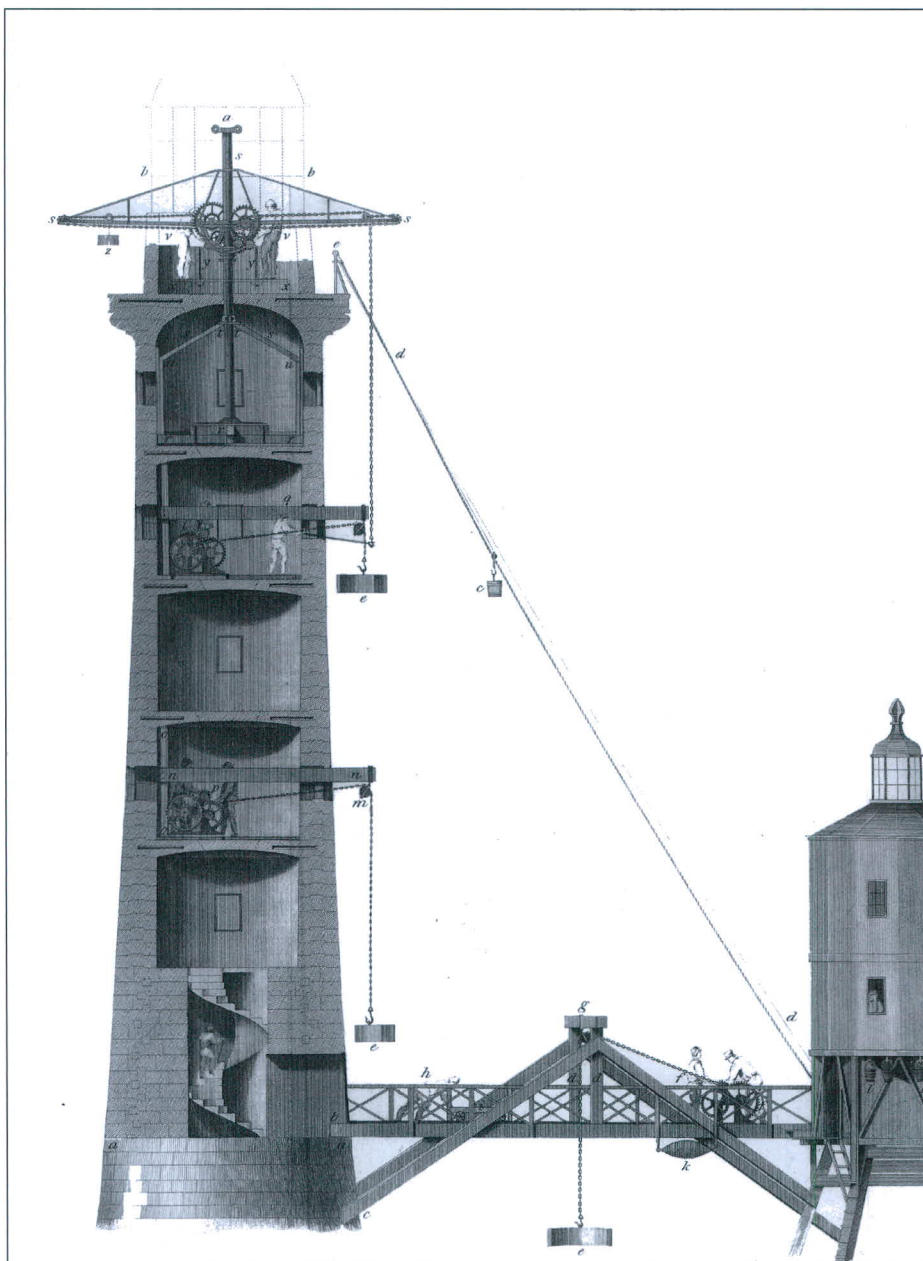
During 1809 the 26th course of stone had been completed on the rock. By May 18, 1810, the balance crane had been placed on top of the tower and the stones of the 27th course arrived at the rock to be placed into position. The first stone of the 1810 season was laid on May 18, and by May 22 the stones of the 31st course had been laid, making a total of five full courses laid in only four days work. By June 4, five additional courses had been laid.

The status of work at Arbroath on June 5 showed that only three courses of stone remained partially unfinished and all of the rough stones had been received from the quarries. Likewise, in Edinburgh the lantern and illuminating equipment were nearly finished. Stevenson sent word to the quarries to shut down, and he quickly paid off the workers there.

By June 14, the 47th course was ready to be laid. This course was made up of the large pieces of stone for the tower's storeroom floor. Special construction methods had to be used to temporarily support these floor stones until they were securely held in position by both the cement and weight of higher courses. Wednesday, June 27, 1810, brought the laying of the 62nd full course of stone.

The political leadership of the town of Arbroath, where the stones were dressed, asked to be taken to the Bell Rock to see for themselves its state of construction. Stevenson was pleased to have them visit the construction site on July 3.

Stevenson then returned to Edinburgh



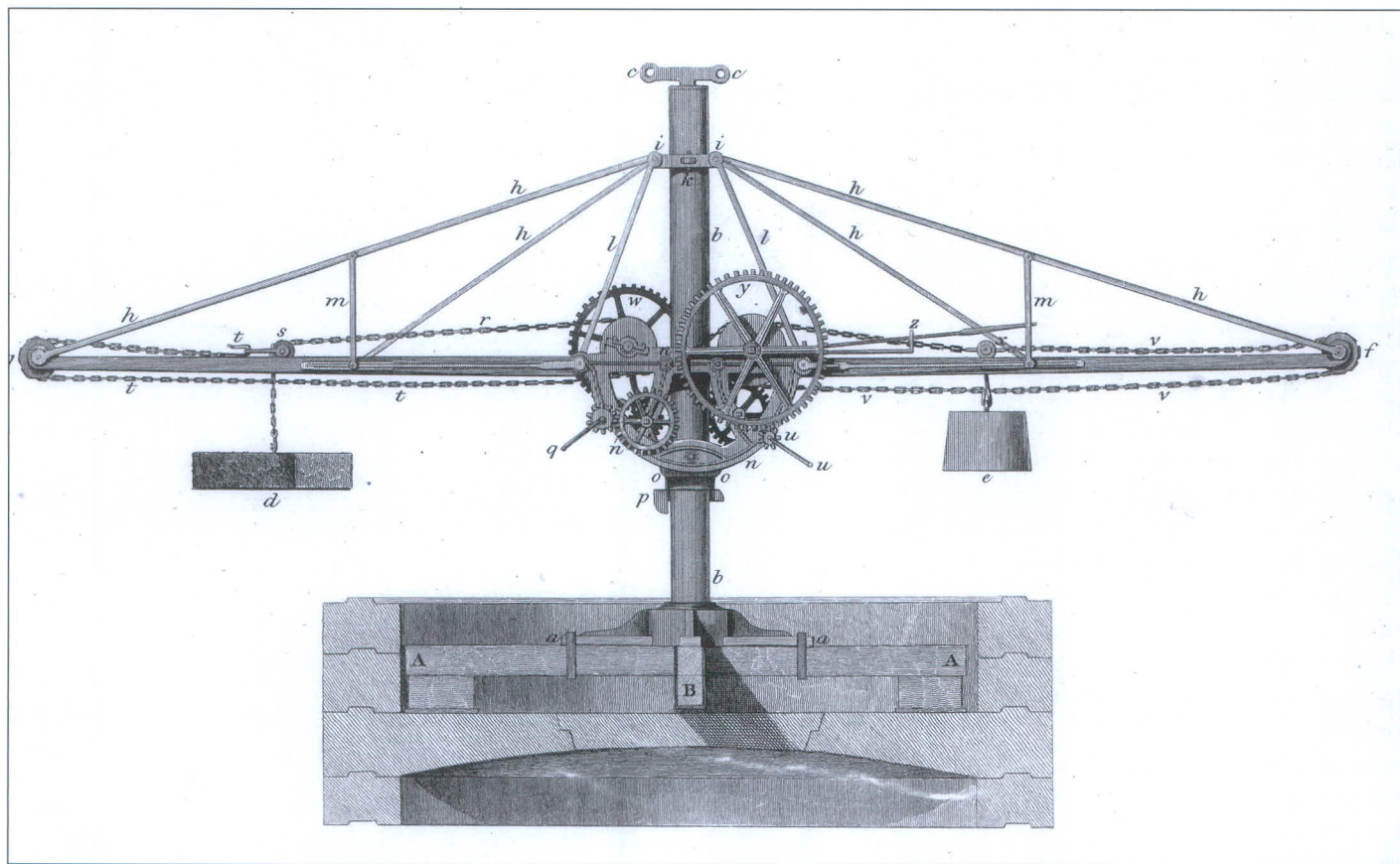
The bridge connecting the tower and the barracks. Drawing from *Account of the Bell Rock*.

and found the light-room and reflecting apparatus nearly finished when he visited the Greenside Company's works where it was being made. He had also received information from Mr. Prescott that the plate glass for the lantern windows would soon be ready; and Messrs. Meirs and Son of London stated that they would cast the fog bells at any time, on receiving a week or 10 days notice. The only article connected with the light-room, regarding which there was a doubt, was the colored glass for distinguishing the light, which had long ago been commissioned from Mr. Okey of London, who, though a very ingenious artist, was rather difficult to pin down as to a date for shipment.

The final stonework for the tower was completed at Arbroath on July 6, 1810, and on July 9 the tender *Patriot* loaded the final cargo of finished stones from the Arbroath work yard and set sail for Bell Rock.

The 81st course of stone was laid on July 16. This course was special in that it formed the dome of the library, just below the lantern, and possessed a special groove around its circumference into which an iron bar ring was laid and then covered with molten lead. The iron-bar ring was designed to absorb the outward pressure that the library's domed ceiling produced on the outer tower wall.

On July 22, 1810, the final special cornice stones made from liver-stone were delivered



The balance crane. Drawing from *Account of the Bell Rock*.

to the Bell Rock, and on July 26 the cornice and balcony and floor of the lantern were laid, except for the center stone of the lantern floor.

The final stone in the walls of the tower was laid on Monday July 30, 1810, and a ceremony was held by Stevenson and the entire construction crew to dedicate this stone.

It was not until September 2 that the wooden bridge, built at the start of the season, was torn down and replaced with the old rope bridge. The last stone of the lighthouse, which was the top step of the stairs to the first floor, was set in place with much ceremony. By early October, construction work was begun on the lantern and the lantern glass arrived at the rock.

Then, on October 16, 1810, a very unfortunate accident is recorded as follows:

The light-room work had proceeded, as usual, to-day, under the direction of Mr. Dove, assisted in the plumbing work by Mr. John Gibson, and in the brazier work by Mr. Joseph Fraser; while Mr. James Slight, with the joiners, were fitting up the storm shutters of the windows. In these several departments, the artificers were at work till 7 o'clock P. M.,

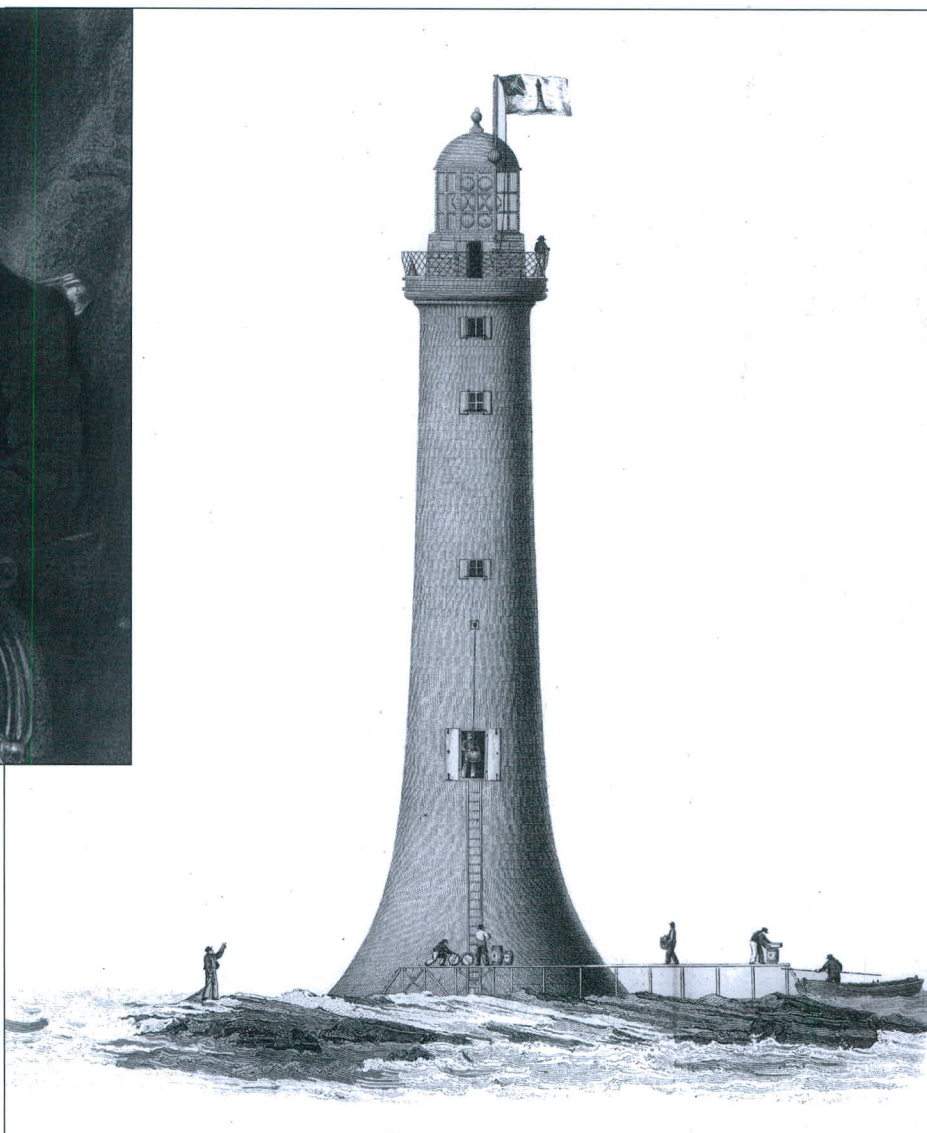
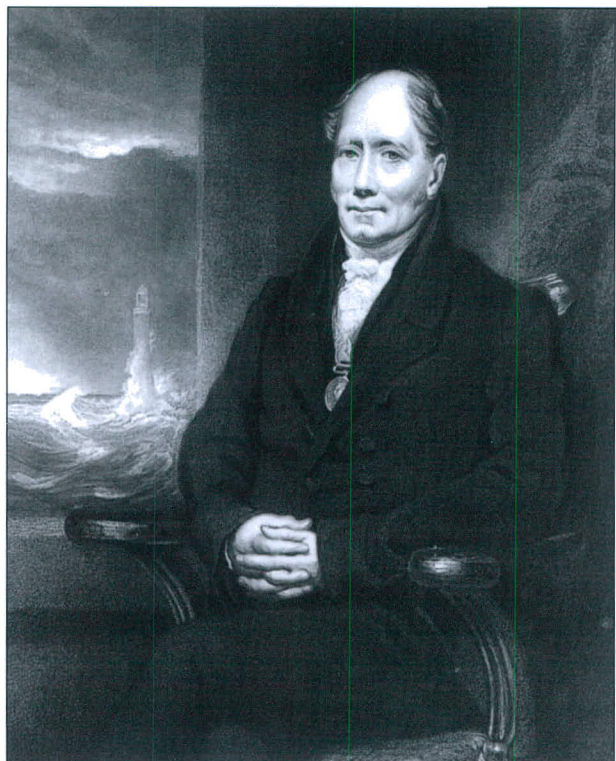
and it being then dark, Mr. Dove gave orders to drop work in the light-room; and all hands proceeded from thence to the beacon house, when Charles Henderson, smith, and Henry Dickson, brazier, left the work together. Being both young men, who had been for several weeks upon the rock, they had become familiar, and even playful on the most difficult parts about the beacon and building. This evening they were trying to outrun each other, in descending from the light-room, when Henderson led the way; but they were in conversation with each other, till they came to the rope ladder, distended between the entrance-door of the lighthouse and beacon. Dickson, on reaching the cook-room, was surprised at not seeing his companion, and inquired hastily for Henderson. Upon which the cook replied, "Was he before you upon the rope ladder?" Dickson answered "Yes; and I thought I heard something fall." Upon this the alarm was given, and links were immediately lighted, with which the artificers descended on the legs of the beacon, as near the surface of the water as possible, it being then about full

tide, and the sea breaking to a considerable height upon the building, with the wind a S.S.E. But after watching till low water, and searching in every direction upon the rock, it appeared that poor Henderson must have unfortunately fallen through the rope ladder, and been washed into the deep water.

The deceased had passed along this rope ladder many hundred times, both by day and night, and the operations in which he was employed being nearly finished, he was about to leave the rock when this melancholy catastrophe took place. The unfortunate loss of Henderson cast a deep gloom upon the minds of all who were at the rock, and it required some management on the part of those who had charge, to induce the people to remain patiently at their work; as the weather now became more boisterous, and the nights long, they found their habitation extremely cheerless.

On October 23, 1810, the ventilator ball was placed atop the lantern and a seven-gun salute was fired from the tenders to commemorate the occasion. The glazing of the lantern was completed on the following day.





Clockwise from above: Robert Stevenson with the Bell Rock Lighthouse in the background. Drawing from author's collection. The Bell Rock Lighthouse with construction complete. Drawing from *Account of the Bell Rock*. The Bell Rock Lighthouse as seen today. Photo from author's collection.



The main outside door to the lighthouse was put into place on October 30, and the workers moved from the barrack house into the various rooms within the lighthouse where clean up and minor construction continued.

The apparatus for the light-room remained in Leith awaiting the red-colored glass that was to distinguish two sides of the reflector chandelier. Finally, on December 1, 1810, the red glass arrived from London, and on December 9 the light-room equipment was shipped from Leith to the lighthouse.

Due to strong winter gales, the light-room apparatus could not be landed on the Bell Rock until December 15. Construction and adjustment of the reflectors, lamps, clockwork, and chandelier then began. Back in Leith, the advertisement of the light was made by the Northern Lighthouse Board with the following notice to mariners:

**Navigation of the North Seas.** – A Light-house having been erected upon the Inch Cape, or Bell Rock, situate at the entrance of Frith of Forth and Tay in north Lat. 56° 29', and west Long. 2° 22'.

The Commissioners of the Northern Lighthouses hereby give notice, that the light will be from oil, with reflectors, placed at the height of about 108 feet above the medium level of the sea. The light will be exhibited on the night of Friday, the 1st day of February 1811, and each night thereafter, from the going away of daylight in the evening until the return of daylight in the morning. To distinguish this light from others on the coast, it is made to revolve horizontally, and to exhibit a bright light of the natural appearance,

and a red-colored light, alternately, both respectively attaining their greatest strength or most luminous effect in the space of every four minutes; during that period, the bright light will, to a distant observer, appear like a star of the first magnitude, which, after attaining its full strength, is gradu-

ally eclipsed to total darkness; and is succeeded by the red-colored light, which in like manner increases to full strength, and again diminishes and disappears. The colored light, however, being less powerful, may not be seen for a time after the bright light is first observed. During the continuance of foggy weather, and showers

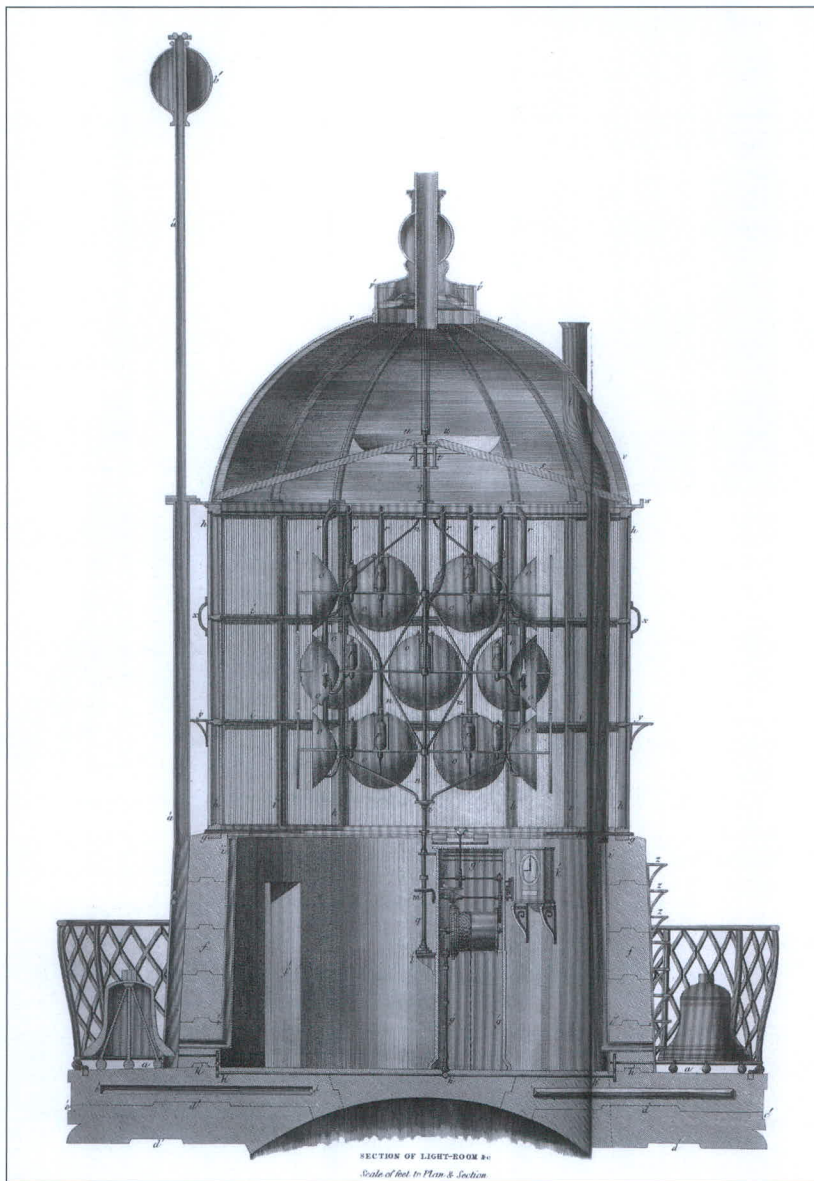
of snow, a bell will be tolled, by machinery, night and day, at intervals of half a minute. Notice is hereby also given. That the floating light, moored two and a half miles N.W. ½ N. from the Bell Rock, will, from and after the 1st day of February 1811, be discontinued, and, as soon thereafter as the weather permits, the vessel will be removed from her station.

On December 27, 1810, the work on the Bell Rock Lighthouse was finished. They now had to wait for several weeks before the light was lit to allow the notification of its presence to be made to all mariners. Four light keepers were left in the lighthouse that would continue to finish the work of arranging its kitchen, storerooms, and bedrooms.

### Events of 1811

At last, on the night of February 1, 1811, the light was first exhibited from the Bell Rock Lighthouse and the former lights on the floating light were darkened for the last time. The floating light arrived in Anstruther harbor on February 12, where it remained until sold later in the year. The final work done was the removal of the beacon-barrack house from the Bell Rock at the end of September 1811.

Stevenson became famous through his leadership and inventive genius in the design and construction of the Bell Rock Lighthouse. This was only the second lighthouse constructed on a sea-swept rock and is now the oldest such tower in existence. The Bell Rock Lighthouse became the crowning achievement of Stevenson's career.

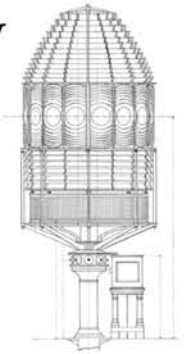


The Bell Rock lantern and illuminating equipment. Drawing from *Account of the Bell Rock*.

ally eclipsed to total darkness; and is succeeded by the red-colored light, which in like manner increases to full strength, and again diminishes and disappears. The colored light, however, being less powerful, may not be seen for a time after the bright light is first observed. During the continuance of foggy weather, and showers



# Join the U.S. Lighthouse Society Today or Give the Gift of Membership!



## *Restoration & Preservation*



*Thomas Point Shoal Lighthouse, MD*

*The U.S. Lighthouse Society has donated to many lighthouse preservation projects throughout the U.S. Most recently we were honored by being presented with the Preserve America Stewardship Award from The White House for our restoration work at Thomas Point Shoal Lighthouse.*

*To learn more visit  
**www.uslhs.org**  
or  
call Headquarters at  
415-362-7255*

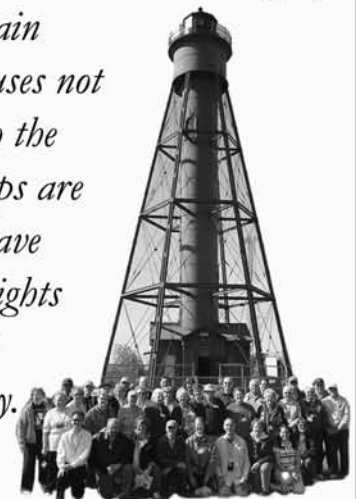
## Help Support Our Important Mission!

## *Education*



*The Keeper's Log magazine is the only one of its kind and has been published quarterly since 1984. Receive this award-winning publication as a benefit of membership.*

*The Society organizes domestic and international lighthouse tours. Many of our excursions gain access to lighthouses not normally open to the public. These trips are a great way to have fun, see lots of lights and learn about lighthouse history.*



*Tincum Lighthouse, NJ*