

see also RFair filebox, "Lighthouses (Scotland)"

and Bassey were covered in ribbons, streamers and bows. The masons all had new aprons. When this last stone was landed and laid as the lintel of the lightroom door there was due Masonic ceremony.

On Friday, August 3, the centre stone of the lightroom floor was laid, again with Masonic ceremony. In July, 1810, the Commissioners decided to buy a piece of land next to Arbroath Harbour which had an unobstructed view of the lighthouse on which a complex of buildings could be erected to accommodate the lighthouse keepers' families, the seamen and Master of the tender, and as store-houses.

John Nicol, a writer in Arbroath, purchased the ground on behalf of the N.L.B. The complex was to have a small courtyard and a bleaching green. At the end of July, 1810, a lighthouse vessel went to Mylnefield to load the first cargo of stone to build the Signal Tower complex.

On Saturday, August 4, the artificers all returned to Arbroath from the rock and were welcomed by a large crowd. That evening, Stevenson invited the builder foreman, Peter Logan, Francis Watt, joiner; Captain James Wilson, landing master; Captain David Taylor, of the tender 'Smeaton'; David Logan, Clerk of Works at Arbroath; Lachlan Kennedy, engineer's clerk and book-keeper, and some friends, to the principal inn where they all relaxed and enjoyed themselves.

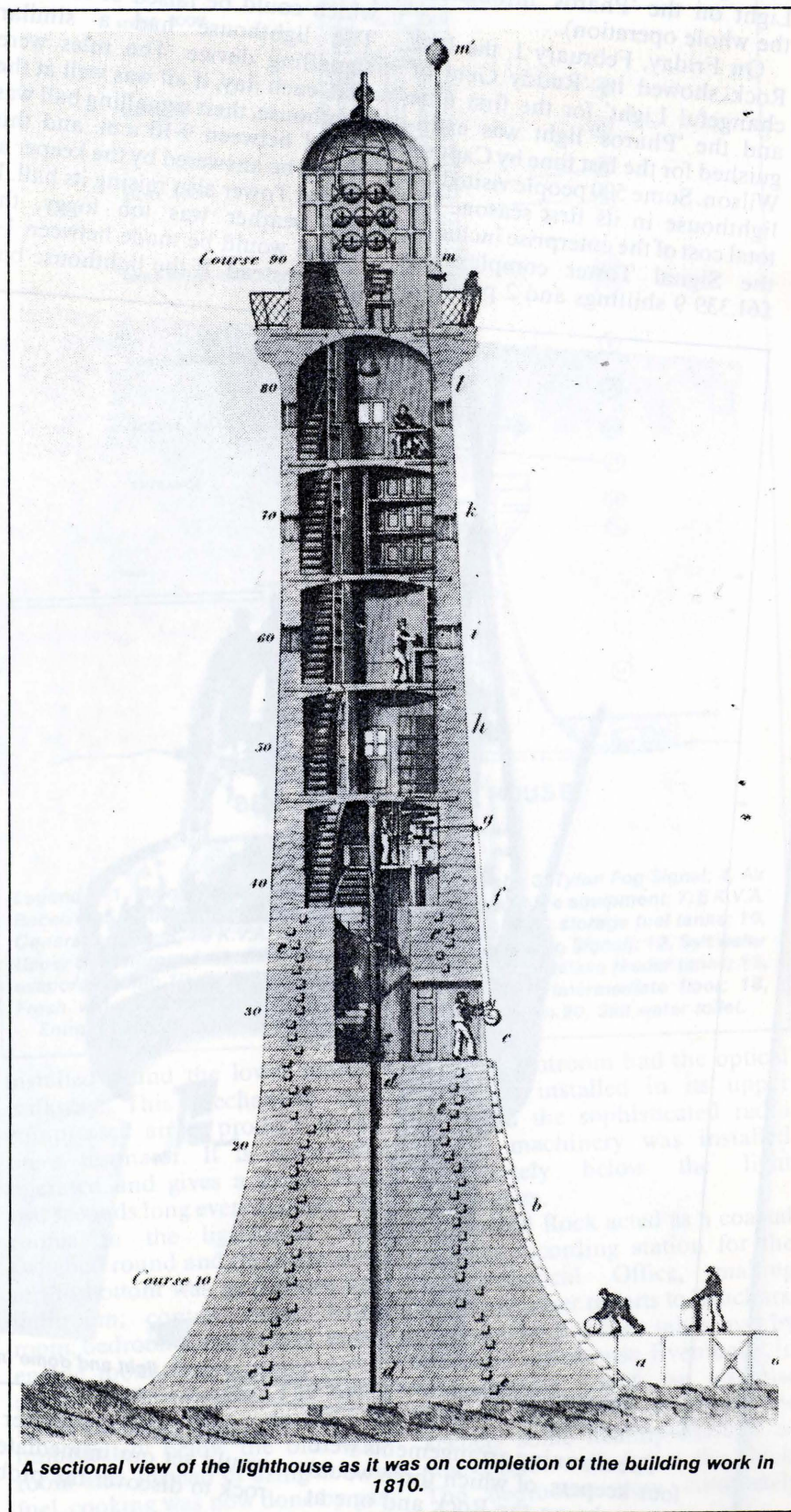
The lease on the Bell Rock Yard in Ladyloan still had three years to run so that was cancelled and the site cleared. Left-over masonry was used to build Signal Tower. Indeed nothing at all was wasted — the two principal beams of the wooden bridge connecting the Tower and the Beacon were taken to Arbroath for Signal Tower.

In September, 1810, James Glen who was in charge of the Beacon and railway, and Robert Selkirk were left at the lighthouse with the task of making it habitable. At Arbroath, Peter Logan and Lachlan Kennedy were left to oversee the building of the Signal Tower complex. During September and October, the work of fitting up the lightroom continued. The roof of this room was a copper cupola and the glass panes for the windows were $\frac{1}{4}$ inch thick. When the ventilator-gilded ball was set on the cupola on October 23, seven guns

were fired and the toast "*Stability to the Bell Rock Lighthouse*" was proposed.

The rooms from top to bottom of the lighthouse were as follows: The lightroom; the stranger's room and library; the bedroom; the kitchen; the lightroom store; water, fuel and provisions store. The light mechanism was sent from Leith and was safely landed at the Bell on

Saturday, December 15. Mr James Dove, the smith; James Clark, the clockmaker; and John Forrest, general superintendent of keepers and foreman of lightroom repairs, all stayed at the rock to install the light and ensure that all was smoothly functioning. On Monday, December 17, a public advertisement was taken out in most British newspapers to inform all mariners



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The Bell Rock Lighthouse 1806 to 1811

The World's Lighthouses
before 1820 - D. Alan
Stevenson
(London:
1959)

within £630 his estimate of cost. Some opposition was raised to the proposed expenditure, on account of the depletion of the British Exchequer by the cost of the continental war then raging, but the evidence presented to the Committee convinced it of the urgent need to prevent wrecks along this coast and it recommended that the lighthouse should be erected without delay and that the Government should lend £25,000. The offer of this amount satisfied the Lighthouse Board, which had accumulated £28,000, that it could undertake the work and Parliament passed the Act in July 1806. It provided for the levy on shipping of one-half of the authorised dues 'as soon as in the Course of building the said Light House, a proper beacon or distinguishing Mark or Object' should be erected on the Rock, and for the imposition of the full duties whenever a ship carrying a light as a seamark should be moored near it.

John Rennie was appointed by the Commissioners to be chief engineer or consulting engineer for the lighthouse, but in fact he did not assume that office in the modern sense. Stevenson prepared all the plans (which were not even submitted for Rennie's approval) and arranged for and carried out the construction of the tower (which Rennie could not do from his London home). The Commissioners and Stevenson had the benefit of Rennie's opinions and advice, particularly in December 1806 before the plans were made. Thereafter in the autumn of each of the next three years Rennie visited the work-yard at Arbroath and, though he seems never to have set foot in the tower, he landed on the Rock or sailed round it and on each occasion informed the Commissioners that the operations were proceeding excellently. During the years of construction Stevenson had the advantage of friendly correspondence with Rennie who never took a decision or issued directions or instructions but occasionally offered suggestions which Stevenson was free to adopt or reject as he pleased. This relationship led to a claim by Sir John Rennie in 1849 that his father designed and constructed the lighthouse; various facts bearing on this point are dealt with in the Appendix at the end of this book.

OPERATIONS IN 1807

Early in this year Stevenson began his working drawings, engaged foremen and assembled 30 artificers, chiefly masons, at the little harbour of Arbroath to prepare a yard with working sheds, a lime-kiln and a circular masonry platform of 44' diameter upon which each course of the lighthouse would be placed for exact fitting of the stones after dressing. In these times it was often impossible to procure materials at short notice, so large quantities of stores and tools likely to be required were collected before work started.

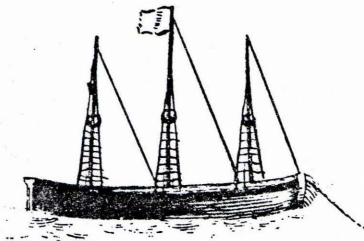
For a temporary lightship, as provided by the Act, a pilot recommended by the Trinity House of London advised the purchase of a Prussian fishing-dogger 67' long and of 82 $\frac{2}{3}$ tons register, which with the help of Leith shipmasters was re-rigged with 3 masts.

In building on this sunken Rock covered by the sea so deeply on every tide, problems would be faced which could be solved only as the work proceeded. It was obvious, however, that no opportunity should be missed of working upon it on all the limited days of the summer season when the fortnightly low spring tides coincided with good weather. This would necessitate a large company of artificers being kept at hand ready to start work on the Rock immediately each tide fell and continuing to work until driven off by its rising: so they must reside in a ship kept close to the Rock. The unusual conditions might attract

A Fuller Account of Certain Lighthouses

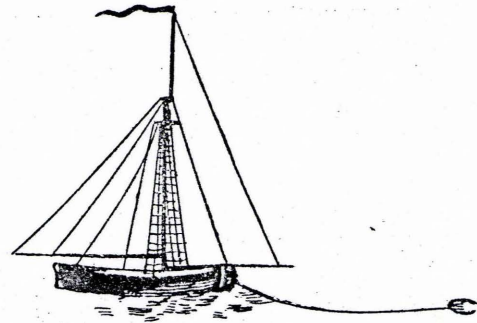
a few adventurous men, but it would be difficult to persuade a sufficiently large number of skilled men to endure confinement in a heaving vessel anchored in the ocean and the labour of rowing one or two miles before and after each tide's work.

As the Lighthouse yacht, a cutter of 81 tons which carried stores regularly to the scattered Scottish lighthouses, could not be devoted entirely to the Bell Rock works, a sloop of 40 tons, named the *Smeaton*, was built to serve as a tender for the lightship and to bring to Arbroath undressed blocks of stone, stores and implements from Aberdeen, Dundee and Leith. She could accommodate 24 men at a pinch while the more roomy lightship, named the *Pharos*, was fitted with berths for 30 men in addition to her crew.



The Pharos Floating Light

131. The temporary lightship *Pharos*



Smeaton

132. The Bell Rock tender *Smeaton*

1807 JULY

It was notorious among seamen that peril would attend the movements of shipping around the dreaded reef, so it was hardly surprising that as the lightship was about to sail from Leith for Arbroath at the end of this month, two sailors took alarm and ran off when they learned of her destination. But soon their places were filled and, escorted by the Lighthouse yacht, she set sail and, after testing the sea-bottom for holding-ground, anchored in 17 fathoms one mile E.S.E. from the Rock. A formal *Notice to Mariners* announced that she would be lighted as a seamark on 15th September.

1807 AUGUST

On the 7th August the *Smeaton* laid permanent moorings $\frac{1}{4}$ -mile off the Rock for the use of attending vessels, while Stevenson marked out sites for the tower and the temporary beacon and selected two landing-places that were accessible to row-boats entering from east or west through gullies screened by low shelves from the opposite winds. A party of 6 masons, chosen as being accustomed to life at sea, cleared seaweed from these areas. When they returned to Arbroath, and described their novel experiences, many of the other men at the yard supposed that work on the Rock would be a welcome relief from their usual occupations and applied to be transferred to it. But Stevenson required the men he engaged to undertake to remain afloat with him for at least 4 weeks without going ashore. He explained that they would be sea-sick and weary of ship-life and would wish to return to land, thus causing inconvenience to the operations from frequent changes of workers, whereas continuing for a month afloat should render them sufficiently sea-hardy to remain

The Bell Rock Lighthouse 1806 to 1811

with little discomfort until the close of the season. Twenty-four artificers accepted his conditions and took up their quarters in the *Smeaton* while a party of Aberdeen masons engaged themselves for a year at '20s. per week summer and winter, wet and dry, with free quarters ashore and likewise our victuals when we are at the Rock. As for Sunday's work and premiums we leave that to the honour of our employers.'

To avoid accidents in the vicinity of the reef, instruction in boating had first priority and every man was allotted a particular place in one of the *Smeaton's* two boats each holding 12 persons. The landing-master steered one and Stevenson, always the last to leave the Rock, steered the other. A sharp watch on the weather and on the level of the rising tide ensured that the party should always leave it before conditions for withdrawal became dangerous.

As far as tidal levels and daylight permitted, a landing on the Rock was attempted on both tides of each day, though every fortnight for 5 days or so neap tides prevented landings as the sea did not ebb sufficiently and the working areas remained under water.

The larger extent of rock exposed at low-water offered some constructional advantages over the Eddystone, one being that there was ample space upon it for setting up a smith's portable forge; thus there could be avoided the loss of time, deplored by Smeaton, in carrying ashore all tools to be sharpened. But the bellows, tinder box, fuel and embers of the previous fire had to be carried to and fro on every trip, a great inconvenience in the boats. The demand on the forge kept the smiths employed continuously, for the sea-hardened sandstone quickly blunted the tools: whenever the rising tide extinguished the forge or endangered the bellows, the masons' work came to a standstill.

On the 18th August the artificers made their first landing at 5 a.m. shortly after the reef emerged from the water. During the next 6 days landings took place on 7 tides and good progress was made in boring into the rock dovetailed-holes 20" deep and 2" in diameter to hold the 12 iron stanchions to which the legs of the beacon would be attached.

On the 22nd the *Smeaton* sailed to Arbroath for provisions, and the artificers exchanged her limited accommodation, which would have been unbearable in bad weather with hatches closed to keep out seawater, for that of the lightship with the attractions of a relatively spacious sleeping-space and less cramped row-boats. But the smallest wave set that flat-bottomed vessel in motion when at anchor and it was said that in bad weather she would 'roll out her masts' and 'even turn a halfpenny if laid upon her deck'. Her behaviour destroyed at once any illusion on the part of the artificers or Stevenson that they had become sea-hardy persons, and the men found it more awkward to clamber between lightship and row-boats and disliked having to pull 4 times daily at the oars over twice the former distance. Gradually troubles disappeared: most of the men ceased to be affected by sea-sickness which at first made them very miserable and thankful to leave the ship for the Rock, and boating became a favourite amusement, prizes being given in team races.

1807 SEPTEMBER

The method to be adopted for bringing stones to their ultimate position in the tower remained undetermined. Alternatives included dropping the stones over the site at high-water or floating out stones attached to corks or air-tanks, or sinking barges or cylinders containing them. An experimental stone-carrying barge or praam had been built already,

which it was intended should be filled with stones, anchored close to the Rock and, when the tide fell, towed through one of the gullies to a landing face. Trial of this procedure on the 1st September gave satisfaction but a suitable method of hauling the heavy stones thence over the jagged rock surface to the site of the tower was not apparent. No risk could be taken of losing even one of the carefully-prepared stones—replacing it might interrupt the operations for a week—nor must their fine edges be exposed to damage.

On the 2nd there occurred an incident that might have resulted in tragedy and which emphasised the need to complete the beacon as a refuge. The artificers who had landed from the *Pharos* in 2 boats had been joined by 8 men in a boat from the *Smeaton* which lay close to the Rock. After they arrived, the sea-motion increased and 2 sailors took it upon themselves to return in their boat to the *Smeaton* to help their mates to handle her moorings; but she broke away and drifted with her boat for 3 miles to leeward. By the time the crew were aware of her drift, a considerable gale had arisen which prevented her boat from returning to the Rock before it overflowed with the rising tide. There would not normally have been sufficient room in the *Pharos's* 2 boats for all the men then on the Rock. Providentially at the moment when the party prepared to leave it, the unexpected arrival of a pilot-boat averted the danger that would be faced by 2 overladen boats in a rough sea, and she carried the 8 surplus men to the *Smeaton*.

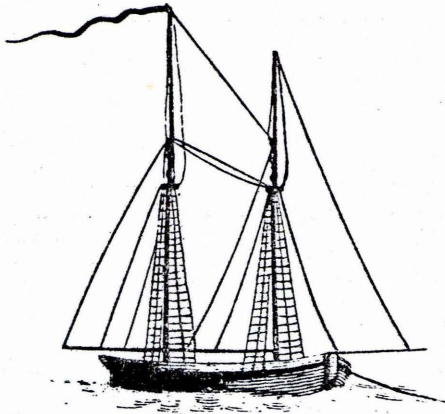
By the 5th 12 masons, working sometimes knee-deep in water, had almost completed the holes for the beacon legs, while others had begun to excavate the foundation of the tower. On the evening tide, low-water occurred too late for a landing: a violent storm arose suddenly and during the night the *Pharos* with a full complement of artificers broke adrift, her cable being severed by floating wreckage from an unknown vessel. When the storm passed, another position was chosen for her moorings 2 miles from the Rock so that she would be less likely to drift upon it if her cable should snap again.

On the 15th when the tides again favoured landings, the chief smith fell into the sea on leaping from the boat and as his wet tinder did not strike fire the forge could not be lighted and the masons had to abandon their work. The yacht arrived on the scene after her annual delivery of stores to the Scottish lighthouses and the artificers transferred to her more agreeable accommodation.

On the 19th the *Smeaton* brought in tow the 6 principal beams 50' long and 18" square which would form the legs of the beacon; 40 artificers and seamen landed and erected a 30' derrick with guy-ropes and bolted a winch to work the purchase-tackle. The men had been divided into squads to perform different duties. On Sunday the 20th the row-boats towed the raft formed by 4 of the beams lashed together and anchored it at high-water over the site of the beacon where it grounded as the tide ebbed. All hands, numbering 52, then landed and began working in water up to their waists. One squad raised one beam to become the prop of the tackle for raising the second beam. Thus 4 of the 6 legs were set up as a pyramid of 33' base, secured at the top temporarily by ropes. Another squad inserted the 5' iron stanchions into the rock and lashed the beams to them. These stanchions had been kneed to suit the angle of the beams and they fitted perpendicularly into the holes bored in the rock, there to be secured by wedges, first of soft timber, then of oak and finally of iron, driven in successively—a method which gave more security than pouring molten lead into the gaps. This tide was blessed with a calm sea which permitted as much as 7 hours' work. Four artificers who previously had objected to Sunday employment

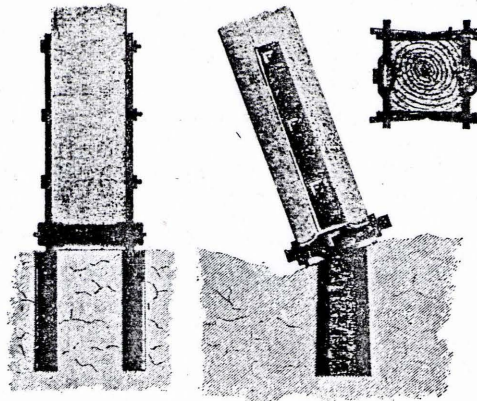
turned out with the keenest workers and they never afterwards rejected it. Sunday labour transgressed the religious upbringing of the Scots artificers and they were never pressed to undertake it. They did so with the conviction that the lighthouse would prevent shipwrecks. If they had not been willing to seize the opportunities of working on suitable tides on Sundays, the duration of the operations would have been extended by a year at least.

On the 21st the favourable weather continued; again 52 men landed and set up the remaining two legs. Difficulty of transporting and victualling so many persons then made it necessary to reduce their numbers, so the less expert men were carried in the *Smeaton* to Arbroath to work in the yard.



Sir Joseph Banks

133. The Bell Rock tender *Sir Joseph Banks*



134. The method of attaching the beacon legs to the rock

On the 22nd 30 men landed from the yacht and connected up 4 of the 20' struts joining the legs, and on the 23rd they fixed bracing chains to connect the last 2 struts. The *Smeaton* returned with provisions but heavy seas prevented her from delivering them to the yacht which a gale forced to take refuge in St Andrews bay under the lee of Fife Ness. On the 24th and the 25th the yacht returned to the Rock but on each occasion landings proved impracticable and strong winds drove her back to the bay each evening. The beacon, though still insecure, appeared to be standing undamaged. It was fortunate that good weather had prevailed during the tricky operation of erecting it.

On the 26th, 30 men landed and worked for 8½ hours. Two events made this day memorable and eased transport: the parts of the forge could be lashed to a temporary platform on the beacon when the men left the Rock, so freeing the boats of this encumbrance, and instead of the artificers eating at irregular times their dinner was cooked on the yacht and brought out to the Rock daily at their normal hour.

On the 27th, 10 of the men returned to the yard, leaving 20 carpenters and smiths to complete the beacon to which, at high-water in a calm, they could now step directly from a boat; so, throughout neap tides, work upon it continued daily although its foundation remained covered by water. Its height of 48' made it a conspicuous and most welcome mark to shipping.

1807 OCTOBER

After 3 days of bad weather 20 artificers spent 5 days in excavating the rock for the foundation of the tower and strengthening the beacon on which as much as $16\frac{3}{4}$ hours' continuous work was obtained on one day. In a trial for the next summer, night-working by torches proved feasible, though after their extinction the contrasting darkness added to the awkwardness of withdrawing the boats through the gullies.

Before the season's operations on the Rock were terminated the lower parts of the beacon were treated for preservation: brushwood was piled round its legs and lighted and the charred timbers were covered by coats of pitch to the height of 12'. For the relief of shipwrecked persons, cases containing 56 lb. of biscuits and 4 dozen bottles of water were fixed to the top.

The progress made in this short season gave assurance of success and fulfilled Stevenson's hopes. His chief concern arose now from the delay in receiving granite from the quarries. At one time 3 men travelled round the quarries in north-east Scotland seeking large blocks for the tower. Yet at the end of October 10 blocks were lacking of the 123 required for the 1st complete course, 30 lacking for the 2nd and 20 lacking for the 3rd, and unless more blocks were obtained soon, there would not be enough material at Arbroath to employ the 44 artificers throughout the winter and it might not be possible to lay 3 courses on the tower next season, which was the aim.

OPERATIONS DURING WINTER 1807-8

The cessation of the operations on the Rock gave Stevenson the opportunity to put in hand preparations for the next working season.

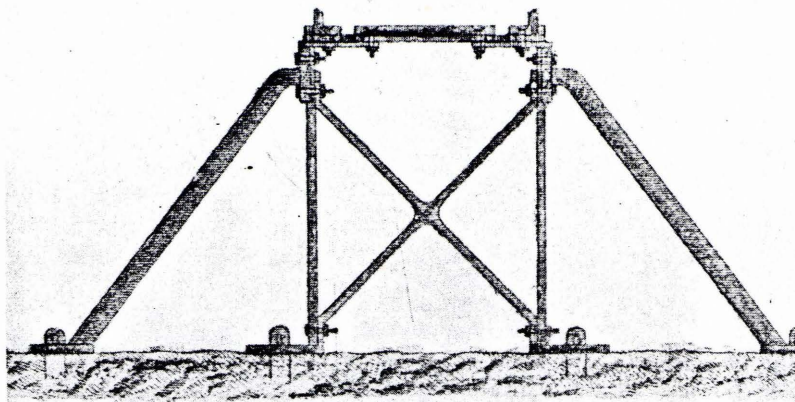
The accommodation for the men in the ships had to be improved and their labours in boating eased: this could be effected by providing a more commodious tender devoted entirely to attendance on them—to manoeuvre according to wind and current and drop and pick up the boats and so reduce rowing. Therefore a schooner, named *Sir Joseph Banks* after the Arctic explorer, was built to accommodate 15 sailors and their officers, and 50 artificers and their foremen. On deck and over the stern, she carried three 8-oared boats 20' long; each could seat 18 to 30 persons according to weather conditions. At the suggestion of Henry Greathead the South Shields boatbuilder, who had incorporated the ideas of Lionel Lukin a coachbuilder and William Wouldhave a painter in producing excellent lifeboats, Stevenson increased the buoyancy of the boats by lining them with cork; this reduced the danger at the critical moments when the men transferred between the schooner and the boats, and when they passed through the gullies in the reef with the tide not sufficiently low for the rocky shelves to give shelter from the waves—already, several had been upset and damaged and oars lost.

To speed the transport of the building-stones, 3 more praams 28' 6" × 8' 6" were built. They were lined with casks for buoyancy and had a central hawse-hole to suit a new method of slipping moorings quickly.

It was decided to transport the stones over the sharp irregular rock surface between the landing-places and the tower, an extreme distance of 300', by a level cast-iron railway to skirt the tower foundation and extend to the landing-places. The rails would be carried on frames with side supports varying in height from 6" to 5' according to the irregularities of

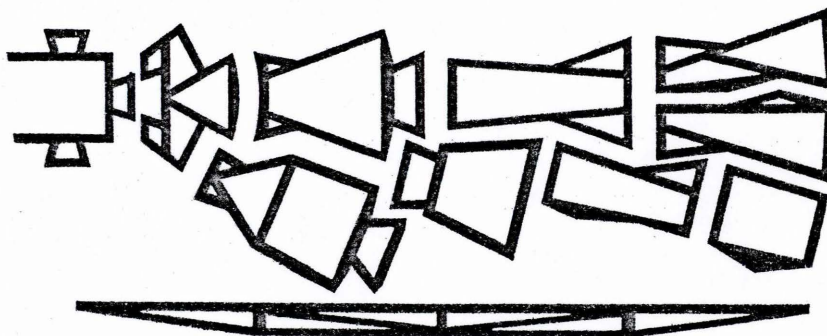
the rock surface. The stones could be wheeled on iron trolleys jointed to suit both the curved and the straight rails.

Standard cranes and winches could be obtained for raising shipments at the landing-places, but visits to crane works disclosed no appliances capable of lifting stones from



135. The cast-iron railway which carried materials from the boats to the lighthouse site

the trolleys and laying them in position perpendicularly. Lifting-sheers as used at the Eddystone, by which Smeaton transferred stones directly from boat to tower, would be slow and inadequate in reach; so a new type of crane was designed, of which 2 were provided with 21' shafts for the tower and one with a 28' shaft for the masonry platform at Arbroath.



136. Templates for shaping stones

During the winter the Lighthouse yacht attended to the lightship and carried artificers to the Rock occasionally to examine the beacon. The sailors shifted stones at Arbroath and took turns of duty in the lightship where life was so uncomfortable and dreary that but for the dreaded activities of the pressgang, seamen might not have been obtained to man her. In the 5 ships occupied ultimately in the Bell Rock works, in addition to the yacht, 35 sailors received an Admiralty certificate of protection which was effective only so long as each man remained on board the vessel which it specified. In 1810 the pressgang seized one of the young protected seamen while he was visiting friends near Arbroath: he passed 5 months

in prison before the Law Courts in Edinburgh heard an appeal by the Lighthouse Board on his behalf, when he was released.

As in all subsequent British sea-towers, Smeaton's plan of dovetailing stones was adopted by Stevenson, also his precaution of using trenails, wedges and joggles to keep them in position while the cement hardened and until they were weighed down by the completed course above. At Arbroath up to 60 masons, smiths, and carpenters cut and stored the blocks brought in the *Smeaton* from the granite quarries of Aberdeen and Peterhead and the sandstone quarry at Mylnefield near Dundee. Several courses were prepared at the same time, according to the dimensions of the blocks received. Movement of the great mass of masonry required careful planning so as to reduce to a minimum the handling of stones which weighed up to 3 tons. From the full-sized outlines of portions of each course drawn on a polished platform measuring 70' by 25', a wooden mould or pattern with positions marked for joggle, trenail and wedge was cut for each shape of stone and its edges were stiffened by iron plates. These moulds were stored so that any damaged stone could be replaced promptly.

OPERATIONS IN 1808

In March 1808 Stevenson visited the Rock and found the beacon unaffected by the winter's gales. He decided therefore to try out his original intention of enclosing its upper part as a cabin in which the men could live in the summer months and thus not only avoid the labour and delay of sea-transport often 4 times daily, but be ready to descend to the Rock as soon as the tide receded. If this plan should succeed, many additional hours of work on the Rock would be obtained. This radical alteration of the beacon would be put in hand in the coming season but meantime, as every precaution was taken to avoid accidents which would discourage the men to the great disadvantage of the enterprise, the beacon would be strengthened by iron ties. An open platform would be fitted upon it 20' above the rock, to accommodate 2 forges clear of the sea and provide a space for mixing mortar: its 2" floor planks would fit loosely so that a mounting wave might displace them without damaging the structure.

Subject to interruption by adverse weather conditions, the operations in the season of 1808 followed a regular programme: during each fortnight of spring tides the tender *Sir Joseph Banks* lay at anchor off the Rock, landings being attempted at about three-quarters' ebb and work perhaps continuing into the evening by torch-light—gaining one hour's work on a tide was worth all the trouble of double transport—while during each fortnight of neap tides all the men returned to Arbroath to assist the masons preparing stones.

1808 MAY

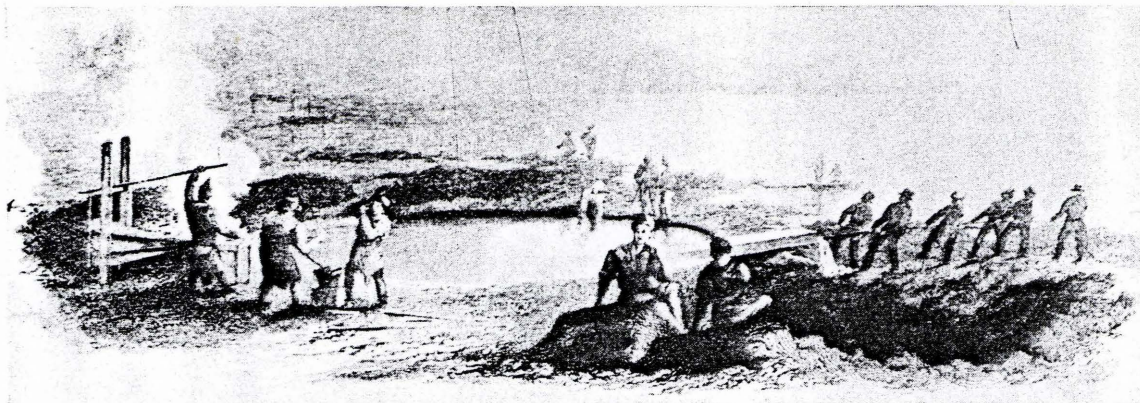
On the 26th May the tender *Sir Joseph Banks*, after laying moorings, took out from Arbroath the first party of the season, consisting of 18 artificers who again had to be instructed in boating. Several men suffered from seasickness as before and disliked living on a ship, but the extra pay and the unusual circumstances never ceased to attract volunteers from the yard.

At the end of the month 22 workmen and 6 sailors strengthened the beacon, deepened the foundation pit when the tides fell sufficiently, and set up frames for the railways.

The Bell Rock Lighthouse 1806 to 1811

1808 JUNE

On the 7th June, with 25 men occupied on the excavations, Stevenson's diary described the scene: 'The Bell Rock this morning presented by far the most busy and active appearance it had exhibited since the erection of the Beacon. The surface of the Rock was crowded with men, the two forges flaming, the one above the other, upon the Beacon, while the anvils thundered with the rebounding noise of their wooden supports and formed a curious contrast with the occasional clamour of the surges. . . . In the course of the forenoon the Beacon exhibited a still more extraordinary appearance than the Rock had done in the morning. The sea being smooth, it seemed to be afloat upon the water, with a number of men supporting themselves in all the variety of attitude and position, while,



137. Pumping the foundations before setting stones (Scott)

from the upper part of this wooden house, the volumes of smoke which ascended from the forges gave the whole a very curious and fanciful appearance.'

The master of the lightship, lying at anchor 2 miles away, referred to the men at work on the Rock in the evenings by torch-lights at sea-level as 'resembling the fiends in the lower regions'. Strangers sometimes supposed the columns of smoke rising from the sea to proceed from a ship on fire.

In a gale during the night of the 9th June, the tender 'rolled and pitched in such a manner that the hawser by which she was made fast to the buoy snapped and she went adrift. In the act of swinging round to the wind she shipped a very heavy sea which greatly alarmed the artificers who imagined that we had got upon the Rock.' Hampered by nearly 60 persons on board and with 2 boats lashed on deck, she ran for shelter to the Firth of Forth.

In the intervals between carrying stone from the quarries to Arbroath the *Smeaton* brought out artificers to the Rock and stood by, so that on the 20th as many as 62 men landed to work. The number was limited by the sleeping accommodation on the tender, the seating of the row-boats and the working space on the Rock. Eighteen sailors in addition to managing the boats carried tools between the masons and the smiths, stowed and wedged in clefts and gullies as many of the heavier implements as could be left on the Rock, and carried the stone chips from the excavations to the *Smeaton* to ballast her after discharging her cargoes.

A Fuller Account of Certain Lighthouses

By the 23rd the submerged parts of the foundation had been encircled completely with low concrete walls designed to exclude the wash of the waves and by the end of the month, despite the loss of time in baling water from the pit, its excavation was nearly completed. The railway was being extended gradually from the east landing-place and a third forge was set up on the reef temporarily during each visit to expedite the incessant sharpening of tools.

At Arbroath on the 14th June the 1st entire course was ready for shipment after a year's work. The hope of obtaining enough granite stones of 18" depth to complete the course had been disappointed and stones of 12" depth had to be used instead: little extra labour would have been required in handling and transporting the larger stones.

1808 JULY

By the 7th July all cracked and doubtful rock had been cleared from the foundation pit and it was seen that 18 holes of various shapes and sizes must be filled to bring up the rock to a level seat of 42' diameter for the 1st entire course. A light row-boat carrying a dimensioned mould of the largest hole set out immediately for Arbroath where masons in relays worked for two nights and one day to prepare a stone to fit it. On the 9th a praam brought this stone over the site of the tower and with a quiet sea at high-water dropped it gently on the rock. On Sunday the 10th a derrick and guys moved this mass of 20 cubic feet to fill its shaped cavity. During the neap tides from the 14th to the 23rd the sea-level did not fall low enough to expose the rock, but when it did so on the 26th the other 17 stones of special shape were inserted in their holes.

The way was open now to lay the 1st complete course. Trial of the process of transporting stones from the yard, transferring them to the praams and leading these barges through the gullies had been satisfactory, but as the railways had not been advanced far enough to carry the stones from the landing-places to the tower base it was decided to drop the stones upon the site at high-water as had been done with the foundation stone. So it proved fortunate that the 1st course had been reduced in thickness, as the smaller stones could be dropped through the water and then moved more easily.

1808 AUGUST

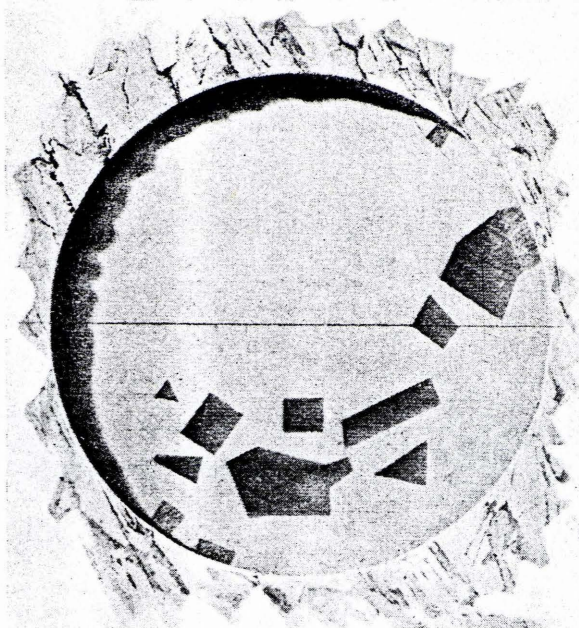
On the 4th August one of the cranes was raised beside the foundation. This enabled the first 4 stones of the 1st course to be deposited: they were trenailed or spiked to the rock through 2 holes bored into each stone at Arbroath. On the 12th the laying of the 1st entire course of 123 stones was completed. It contained 508 cubic feet of granite and 76 of sandstone, a total weight of 104 tons; 4,519 square feet had been dressed and 798 cut and bored for wedges and trenails.

As the railway from the east landing-place had been extended to the tower and the second crane raised at its other side, every stone of the 2nd course of 18" depth could be lifted from a railway trolley and deposited in its final position in the tower base by one or other of the two cranes. By this means the 2nd course of 136 stones weighing 152 tons was completed by the 27th, raising the base to 2' 6". As it overtopped the rock all round, pumping was discontinued and much inconvenience and delay avoided.

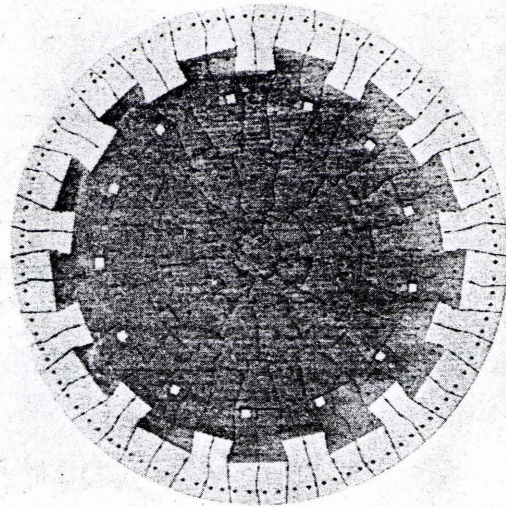
The Bell Rock Lighthouse 1806 to 1811

1808 SEPTEMBER

On the 9th September, after 10 stones of the 3rd course had been laid, gales prevented landings. When they were resumed it was found that the waves had raised some of the stones above their beds with the trenails acting as stilts. On the 18th, 31 stones were laid in $6\frac{1}{4}$ hours and on the 21st, completion of the 3rd course brought the base to a height of 4'.



138. The 18 shaped stones which were set below the 1st entire course



139. The arrangement of stones in the 1st entire course

But the occasion was saddened by the loss of a young seaman who, in attending to one of the moorings, was swept away by the current when a boat capsized.

As heavy swells prevented the use of the east landing-place and as the railway to the west landing-place was not completed, Stevenson decided to suspend the operations for the season and did not cut joggle-holes in the stones of the 3rd course lest they might give a grip to the winter's waves. When informed of the excellent progress, Rennie wrote twice to urge him to buy a large quantity of lead to spread on top of the course to anchor it down, but he decided rightly that this precaution was unnecessary.

During this season the extent of working on the Rock was 265 hours, only 80 hours being spent in building the tower. Four hundred stones had been laid weighing 388 tons: they had been cut with such accuracy that there was no delay in placing each in position.

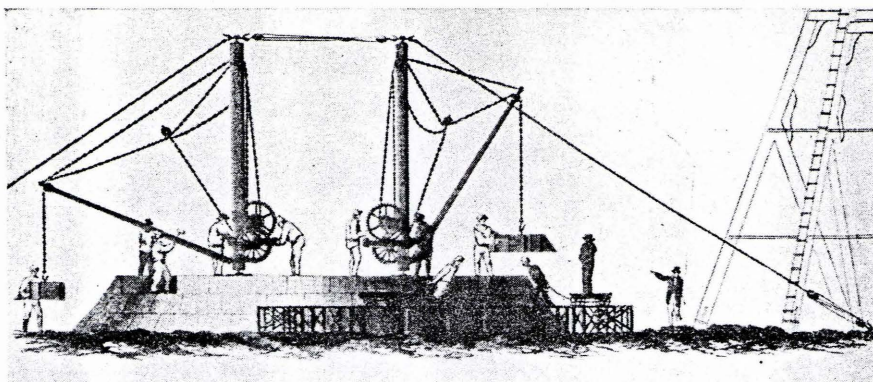
OPERATIONS IN 1809

Throughout the winter, as before, a few men from Arbroath visited the Rock occasionally to carry out small repairs to the beacon and the railways and thus ensure that no obstacle should impede the start of the next season's operations, when Stevenson hoped to set the remaining 22 courses to complete the solid base of the tower.

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The search continued for large blocks of granite, which were desirable both for durability and as weighting 18 per cent. more than sandstone, and new faces were opened at quarries near Aberdeen in the effort to obtain enough blocks to sheathe the exterior of the tower to the top of the solid base 30' high.

During the winter Mylnefield quarry ceased to produce sandstone blocks, as they would crack if cut and worked during frost. But a small supply of stones that had been cut there in the autumn could still be had. In February, when the *Smeaton* sailed up the Tay river



140. A view of the work in September 1808 (Slight)

to the quarry above Dundee to fetch them, all hands laboured to save her from damage by floating ice: on the return journey when she crossed the Tay bar in a snowstorm to enter the North Sea the entire crew except the helmsman were forced to take to the rigging for safety and no succour could be given to another sloop which foundered close-by. This incident emphasised the possibility of an accident to the Lighthouse ships. As an insurance against the suspension of operations at the Rock in such an event and also to expedite the transport of stone, the *Patriot* of Kirkcaldy, a sloop of 40 tons burden, was purchased; another sloop, the *Alexander*, was hired; and 2 more praams were built at Arbroath.

1809 APRIL

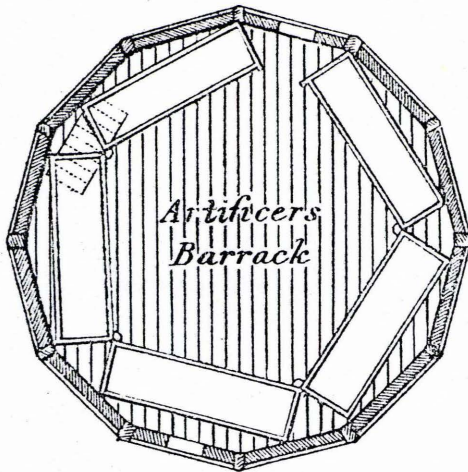
The season's operations began on the 30th April when the tender brought to the Rock 15 artificers with the immediate tasks of extending the railways, cutting joggle-holes in the exposed surface of the 3rd course and fitting the beacon for residence. The cabin would be divided into 3 habitable rooms at levels of 28', 35' and 42' above the rock, with the tip of the roof ventilator at 61'.

1809 MAY

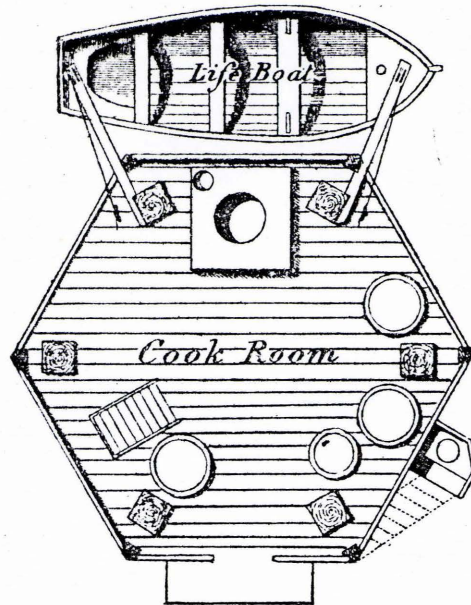
At the beginning of this month 36 workmen and sailors made frequent landings in rough seas and bitterly cold weather. On the 24th the *Sir Joseph Banks* brought out the first stones of the 4th course. The weather became worse and work on the Rock proceeded in wintry conditions which culminated on the 31st with snow lying 3" deep on the deck of the tender and the landing-master having difficulty in guiding the boats through snow-showers.

1809 JUNE

On the morning of the 1st of June the weather took a sudden turn for the better and at mid-day 11 artificers remained on the beacon on the rise of the tide, according to routine. Suddenly a stiff gale rose which prevented the use of the row-boats and forced the *Smeaton* to slip her moorings and make for shelter in the Firth of Forth; but the tender stood by the men on the Rock and rode out the gale. In the beacon cabin which was not yet ready for residence, with old sails for protection from the wind and rain, the men made shift for



141. A tier of sleeping bunks in the beacon-house



142. The kitchen on the beacon, with a boat for emergencies

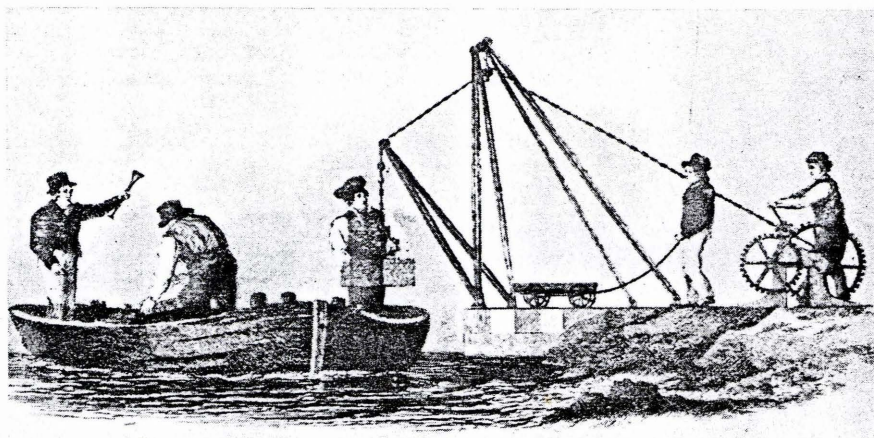
30 hours until the storm abated sufficiently to allow a boat to approach. Undeterred by their experience 33 artificers joined their comrades to work on the next tide. The waves had raised 3 stones of the partially-laid 4th course but, as before, they held by their trenails. The crane at the east landing was broken. The low platform of the beacon had been torn up and the casks of lime and cement left upon it had been washed away.

On the 11th, 16 hours' continuous work extending over the two tides was devoted to building the tower and to fixing a rope-bridge to connect the base to the beacon so that the men could pass between them without waiting for the tide to ebb. On the 17th a rough sea again prevented withdrawal of the same 11 artificers, but they spent the night under better conditions than before, with the cabin more complete and provided with bedding and an emergency supply of food. Stevenson had now to restrain the keenness of the men who landed at daybreak whenever tide and weather suited. On Sunday 25th, 57 persons landed at 3 a.m. Working over the two tides they completed the 7th course and raised the base to 10' above the foundation. At Arbroath the masons were cutting granite for the 16th course and sandstone for the 21st.

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1809 JULY

On 2nd July the 9th course was completed to a height of 12'. Several disadvantages followed the attainment of this level. First, the operation of raising the moveable crane to each higher course increased in difficulty and its guy-tackles, from their angle, became almost unmanageable: a balance-crane on a new principle was therefore designed and constructed. Secondly, it was seldom possible to work on the tower during darkness, as torches could rarely be kept burning, being more exposed to the winds. Thirdly, the waves, no longer broken up by the shelving rock, struck directly at the upper parts of the tower and freely washed out the mortar from between the stones, which had often to be re-laid. Until the base was raised a few feet above high-tides, this loss of mortar brought about a heavier demand for the mixers' services.



143. Landing stones at the Rock (Scott)

On the 6th the joiners working at the beacon were allowed to take up their quarters in it during spring tides to avoid 'the continual plague of boating', a transfer welcomed by all as leaving the boats less crowded. The outside of the beacon had been coated with tar and tarpaulin and the interior packed with moss to make it wind-tight and warm. A brick hearth had been built-in but the men were warned of the dangers of fire, when a rescue might be impossible. One of the joiners fitting the berths and bedding took up continuous residence in it with a small black dog for company: he suffered greatly from sea-sickness and had a fear of boating and an aversion to climbing the makeshift ladder.

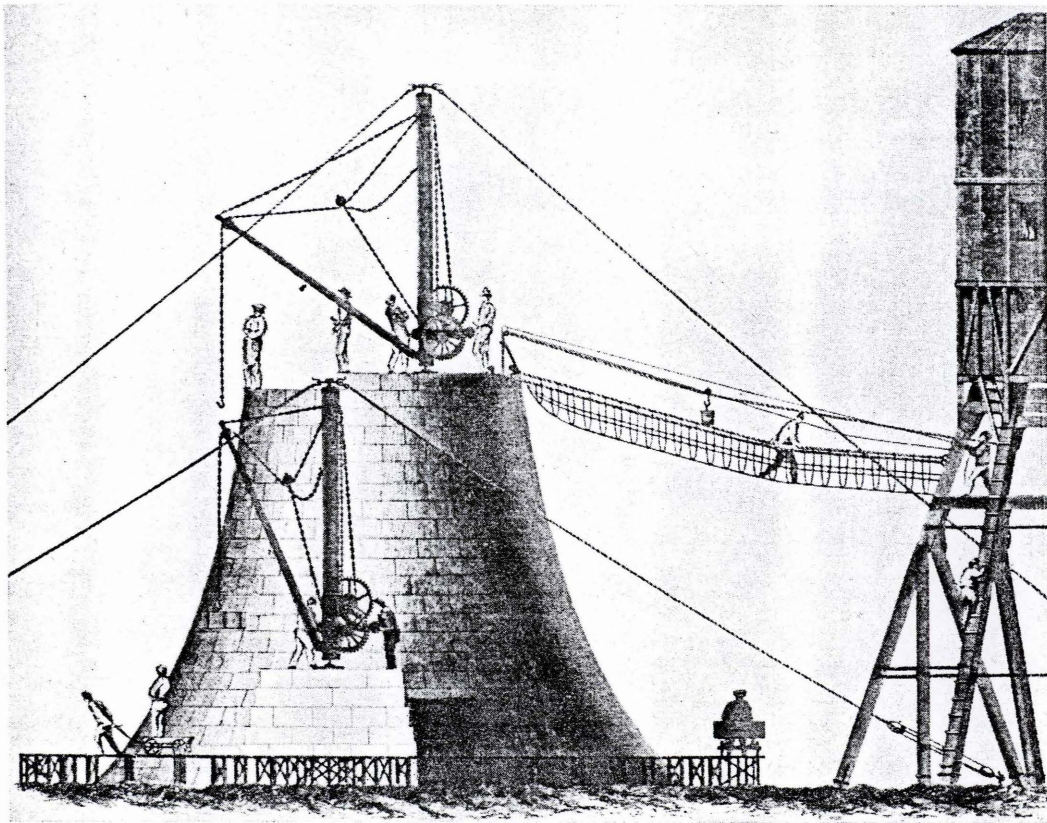
The speed of laying stones on the tower now exceeded that of their delivery at the Rock, so night-shifts were arranged to expedite the moving of stones at Arbroath, namely, the delivery of blocks from the quarries and the shipment of finished stones to the Rock. On the 8th when the base was raised to 13' rejoicing ensued when it was noticed that the high-water of the neap tide did not overtop it.

On the 15th the artificers landed at 6.45 a.m. and as the water again did not overflow the tower they continued to lay stones until midnight, setting no fewer than 52. This day's work brought the 12th course to completion and raised the tower to 15'. As the joiners had lodged without mishap on the beacon, 23 artificers and a cook petitioned to follow their example and were allowed to do so.

On the 22nd an embargo interrupted the proceedings by confining all British ships to port, in consequence of the projected military expedition to Walcheren in Holland. An application for exemption for the Lighthouse vessels was despatched immediately to London and, though it was granted without undue delay, 10 days of weather good for transport had been lost. However, the artificers who were isolated on the Rock had not been idle and in addition to extending the west railway had raised the lower crane on a temporary masonry stool so that it could lift the stones directly from the trolleys and free the upper crane for depositing them on the tower.

1809 AUGUST

On the 1st August 46 men were working on the Rock and because of the increased numbers now lodging in the cabin the beacon's legs were strengthened further. But its considerable tremors in a gale frightened the artificers and several applied to return to the



144. A view of the works in August 1809, the solid portion nearly completed (Slight)

tender. Fifteen remained in residence, joined by Stevenson who was glad to be relieved from making the sea-passage daily between the tender and the Rock in an open boat.

During fog on the 19th, one of the boats lost her way back to the tender after leaving the Rock on the evening's flood-tide. The first land she sighted was Fife Ness 14 miles

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distant. In the morning the occupants, who had been without food, reached the tender, exhausted after rowing for 16 hours.

On the 20th August the entire 23rd course containing 51 stones was laid in one day; being a Sunday a religious meeting was held at noon when 30 men crowded into the upper room of the beacon, two of them joining hands to support the Bible which was read by Stevenson. On the 25th the solid portion of the lighthouse was finished; this was the 25th entire course and the last containing granite. Building the tower halted, as the solid base would best resist winter's storms and the need for another crane on the tower was urgent, the guy-ropes of the one in use being then of the unmanageable length of 80'.

1809 SEPTEMBER

The furnishings of the tower were put in hand including the construction of a lantern to contain a revolving coloured light from reflectors and argands on 4 sides of a rotating frame, 2 opposite sides each with 3 reflectors covered with sheets of red glass and the other two opposite sides each with 7 reflectors without coloured glass. This arrangement achieved with this size of lantern the maximum possible power and range for the white flash and distinction from other near lighthouses by the red flash when close to.

1809 OCTOBER-NOVEMBER

The artificers to the number of 24 lived in the beacon until November, strengthening its supports and extending the railways. The cranes and other implements likely to break loose during the winter were dismantled and taken ashore or stacked on top of the tower or the beacon.

Already some 1,400 tons of stone had been built into the tower, but 700 tons of sandstone were still needed. Severe frost had split many fine stones completed at the yard at Arbroath, despite careful covering, and interrupted work at Mylnefield quarry so much that it was unlikely that it could produce enough blocks in time to complete the tower in the next season, which Stevenson considered to be possible, so he decided to obtain an additional supply of stones from Craigleith quarry, near Edinburgh, which yielded an excellent sandstone that was not damaged by being cut during frost. Its use for the top courses of the balcony, would enable the lantern under construction in Edinburgh to be fitted temporarily upon them and so would reduce much trouble and time in erection on the exposed Bell Rock tower. So a yard was rented in Edinburgh to which masons were transferred from Arbroath.

OPERATIONS IN 1810-11

Much work had to be done to complete the tower. The 66 courses above the solid base would be of less diameter than the lower courses and so contained fewer stones, but they required more careful fitting as they were shaped to suit the compartments, the stair and the furnishings. Most of the stones had still to be brought from the quarries and dressed to shape. All had to be transported to the Rock (57 courses from Arbroath and 9 from Edinburgh), raised and set in place. The operations involved had been improved in details either to ease labour and hasten the work or to reduce the risk of accidents. After the

masonry work was done the structure had to be made habitable by fitting much woodwork throughout, and crowned by the lantern and the light. Further, 4 stone houses for the lightkeepers had to be built at Arbroath.

Stevenson introduced an important improvement on the system adopted by Smeaton at the Eddystone lighthouse and by Sir Christopher Wren below the dome of St Paul's Cathedral in London of tying the circular walls together by chains built-in to form horizontal rings. He used a ring of Swedish iron instead and designed the floors of each compartment with the stones grooved laterally so that they became as one; thus the pressure acted perpendicularly on the walls instead of thrusting outwards as with an arch. The walls were bound together by projections and grooves cut in the horizontal surfaces of the stones.

1810 APRIL

Having laid moorings off the Rock, the tender *Sir Joseph Banks* opened the season's campaign by carrying out 17 artificers on the 18th April; in view of the uncertain weather of spring they lived in the ship instead of in the beacon and as formerly rowed to and from the Rock every tide. In 10 days they repaired the railways, which had been damaged by loose boulders weighing up to 10 cwts which the winter waves had lifted up from the sea-bed and rolled over the reef, and replaced the swaying rope-bridge between the tower and the beacon by a rigid timber gangway 44' long and 6' wide which was floated out in sections. It would facilitate passage to the tower and, through a hatch in its floor, materials could be raised more easily from the trolleys.

1810 MAY

The artificers who sailed for the Rock on 7th May when neap tides had passed were warned that as the works would be pressed to a conclusion before the winter, 3 or 4 months might elapse before they returned to Arbroath. As the weather continued boisterous—spray was flying 20' over the tower and 50' above the Rock—they remained in the ship until the 10th, when a landing could be made. They brought the beacon cabin into condition as a dwelling and, to get more living space, shifted one of the forges to the top of the tower where they fixed the base of the new balance-crane. On the 11th, 18 men who were anxious to avoid boating took up residence in the beacon. On the same day the *Smeaton* was loaded with 38 stones at Arbroath but she failed to land them on the Rock as the weather worsened and she was driven by a gale to seek shelter in Leith Roads. For several days at high-water the men in the beacon had the unpleasant experience of the sea 'breaking over the top of the building in great sprays and ranging with much agitation among the beams of the beacon' but when, 'tired beyond measure for want of employment', they crossed by the gangway to the tower at about three-quarters' ebb of each day-tide when the wind abated, they bored the joggle-holes in the 25th course and got the balance-crane into working order. It traversed in a 'collar-chamber filled with cast-iron friction balls', an early use of ball-bearings.

On the 18th the wind fell away and the first cargo of stones of the season, 23 in all, was landed from the *Smeaton*. They were raised quickly through the gangway hatch and laid on the tower. For the next 10 weeks up to 31 persons including Stevenson lodged in the beacon and some 15 sailors rowed to the Rock most days to shift the building materials.

On the 21st the last cargo of sandstone from Mylnefield for the tower was delivered at Arbroath by the *Patriot*.

As the tower rose, the space on the open top became much cramped from its shrinking diameter and the situation of the men at work was precarious. Lest anyone should slip when the Rock was covered by the sea, a boat was suspended from the beacon and a seaman, ready to loose a life-line of 200 fathoms, kept watch for accidents. When the Rock was dry the men working below were in danger from falling tools.

1810 JUNE

As the continuance of stormy weather interrupted delivery of stones at the Rock and caused anxiety that the tower might not be completed before the winter, every effort was made to hasten the work. For instance, as soon as the *Patriot* entered Arbroath harbour at 11 p.m. on Saturday 2nd June the engineer's clerk called out the men at the yard. They began loading her with dressed stones at midnight: she sailed with a full consignment at 4 a.m. and within an hour reached the Rock when the 18 stones were at once taken off.

On the 17th June the west railway and its landing-place were completed by torch-light to the full length of 290', but the east railway being only 90' long was preferred whenever wind and sea permitted its use. Ropes attached to additional iron rings fixed into the rocks gave more security in the passage of boats through the entrance gullies.

On the 21st an attempt to reduce the handling of stones by landing them at high-water directly from a praam manoeuvred below the gangway hatch failed, as the lift of the sea caused a jerk and strain on gangway and beacon which tended to loosen their joints. But by bringing into service both landing-places and railways, the speed in handling the stones exceeded so much the rate of building the tower that either the *Patriot* or the *Smeaton* might have been dispensed with or the hire of the *Alexander* terminated were it not that an accident to one of the ships would have disrupted the whole operation. It was also possible that one of these vessels might be required to replace the lightship. Having been at sea continuously for three years her condition gave cause for concern; though so far as could be seen from a partial careening at her station, woodworm had not affected her hull excessively.

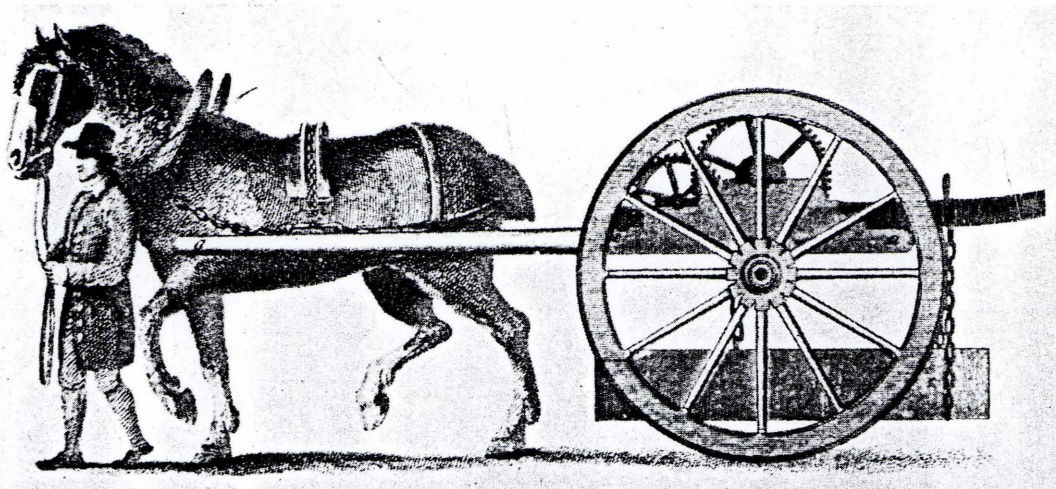
On completion of the railways the company residing in the beacon was reduced to 22, but it was increased when two more smiths were brought to the Rock to keep in good order the many appliances that expedited the work.

1810 JULY

Danger still remained for the men on the beacon. On the 4th July during a strong gale and a heavy swell, the sea broke up its low platform and caused alarm. The waves dashing over the gangway prevented passage to the tower which, with 68 courses laid, now rose 80' above the Rock. Several men had been anxious to take refuge in the substantial tower rather than remain in the beacon: had they done so their plight would have been worse. Morning disclosed that the waves had overtopped the open walls and windows and water had poured down the stairs and out at the entrance doorway. When the storm abated two days were devoted to repairing the beacon and the gangway and replacing mortar between the stones of the upper courses.

On the 6th the last course to be dressed at Arbroath was completed and ready for

shipment, leaving only the 23 steps of the stair to be cut. The *Smeaton* carried to Leith the carter James Crow with his horse Bassey and the Woolwich sling-cart which had shifted all the blocks and stones at the yard and harbour at Arbroath. They would bring to the ship at Leith the stones for the parapet and the parts of the lantern which were being fitted together in Edinburgh. On arrival there Stevenson had the pleasure of meeting Mrs Dixon, one of Smeaton's daughters, who had intended to visit the Bell Rock but from its inaccessibility had to be content with inspecting the upper courses and lantern.



145. James Crow and his horse Bassey moving a stone by the sling-cart. The skeleton of this horse was exhibited for many years in the museum of the Royal College of Surgeons in Edinburgh

On the 9th the last cargo of stones dressed at Arbroath was delivered at the Rock and on the 12th the *Smeaton* brought from Leith the first cargo of Craigleith stones. Accompanied by the *Patriot* she returned there to fetch more stones, the lantern and the lighting apparatus.

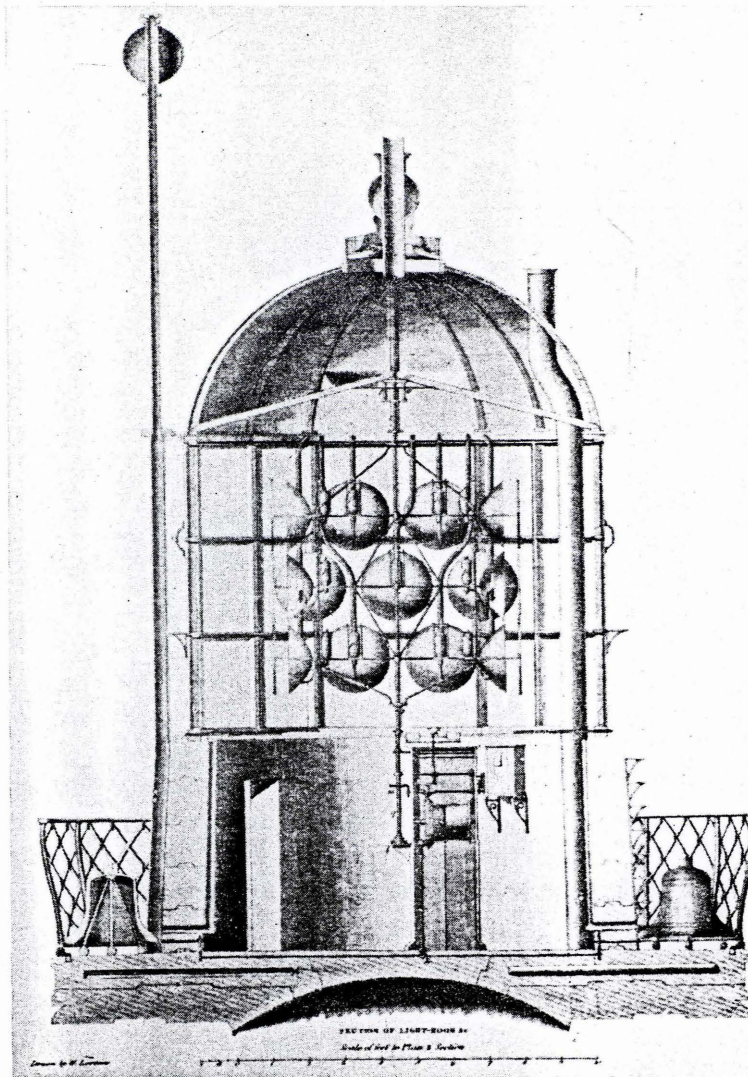
After completion of the 68th course the raising of a stone from the trolleys involved coiling over 45' of the chain of the balance-crane. This took much time so the continuous lift was split into two, by fixing another winch and a beam to project from one of the tower windows. The stones of the parapet were small and were handled quickly but the slabs for the lightroom floor, each $7\frac{1}{2}'$ long and weighing over 1 ton, were covered with matting and raised with difficulty to the height of 95'. On the 30th July the last stone of the tower was laid, to close the 91st course. In case completion of the operations in 1810 should be prevented, the lower parts of the beacon were again treated for preservation.

1810 AUGUST

On the 4th the building work was finished so all the masons returned to Arbroath to build the 4 houses for the lightkeepers, using the stones of the masonry platform and sandstone from Mylnefield quarry. The lease of the yard was surrendered, only 4 of its 7 years' period having expired. The accuracy of the position of the Bell Rock reef on current sea-charts being doubtful, Stevenson set out a long base-line along the shore at Barry and corrected the position by angles.

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On the 14th the *Smeaton* carried to the Rock 17 craftsmen to complete the woodwork. During that night a storm arose which increased in violence until it surpassed in severity the worst that had been experienced by any of the men when residing in the beacon. The ship broke adrift and as usual made for the shelter of the Firth of Forth. The tops of the



146. The Bell Rock lantern and fog bells. In 1843 the complete lighting apparatus (reflectors, lamps and revolving machinery) was shipped to Newfoundland and illuminated Bonavista lighthouse until after 1872

waves struck the beacon directly and alarmed the occupants greatly but the damage done to it was slight. Not until the 18th could a boat put out from the lightship to help them. On the 20th materials for repairing the beacon were brought out to the Rock with parts of the lantern. After raising these to the top of the tower the balance-crane was unscrewed and lowered 'in mournful silence' in token of its efficient service. It was taken ashore and preserved for the building of another lighthouse.

The Bell Rock Lighthouse 1806 to 1811

1810 SEPTEMBER-1811 FEBRUARY

On Sunday 2nd September the heavier furnishings were brought to the Rock and the gangway was cut away and replaced by the former rope-bridge. A rope-ladder gave direct access to the tower from the rock. Eventually brass rungs to form an external ladder were inserted into the stones of the tower though Rennie expressed the mistaken opinion that they would offer a grip to the sea and weaken the tower. On 25th October after 36 hours' work by daylight and by torches, plumbers and glaziers inserted the lantern-panes and put the finishing touches to the lantern and connected the machinery to toll in fog the two 5-cwt bells which cost £60 each. The Lighthouse yacht now took over the duties of the lightship as a tender and the *Smeaton* and the *Patriot* resumed their former occupation of carrying to Arbroath for the houses cargoes of sandstone blocks from Mylnefield.

Lack of red-tinted glass delayed exhibition of the light. No sheets as large as 25" square, which was the size required, had been made hitherto in Britain. Eventually James Oaky, a glass worker of London, 'a very ingenious artist . . . rather an irregular correspondent', contracted to supply them; but frequent letters and calls on Oaky failed to obtain delivery, so a foreman travelled by the coach from Edinburgh to London with instructions to remain in attendance at Oaky's premises until he produced the glass sheets. When he did so, the customary *Notice to Mariners* was issued to announce completion of the lighthouse and the intended exhibition from the 1st February 1811 of the light and the tolling of a bell during fog and poor visibility.

On the evening of the 1st February the crew of the lightship raised her 3 lights as usual and extinguished them at the moment when the permanent light shone forth from the top of the Bell Rock tower. On the conclusion of this vessel's uncomfortable vigil of 3½ years, many of her crew married Arbroath girls and remained in the Lighthouse Service as lightkeepers or as seamen in the attending vessels. Four lightkeepers were appointed to serve in the lighthouse, one remaining ashore for a fortnight. From a signal-tower erected at Arbroath communication with the lighthouse by heliograph and flags was arranged, and a pigeon-post was maintained for several years.

COST OF THE WORKS

Including the purchase and hire of shipping and the erection of the dwellings at Arbroath the lighthouse works cost £61,331. The tower contained 28,530 cubic feet of stone weighing 2,076 tons. The light, measured from the centre of the reflectors, had been elevated 88' above high-water of spring tides or about 104' above the foundation.

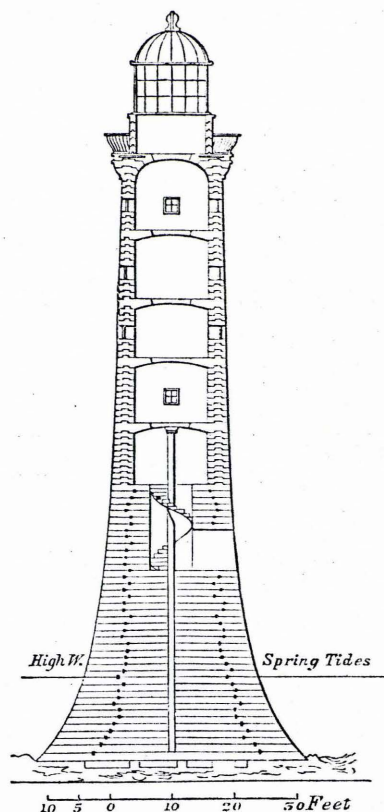
EMPLOYMENT OF THE MEN

An outstanding feature of the Bell Rock works was the enthusiasm of the men to complete an undertaking that fired their imagination despite the hardship and danger to which they were exposed continuously. By sharing their discomforts afloat and on the beacon and clearly doing all that was possible for their welfare, Stevenson won their adherence to the enterprise. It is certain that his requiring them initially to engage themselves for one month was a critical point in its early completion. The men formed a splendid team in which the key posts were filled by able and reliable persons such as the masters of the vessels

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and the chief mason. The engineer's clerk at Arbroath had a great responsibility in providing a continuous supply of materials and supplies for the large company in the ships and on shore.

The men received remuneration that was high for the times. They got payment for overtime and the issue daily of rations which included $\frac{1}{2}$ lb. beef, 1 lb. bread, 2 oz. butter, oatmeal, barley, vegetables and 3 quarts of beer. The current price of whisky was 11s. per



147. A sectional elevation of the tower

gallon. Every effort was made to recompense them for confinement afloat by caring for their welfare and keeping them occupied and cheerful. Men lodging on shore received schooling at night and those who might benefit had instruction in architectural drawing. Every Sunday a religious service was held aboard ship or on the Rock and sittings were reserved in an Arbroath church. Each man received a glass of rum after working in wet weather, when beginning particularly early in the day or ending late, and in celebration of all unusual incidents. Postal rates being heavy, their correspondence was sent free of cost.

CONTROL OF WORKS

The full advantage taken of the peculiar features of the reef, the decision to employ so many men and vessels, and the immediate devising of new contrivances as the work proceeded makes the building of this tower outstanding in the history of lighthouses. Much delay

Soldiers arrived from Montrose to our assistance, & was marched down to the Back of Hill with Drums beating. I cannot particularly describe the Confusion that great part of the Inhabitants was in, many leaving the Town & going to the Country to be without reach of the Shotts. The number of Town & Country men that were Under Arms all Night were above 80, so that Including the Soldiers there was above 150 men in Arms all Night. Capt Fall lay quiet all Night and began Firing again a little after 3 in the morning but Slowly as it was found he had been heating his Balls in order to Sett Fire to Houses. He Yesterday took One of our Vessells Belonging to this place which he ransomed for 50 Guineas & took another at 5 o'Clock on Thursday morning which he ransomed for 70 Gs and kept the Masters as ransomers. About 8 o'Clock he Sent a Boat ashore with 6 French men and a Leut with a Letter to the Prov't. The Tide then being Back they landed amongst the Rocks, they were not allowed to come up to Shore to See Our Force but was mett within Flood Mark by a party of Soldiers headed by the Prov't & some others of the Principal Inhabitants who read & read the Letter the Contents was that if the Prov't &c did not come on board & make terms with him he would come into the Harbour with his Cutter & land his men & destroy the Town a Poscrip in the letter Said that if they kept his men Prisoners or detained them any way he would hang every Prisoner he had on board in their Vew. The French men were Conducted back to their Boat by the Soldiers.

THE BELL ROCK,

a dangerous sunken reef about twelve miles from Arbroath, besides being of national is also of considerable local importance. Here, in the days before the present century began, many a noble ship was dashed to pieces and many a brave seaman found a watery grave. In the earliest known sea map applicable to the coast of Scotland is a chart of the voyage of James V. from the Firth of Forth, by the Orkney and Western Isles, to the Firth of Clyde and coast of Galloway in the year 1540. This map was first published in France in 1583, and afterwards in Edinburgh in 1688. Accompanying the French chart a hydrographical description of the coast of Scotland is given in relation to the Royal

voyage. In this are noticed the rocks and sandbanks, or "dangers," as they are termed, which it was necessary to avoid. In adverting to the course from Leith by the East Coast to Duncansbyhead, he says:—"Entre Finismes [Fifeness] et la pointe nommée Redde, xii mille à l'est sud est du costé de la dicte pointe Redde, gist un danger appelé *Inchkope*." This is undoubtedly the Bell Rock, the inch or island of the cape, and with a reference to the Redhead to the north of Arbroath, the highest and most remarkable point on the coast.

It is difficult to ascertain the true origin of the name now, and for many years, applied to it. Many have been the speculations on this point, one of these being its shape or figure, for before the lighthouse, of which we are to speak, was erected, the rock at some distance had the appearance of a large bell. The name, however, is now generally supposed to have been derived from a tradition that an Abbot of Aberbrothock, seeing the many wrecks which resulted from the existence of this dangerous reef, caused a bell to be erected upon it. It is thus referred to in an old work, "Stoddart's Remarks on Scotland:—"By the East of the Isle of May, twelve miles from all land, in the German Seas, lyes a great hidden rock, called Inchcape, very dangerous for navigators, because it is overflowed every tide. It is reported in old times, upon the said rocke there was a bell, fixed upon a tree or timber, which rang continually, being moved by the sea, giving notice to the saylers of the danger. This bell or clock was put there and maintained by the Abbot of Aberbrothock, and being taken down by a sea pirate, a yeare thereafter he perished upon the same rocke, with ship and goodes, in the righteous judgment of God." Founded on this tradition, Southey's well-known and beautiful poem, "The Inchcape Bell," is written. We need not quote it here, as it is well known to all our readers. The natural

history of the rock is exceedingly interesting, and affords a good field for study.

In the closing year of the last century the wrecks along the coast were numerous, involving a large sacrifice of life, men both of the Mercantile and Royal Navy being numbered among the victims. In the early years of this century Parliamentary powers were given for the erection of a beacon or lighthouse on the rock.

THE LIGHTSHIP PHAROS.

Till the lighthouse could be got ready, it was agreed that a floating light should be moored in the immediate vicinity of the rock. In the year 1806, a number of vessels were taken by our cruisers on the coasts of Holland, Denmark, and Norway. One of these, a Prussian, was purchased for the Bell Rock service. She was called the Tonge Gerret, but the name was changed to the Pharos, and she was fitted up as a lightship, being the first on the coast of Scotland. When she was ready she was accompanied to her station by a yacht having on board a party of gentlemen of the Trinity House, Leith. These were joined by David Balfour, Andrew Duncan, David Cargill, John Fleming, and William Kydd, as representing Arbroath. After much trouble the lightship was safely moored.

The architect employed for the erection of the lighthouse was Robert Stevenson. On his first visit to the rock ample evidence was obtained of the destructive power of the reef, many and varied articles—a soldier's bayonet, a shoe-buckle, pieces of money, a cannon ball, different pieces of ship furniture, &c.—being found scattered over its surface. Arbroath, being the most contiguous harbour to the Bell Rock, was chosen as the best place for preparing the materials before shipment to the rock, and a vessel—the Smeaton—expressly built for the conveyance of these

left our harbour for the first time on the 7th August, 1807, carrying with her Robert Stevenson, the engineer, Peter Logan, the foreman builder, and five assistants. These remained in the vicinity of the rock for three days, making a chart for moorings, and otherwise preparing for the reception of the workmen. Workmen were selected and everything was ready for embarking on Saturday the 15th, but the men, twenty-four in number, preferred to delay till Monday, and on Sunday they went in a body to the Church, when the Rev. George Gleig, the then parish minister, conducted solemn and appropriate services. On the Monday the men embarked; the Smeaton, with colours flying, left the harbour. The vessels in the harbour were gay with bunting, and the pier was crowded by the townspeople, who gave vent to their good wishes in a hearty round of hurrahs.

To detail the progress of the work, or narrate the various incidents which occurred during its progress, would take very much more space than we can afford, although such a narrative would be intensely interesting. We must content ourselves, however, with reference to two or three only out of the many incidents connected with the work of erection. For a time, the men had to eat and sleep aboard the Smeaton.

THE FIRST SATURDAY NIGHT AT SEA

was a merry one. All hands were served with a glass of grog in which to drink their favourite toast "Wives and Sweethearts," and they spent the rest of the evening merrily, each man having to play a tune, sing a song, or tell a story. In this happy manner this and the succeeding Saturday nights were spent, every man being determined to please and be pleased.

THE FIRST SUNDAY AT THE ROCK.

The architect considered it expedient to carry on the

work on Sundays, believing as he did that the erection of a lighthouse at the Bell Rock, having for its object the saving of life, was a work of necessity and mercy. Notwithstanding of this the Sabbath was not forgotten. At eight o'clock in the morning all hands were assembled for prayers, a solemnity which was gone through in as orderly a manner as circumstances admitted. Round the quarter deck, when weather permitted, the flags of the Smeaton were hung up in an awning, forming the quarter deck into a distinct compartment, the pendant was also hoisted at the mainmast, and a large ensign flag displayed over the stern, the ship's companion was covered with the *flag proper* of the lighthouse service, on which the Bible was laid. A particular toll of the bell called all hands to the quarter deck, when Robert Stevenson read a chapter of the Bible, and the whole ship's company being uncovered, prayers were read. A special form of prayer, composed by the Rev. Dr. Brunton, one of the ministers of Edinburgh, entitled, "A prayer for the use of those employed at the erection of the Bell Rock Lighthouse," was also read.

The service being finished, breakfast was taken, and then the bell rang for the artificers to take their stations in their respective boats. Some demur was made as to the propriety of working on Sabbath, on noticing which the architect called all hands aft and addressed the men, pointing out to them the nature of the work, which, he said, was one on which the lives of men depended. He took them to witness that he did not propose to proceed from any want of respect for the forms of religion, remarking that he intended to attend on Sabbaths himself, from a conviction that it was his bounden duty to do so on the strictest principles of morality. At the same time, he told them that they were at liberty to hold their own opinions, and to act on them without the imputation of contumacy. On stating this he stepped into the boat, when, with the exception of four men, all followed him.

While the work was going on busily at the rock the building materials were being prepared in a work-yard on the north side of Ladyloan, Arbroath, on a piece of ground extending to about three-quarters of an acre. Here was built a range of barrack rooms for the men, workshops for smiths and joiners, engineer's office, stores, stables, &c.

JAMES CRAW AND HIS HORSE.

James Craw was in charge of the stable, and acted as principal carter at the Arbroath work-yard. The most convenient form of carriage for the conveyance of stones was what is called a Woolwich sling cart, a mode of conveyance which had long been used by military engineers in moving ordnance. This cart was drawn by a horse, a remarkably strong and powerful animal. It is not a little remarkable that this horse of Craw's must actually have drawn on the sling cart the materials of the lighthouse (upwards of 2000 tons in its finished state) three or four times; in removing the stones from the ship to the work-yard, again to the platform, and from the work-yard again for shipment to the rock, besides moving them about for the men's convenience.

When the work was nearly finished so far as Arbroath was concerned, both James Craw and his horse stood a good chance of being sent to the bottom of the sea. These two yoke-fellows had been shipped for service at Leith, and when in the vicinity of the rock a storm came on which nearly wrecked the vessel in which they were being conveyed. They both lived, however, to see the work completed. When unfit for work the horse was pensioned, being allowed to go at large on the Island of Inchkeith, where he died in the year 1813. After his death Dr John Barclay, the eminent anatomist, procured his bones and set them up in his museum.

THE PERILS OF THE WORKMEN.

Many were the perils to which the men at the Rock were

subjected. On one occasion, the Smeaton broke adrift from her moorings, leaving the men on the rock in a perilous predicament. There they were, thirty-two persons, on a sunken rock in the middle of the ocean, which, as the tide progressed, would be laid under water to the depth of twelve feet in a stormy sea. True, they had two boats, but these were insufficient to take all the men. When the truth dawned on them, they looked to each other in silence, with evident marks of perplexity depicted on their countenances. A melancholy solemnity pervaded the group, while they looked eagerly to Robert Stevenson for a solution of the difficulty. Many were the plans for escape which passed through his mind. One of these, and the most feasible he could think of, was to remove every incumbrance from the two boats, the men to strip off a portion of their clothing, so many men to go into each boat, and the remainder to hang by the gunwales while the boats were gently rowed towards the Smeaton. When he attempted to speak, his tongue refused utterance, and he learned from experience that the saliva is as necessary as the tongue itself for speech. He then turned to one of the pools and lapped a little water, which produced immediate relief. On arising from his kneeling posture, the joyful cry, "A boat, a boat!" saluted his ears. The timeous visitor was James Spink, the Bell Rock pilot, who had come express from Arbroath with letters. With the aid of Spink and his boat, all were got off the rock in safety. There can be little doubt that, but for this timely and unexpected occurrence, many of these brave fellows would that night have found a watery grave. In recognition of this service, Spink some years thereafter received a pension from the Board.

ACCIDENTS AT THE ROCK.

As might be expected, the work was not completed

without a few accidents befalling those engaged on it; but, notwithstanding the extremely perilous nature of the operations, it is a fact, greatly to the credit of all in charge of the work, that only three lives were lost during the whole progress thereof. One of the unfortunate victims was James Scott, a sailor, eighteen years of age. He and Thomas Macurich, then mate of the Smeaton, had gone into a boat to make fast a hawser to the floating buoy; and, when they were in the act of doing so, the chain, which had caught hold of the rock, or of a piece of wreck, suddenly became disentangled, and, bounding up, upset the boat. Macurich succeeded in getting hold of the gunwale, but Scott was unfortunately drowned. The young sailor was a great favourite, and his loss caused deep regret. His father at the time was a prisoner of war in a French fort, and the lad was his mother's chief support.

Another man who met his death was William Walker, on whom a stone fell in the yard at Arbroath. The third was Charles Henderson, a young blacksmith, who was employed fitting up the light room. The work was under the direction of James Dove, who had just given orders to drop work as the light was fading. Young Henderson and another youth, Henry Dickson, playfully endeavoured to outrun each other in descending from the light room. Henderson got first, but was never seen again. He had fallen from the rope-ladder, and was washed into deep water. The poor fellow had passed along this rope-ladder many hundred times, both by day and night. The operations on which he had been employed were nearly finished, and he was about to leave the Rock, when this melancholy catastrophe happened.

THE PRESS GANG.

If the men were liable to accidents, they were exempt from certain troubles which other seamen were in danger of

encountering. The war with France and the Northern Powers was then raging. The impress service was very active at all our ports, but the Commissioners of the Northern Lights were able to prevail on the Government to make exception of the men in their employment. This had the effect of making the Bell Rock service at this port very popular. As the impress officers were very rigid in the execution of their duty, it was necessary to have some means of thorough identification of the men in the Commissioners' service. For this purpose each man was furnished with a ticket descriptive of his person, to which was attached a silver medal emblematical of the lighthouse service. The following is a copy of one which was worn by "Jamie Dreadon," who will be remembered by the "old boys" of Arbroath as having been employed in his latter years to guard Boulzie Hill from suffering from the destructive propensities of the "ill-gated laddies" attending the Academy and the Old Hill School :—

BELL ROCK WORKYARD,
ARBROATH, 2 May, 1809.

James Dryden, seaman in the service of the Hon. the Commissioners of Northern Lighthouses, aged 26 years, 6 feet high, black complexion, marked with the smallpox.

ROBERT STEVENSON,
Engineer for Northern Lights.

Obverse.

James Dryden to be employed in the craft at the Bell Rock. The signature of the Engr.'s Clerk

LACHLAN KENNEDY.

Notwithstanding the possession of the certificate and medal, the men were occasionally in jeopardy from the overzeal of some of the impress officers. More than once difficulties of this kind arose. One of these happened in the case of George Dall, a young man who, in the beginning of 1810, had gone on a visit to some friends in Dundee, and

where he was impressed. The Magistrates of Dundee insisted that the regulating officer had no right to detain him, while that officer insisted that he had, on a plea that a seamen only stood protected when actually on board his ship. Meantime the poor lad was committed to prison till the case should be tried before the Court of Session. The Court decided in favour of Dall, and ordered his liberation.

NOTABLE INHABITANTS OF THE ROCK.

As every community, large or small, has its "characters," the Bell Rock was not destitute of these.

JAMES GLEN,

one of the joiners, was a capital hand in keeping up the spirits of the men in their anything but comfortable quarters. In early life he had undergone many strange adventures at sea, which he recounted somewhat after the manner of the tales of the Arabian Nights. When any one would complain of the comfortlessness of their lodgings, Glen would introduce some of his exploits and hardships, and would tell them that the present place was a paradise to some where he had been. If their slender stock of provisions was the subject, and the short rations they might be put on should the tender be driven off by storm when bringing their stated supplies, he would recount the privations to which, on one of his expeditions, he had been subjected when his vessel was disabled in the North Sea. Indeed, every difficulty which they could suggest was met by some tale of greater hardship, which under somewhat similar circumstances he had endured, and all this was told in such a cheery manner that the happy tone of his mind became infectious.

GEORGE FORSYTH,

a tall, thin, and rather loose-made man, was employed in the

Angus' Grandfather

St. A

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ARBROATH: PAST AND PRESENT.

J.M.M'Bain (1887)

fitting up of the beacon-house. He had an utter aversion to climbing the trap ladders of the beacon, and if possible, a stronger aversion to the process of boating, and to the motion of the ship, which latter he said "was death itself." Nothing would induce George to leave the beacon at night, but there, with no human companion, and with only a small black dog for a bed-fellow, would he pass the lonely night.

When the fitting up of the beacon was completed the artificers, twenty-three in number, took up their abode in it. Among these was

PETER FORTUNE,

a man singularly adapted for residence on such a place. Besides great urbanity of manner he possessed a rare versatility of talents. In person he was small of stature and rather corpulent. Besides being a good cook, he had in course of his previous life occupied many positions of usefulness. He had been a groom, a footman, a soldier, a sutler, a writer's clerk, and an apothecary. He had also a turn for making collections in natural history, for which, on the Rock, he had a fine field for pursuing. As "resident surgeon" on the Bell Rock it was said he had a great partiality for the use of the lancet. His annual fee in this capacity amounted to the modest sum of three guineas. Peter was the factotum of the beacon-house, acting in the several capacities of cook, steward, surgeon, and barber; besides doing duty as clerk or storekeeper to the establishment. During the progress of the work many

DISTINGUISHED VISITORS

were welcomed to the Rock. Among them were the Earl of Kellie, Lord Pitmilley, Sir William Rae, Bart., then Lord Advocate. The Magistrates of Arbroath also paid a visit in their official capacity.

dedication: to Arbroathians

ARBROATH: PAST AND PRESENT.

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SIR WALTER SCOTT,

along with Robert Stevenson and three of the Commissioners, visited the Rock on the 30th July, 1814. They breakfasted in the library, when Sir Walter, at the request of the party, on subscribing his name in the album, added the following interesting lines:—

Far in the bosom of the deep
O'er these wild shelves my watch I keep—
A ruddy gem of changeful light
Bound on the dusky brow of night;
The seaman bids my lustre hail,
And scorns to strike his tim'rous sail.

COMPLETION OF THE WORK AT ARBROATH.

On the 6th of July, 1810, the last course of the lighthouse was finished at the work-yard, and five guineas were placed at the disposal of the men for a "finishing pint." With this sum, the masons, with their wives, sweethearts, and friends, had a jollification, ending in a dance.

LEAVING THE ROCK.

On Saturday, the 4th of August, 1810, the building operations being finished, the artificers bade farewell to the Rock. During their long residence there, they had lost different articles of their clothing, which had dropped into the sea. When they set out on their trip homewards, some wanted jackets, and others, for want of hats, wore nightcaps; each suffered more or less from a scanty wardrobe; and, when they appeared on deck of the Sir Joseph Banks, which was to convey them ashore, they looked a rather tattered demalion lot. At five o'clock that afternoon, the tender, with those on board, entered the Harbour of Arbroath, where they were heartily welcomed by a numerous throng of