Chapter Three

Alan Stevenson 1807-65 – Of Skerryvore Lighthouse fame

Family recollections

Alan was the eldest son of Robert and Jean to survive infancy. The nursery at 1 Baxter Place had three occupants when he was born, Jane, Thomas and Elizabeth, but a year later the twins Thomas and Elizabeth had died. Two months after their death another son Robert was born and Alan and Bob became close companions for each other.

Tutors visited the home to teach the boys until they were six when they were sent to the High School of Edinburgh. This was an ancient institution sited near the old University buildings in the Old Town. It was considered at the time to give the best education. It moved to new and splendid premises on the south side of the Calton Hill in 1829, close to the Stevenson boys' home. Alan did not leave the High School until July 1821 when he matriculated at Edinburgh University in the Faculty of Arts and in the Autumn took classes in Latin, Greek and Mathematics.

In the spring of his sixteenth year Alan received a formal letter from Robert asking for his decision as to a career. He replied as follows, written surely with his 'tongue in his cheek'!

> 'Dear Father, I take this opportunity of answering your letter in which you stated a desire that I would apply myself to some business and although I must confess I had a liking for the profession of a soldier, on receipt of your letter I determined to overcome this foolish wish and am happy to say I have succeeded. On further consideration I found in myself a strong desire for literary glory and I picked upon an advocate but there was a want of interest. It was the same way with a clergyman and as I am by no means fond of shop-keeping I determined upon an engineer, especially that all with whom I have spoken on the subject recommend it and as you yourself seemed to point it out as the most fit situation in life I could desire. I only doubt that my talents do not lie that way, but in hopes that my choice will meet with your full approbation, I remain, my dear Father, Your ever affectionate and grateful son, Alan Stevenson.'[5]

He then signed a formal contract of apprenticeship to his father dated 'As from October 1822 - for learning the art and practice of a civil engineer, as exercised by him, for the space of five years, undertaking faithfully, diligently and honestly to attend to his said master's service by night and day and not to divulge any secrets which his master might entrust him.'

Alan was wrong that his talents 'did not lie that way ...' He became an engineer of outstanding ability within the comparative few working years that were granted to him. Probably the choice he made did lead to his early death. His health was never robust and it should have been obvious to his parents that the strong physique held by his father and grandfather had not been inherited by their eldest son. Travelling round Scotland to reach the distant lighthouse stations by sailing ships was still a tough and hazardous business. His mother worried constantly about him but with his mind made up Alan never looked back, and gave his heart to the job. He never at any time gave in to the messages his aching body must have been sending out to him.

Robert felt his son should learn some independence away from home, and was also aware of the limits of the Scottish environment that had been so far the whole of Alan's experience, so he arranged with the Rev. Charles Pettingal, in the London suburb of Twickenham, to receive Alan as a pupil. He gave

lessons in classics and science. A report of his progress sent to his parents said:

> 'Mrs Pettingal and I are pleased with your son. His disposition is so mild, so amiable, so perfectly willing to do what is pointed out to him as right.'[5]

Alan had great personal charm and back home in Baxter Place he and his young brother Thomas, for whom he had a special affection, were involved in every kind of high-spirited mischief. Alan wrote parodies about the many visitors to his father's table, and could see a joke in almost any situation. To a certain extent Robert could share their laughter, but he was determined that his children should learn self-control as well as all the social skills of the day. This included, in Pettingal's words, an ability 'to bear a part in a ballroom and acquire an easy carriage.' The first quarter's account amounted to £87. 2s. and included expenditure on books and amusements. They visited the Isle of Wight, saw the Royal George stationed off Portsmouth, visited a circus, fair, and dockyard. He was much moved to see the miserable condition of prisoners who were passing through the dockyard who had been captured during the war with Denmark.

His first cousin Tom Smith, intellectually the most promising of Thomas Smith's children, joined him at Twickenham in August. Later Tom entered Pembroke College at Oxford. Alan was released from Twickenham in October as Robert wrote that 'Alan must be more of a man of business: the theory will do little for him in our way of life without the practice.' He sailed from London in the *James Watt* steam packet for Leith to attend Edinburgh University and worked for two hours daily in George Street as well where 'he was occupied to improve his hand.' In 1824 still only 17 years old he was left by his father at the Rinns of Islay where a new lighthouse was being built. Alexander Slight, one of his father's senior assistants, gave him instruction. The work was on an island exposed to the worst blasts of the Atlantic and Alan had to experience terrible conditions 'in hopes of him profiting by the practice of these works and in surveying.'

Every aspect of life was put in Alan's way by his father- including horse riding. Robert wrote to William Blackadder, his resident surveyor at Glamis, for a proposed railway.

> 'As I have an idle horse in the stable, and should you wish to have him in hand in going over the line, if you think that he [Alan] could be put up either with you or at the Sun Inn, I will send him from Fife next week. If you have room for him in your stable I think an hour's work in the morning and currying the horse would be excellent exercise for Mr Alan and a useful lesson through life. He would also have the advantage of riding daily-all things should be practised in youth.'[5]

Alan made himself proficient in French, Italian and Spanish with a wide knowledge of the standard literature of these languages. He had a great gift in the use of words and an appreciation of style in writing. He gave a paper to the Royal Physical Society on 'The causes of obscurity in style and the means of obviating them.' This had some original advice to authors on many aspects of writing. His great love of literature worried Robert, who feared he might take up writing as a career instead of engineering, but Alan remained faithful to his choice and read and wrote only as a relaxation in his spare time.

Travel followed in 1827 to Russia, Sweden and Holland. He

gained much insight into the working of the Russian mind. 'No country,' he wrote, 'is surely further removed from everything that is connected with liberty, happiness and religion.'

On a visit to Paris in 1834 he met Lèonor Fresnel, the eminent French scientist, who befriended and assisted him, giving him introductions to enable him to see any lighthouses he wished. Taking advantage of this opportunity he travelled extensively round the French coasts, and made full reports of all he saw which he sent to his father in a series of seventeen remarkable letters. The lights were not all in a good state of repair and efficiency, as this sad account makes clear:

> 'Tour de Cordouan
> August 31st. 1834.
> My dear Father,
> Mr. Drouin the Contractor for the Lights of the Ocean landed me here yesterday with great difficulty and it has since blown an hurricane of rain and hail. You would be sadly disappointed to see this noble edifice which for want of timely repair is fast going to decay; and among other changes would miss the beautiful regal crown which surmounted the pediment of the door, but which last winter yielded to the effects of time and neglect and now lies a mass of ruins in the court. The rich carving which has been executed in a reticulated limestone of soft texture is also much disfigured. What would Louis XIV & XV say to this? The lantern alone has undergone some temporary repairs, but the storm of last night and today has forced the water through the joints and the vaulted staircase is swimming with water. I shall say nothing of the Chapel and other rooms which remain as formerly; the two altars still retaining the arcs [?] and small wooden crosses. On one of the altars I found the fragments of a broken *remonstrance*.'[40]

A visit with his brother David to undertake a survey at Lynas Point in Anglesey was to change Alan's personal life. It was there he met his future wife Margaret Scott Jones. He was 26 and Margaret 21. She lived in peaceful, beautiful green countryside at Lynon Hall, with a strict Victorian father and two sisters and three brothers. Only one rather poor portrait of Alan survives, made in his youth, but there is no doubt that he was very handsome. It was at a ball in Anglesey that he first met Margaret, and he never forgot her. It was to be eleven years, however, before Alan could return to marry her.

These eleven years were to see virtually the whole of Alan's staggering achievements in engineering. He completed Skerryvore, perhaps the most beautiful lighthouse in the world. He also made a steady progression with the mathematical precision of calculations for illuminants that were used by all lighthouse authorities.

From Alan's own account of Skerryvore, he tells us of his life in the second 'house', erected on the rock for thirty men, and how he had

> 'spent many a weary day and night at those times when the sea prevented any one going down to the rock, anxiously looking for supplies from the shore, and earnestly longing for a change of weather favourable to the recommencement of the works. For miles around nothing could be seen but white foaming breakers, and nothing heard but howling winds and lashing waves. At such seasons much of our time was spent in bed; for there alone we had effectual shelter from the winds and the spray, which searched every cranny in the walls

of the barrack. Our slumbers, too, were at times fearfully interrupted by the sudden pouring of the sea over the roof, the rocking of the house on its pillars, and the spurting of water through the seams of the doors and windows, symptoms which to one suddenly aroused from sound sleep, recalled the appalling fate of the former barrack, which had been engulphed in the foam not twenty yards from our dwelling, and for a moment seemed to summon us to a similar fate. On two occasions, in particular, those sensations were so vivid as to cause almost every one to spring out of bed; and some of the men fled from the barrack by a temporary gangway, to the more stable but less comfortable shelter afforded by the bare wall of the lighthouse tower, then unfinished, where they spent the remainder of the night in the darkness and the cold.'[41]

On 11th September 1844 Alan and Margaret were married. She was 32 years old and they had three daughters and a son.

It is astonishing that Alan got to the church alive and in time for his wedding. In his 'day to day' diary in the month of August we realise how lucky Margaret was that he turned up!

'6th August: Off Port Patrick at 8 am in very strong easterly gale. Miserable day off Mull of Galloway and the Isle of Man, with south-east hurricane. Impossible to land at Point of Ayre because of the surf. Go to Ramsay and drive to Point of Ayre arriving at 9 pm. I am thoroughly fatigued and go to bed at 11.

8th August: Land at Cape Wrath at 6-in very heavy surf. I fall on the slippery quay and am nearly drawn back by the backdraft of the surf which wet me to the skin with some risk of injury and I got dried at the lighthouse.

18th August: (Sunday) Walk to Inverness (from Clachnaharry Loch) and attend morning and evening service. I take very ill and am forced to go to bed in the evening and take no dinner as my cough is very troublesome.'[5]

The inspection voyage he was on continued in this way until the 28th and two weeks later he was going up the aisle!

The married couple moved at once into 11 Windsor Street and then to Regent Terrace where his two eldest daughters Margaret and Dora enjoyed the large gardens that are still at the back of this beautiful street.

Alan's health was failing even before the birth of his son. He was disabled by a form of arthritis and a creeping paralysis. He handed over his work for the Northern Lighthouse Board (much of it well advanced by himself) to his brothers David and Thomas in 1853. A plea for a pension was made to the Treasury but the papers were lost and he received nothing. He moved to a smaller house in Portobello and then over to Kirkside, a house in the Angus village of St Cyrus. Thomas and Maggie, trying to be helpful, took Kathleen and Bob for a short time when they were still resident at No. 1 Inverleith Terrace, but Thomas could not handle these two gifted 'free thinking' children and Alan took them away after only a few months.

During the lonely, often storm-bound hours when he was building Skerryvore, Alan had translated from Greek a number of hymns by Synesius[42] and he sent them to the Rev. David Hogarth who lived in the Rectory at Portland in Dorset. He was an old university friend. As late in his life as 1861 Alan stayed there for three months translating Homer and Lucretius.

A friend of both Robert and Alan's wrote a letter from Portsmouth to William Wordsworth in the Summer of 1840. He was Captain Basil Hall, son of Sir James Hall, the famous Scottish geologist. The captain was, if anything, even more well-known to the public than his father, and the poet, a keen reader of newspapers, would have been flattered to receive a letter from him. In his letter he says that Alan has asked for an introduction, and that he does not hesitate to bring Alan to his notice. The letter was not sent, and some time after, the unfortunate captain was declared insane and taken to Haslar, the Royal Navy's hospital at Gosport, where he died in 1844.

Another friend, James Wilson, who knew and sometimes visited Wordsworth at Rydal Mount, did tell him of Alan, living on the most dangerous rocks off the Scottish coast, building Skerryvore. Wordsworth gave James Wilson locks of his hair, laurel leaves from his garden, and autographs, some of which were posted to Alan. James Wilson, who was a zoologist, gave a copy of one of his books to Wordsworth, *A voyage round the coasts of Scotland and the Isles,* which was published that same year.[43]

All the above contact was to take place through friends who acted as intermediaries, and Wordsworth and Alan never met. In 1848 Alan sent him a copy of his *Account of the Skerryvore Lighthouse* to which the 77-year old poet replied with a short but finely expressed letter which thanked him not only for the present of the book but for his esteemed work in making the seas safe.

'Rydal Mount
Ambleside
May 20th 1848

My dear Sir
Accept my grateful thanks for the valuable Present of your Account of the Skerry Lighthouse &c from the perusal of which I promise myself confidently both instruction and pleasur, in no small degree. Every one who think and feels must take a lively interest in your lonely situation and most important employment. This be assured I do eminently, and with sincere good wishes for your health and well-being.
I remain
My dear Sir
faithfully your
much obliged
Wm Wordsworth.'

Alan Stevenson Esq^{r} &c &c &c
to the care of Mess^{rs} [A. & C.] Black North Bridge
Edinburgh^{s}

Alan was deeply religious and observed the Sabbath day, but during the building of Skerryvore he made an appeal for the workmen to turn out on a Sunday. They obliged him but he was to suffer agonies of remorse about it and he wrote a long letter of apology some years later to John Sinclair, then working as Assistant Keeper, Pentland Skerries, Huna, [by] Wick.

'Edinburgh 10 March 1846.

Dear Sir,
I feel it to be my duty to address a few words to you on the subject of the greatest moment, which I *habitually* disregarded while you were engaged some years ago at the Skerryvore Lighthouse works under my direction. The difficulty of the work in which we were engaged, and the

uncertainty of the weather, I at that time considered as a sufficient plea for violating the sanctity of the Lord's Day; but I have now seriously to declare my deliberate and sober conviction that, although there be works of necessity and mercy which *ought* to be done on the Day of Rest (according to the precept and example of our Blessed Lord himself), it may well be doubted whether almost any of the operations at the Skerryvore were of the kind to be so exempted; while in the great majority of the cases which occurred, no honest ground for each exemption could have been pleaded. (Jeremiah, xvii. 21, 22, 23.) ... "the Christian Sabbath was openly profaned, almost without the shadow of pretext,"'[5]

Alan was a frequent visitor to France where he became greatly attracted to the Roman Catholic religion and was a close friend of the organist at Amiens Cathedral - he would sit by him in the organ loft during the celebration of high mass. He returned to Scotland and he finally had to come to terms with the established church. When he died he did not know that his own son would be a profound agnostic, a grandson a Roman Catholic priest, and that a great-grandson would become a Buddhist!

Alan's rigorous and careful education prepared him for his life as a practising and an innovative engineer but his health was shattered at an early age. His fine mind, was equally at home with classic authors and contemporary writers as with the advancement of lighthouse lighting technology, and he collaborated with other leading engineers such as Telford and Fresnel. Endowed with great tact and sensitivity, he used his great intelligence to push forward his own knowledge gained from the close work with Fresnel without hurting his father's feelings and rigidly held opinions. He left his two younger brothers with careful far-seeing guidelines before he retired.

He was a man of astonishing physical courage against the adversity of pain. Expressed in many poems to his wife Margaret and to his children was the love he had for them.

When his mother, Jane Stevenson, died at the beginning of March 1846 Alan wrote this poem:

'ON MY DEAREST MOTHER
Of gentle soul, to all that knew her dear,
The tender mother, best of friends lies here,
Whose darling wish was comfort to impart,
To cheer the drooping, soothe the aching heart.
Love, truth, and meekness breathed in all she said;
Faith bless'd her life, hope smooth'd her dying bed.

Dearest of mothers! best of friends, farewell;
These words sincere a son's affection tell;
Through life thy virtues were his joy and pride,
In death his best example and his guide.
Our social hopes and fears, alas! are o'er;
A mother's love now cheers our hearth no more.'[44]

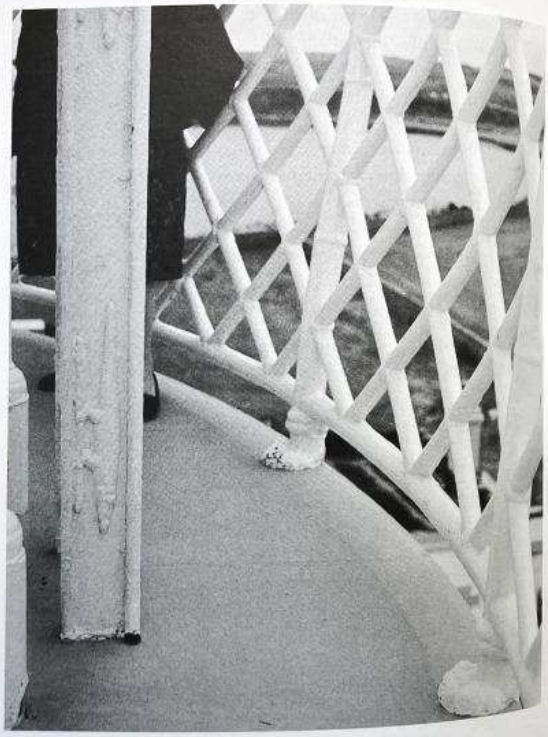
For the twelve years after his retirement Alan's courageous spirit never failed him. **[41]** He continued to lecture and write and the Commissioners gave him a small pension, much eroded by the expensive treatment which he hoped would alleviate his illness. The cause of death was given as 'General paralysis - 8 years.' As his father had wished, he is buried with his wife Margaret Scott Jones in the family burial ground in the New Calton Cemetery in Edinburgh.

A professional aspect

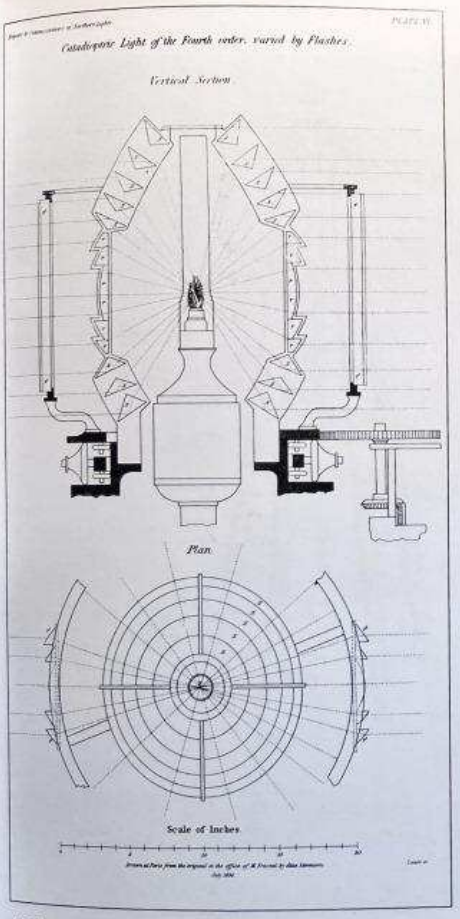
Alan Stevenson with his classical background and M.A. degree can be considered the most intellectual of the Stevenson engineers. At Edinburgh University he had gained under Sir John Leslie the Fellowes prize for excellence as an advanced student of natural philosophy. In 1827-28, before completing his training, encouraged by and with access to the notes of his father, he compiled a list of British lighthouses with their identifying features. It was published as a pocket book for the benefit of mariners entitled *The British Pharos* and, as the first comprehensive work of its kind, proved sufficiently popular to require a second edition within three years.

In 1830, having completed his training, Alan was appointed clerk of works to the Northern Lighthouse Board working under his father. During the next three years he was engaged on several new lighthouses, including Girdleness, Aberdeen, where he may have been responsible for specifying the decorative cast-iron ornamentation including, birds, crocodiles and rustic style bamboo balustrade with animal feet. **[42]**

The Board, acting on Robert's advice, had been slow to develop the potential of Augustin Fresnel's dioptric or lens system of improved lighthouse illumination introduced in France in 1822, and was encountering criticism on this account from David Brewster and others. Alan took the lead in defending the Board from this charge and in progressing this innovation in Britain. During the summer of 1834, he visited lighthouses and workshops in France, gaining knowledge of the best French practice from the work of Léonor Fresnel, Jean-Baptiste François Soleil and Isaac-Ami Bordier-Marcet. In 1835 his influential *Report . . . on illumination of lighthouses by means*



[42] *Girdleness Lighthouse, Aberdeen, 1833. Ornamental ironwork. Note bamboo style balustrade and crocodiles on ladder side.*



[43] *Alan's re-drawing at Paris of a Fresnel fixed small light, 1834.*

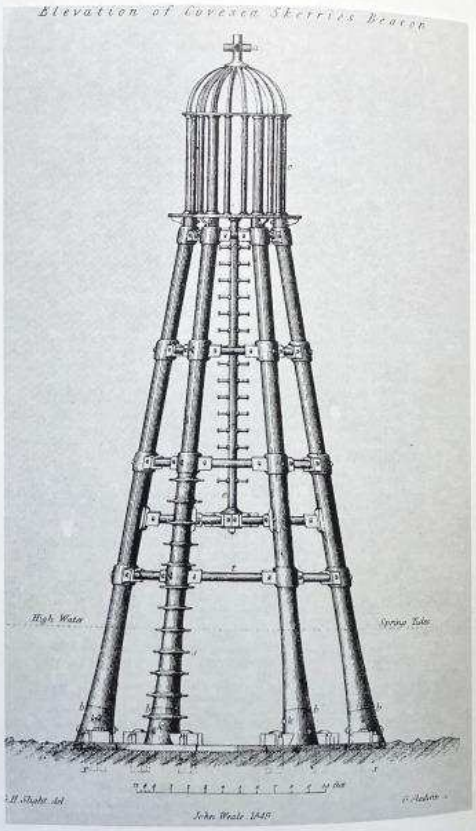
[44] *Granton Harbour proposals with road and railway routes to Edinburgh, 1834. Only the northern part of the road, now Granton Road, was built. From Robert and Alan's report.*

of lenses was published which included a valuable account of French practice and recommended application of the dioptric system in Scotland. **[43]**

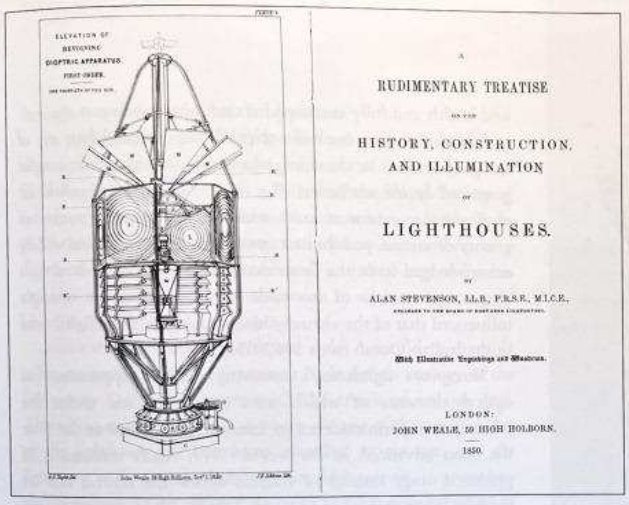
The Board thoroughly approved of Alan's initative and diligence in this matter and soon afterwards the revolving light at Inchkeith and, in 1836, the fixed light at the Isle of May were converted to the new system under his direction. The result was a three-fold order of increase in brightness and the general adoption of the dioptric system in British lighthouses. In 1836 he designed and superintended the installation of the first dioptric light in England at Start Point, Devon, for Trinity House of Deptford Strond.

In c. 1832 Alan was taken into partnership in the firm by his father, the business then being known as *Robert Stevenson & Son.* From 1838, when David became a partner, until 1846, it operated as *Robert Stevenson & Sons.* Between 1832 and 1838 Alan's work included preparation of a chart of the Scottish coast, Ballyshannon harbour improvement, Granton harbour **[44]**, plans for Edinburgh & Glasgow, Edinburgh & Dundee and Perth & Dunkeld railways, Perth harbour, and navigation improvements to the rivers Tay and Ribble. Although it must have been disappointing for Robert and Alan that their railway proposals came to nothing, they undoubtedly had a greater affinity with the maritime work which proved to be the mainstay of their business. Soon afterwards Alan wrote an authoritative account of the development of *Sea Lights,* from the earliest times until c. 1838, which was published in successive editions of the *Encyclopedia Britannica* in 1840 and 1857.

From December 1837 until August 1843 Alan was intensively and almost exclusively employed by the Northern Lighthouse Board on his most important work, the design and



[46] *Covesea Skerries iron beacon, 1844. From Alan's Lighthouses treatise, 1850.*



[47] *Alan's Lighthouses treatise with elevation of revolving dioptric apparatus 1st order, 1850. This apparatus was devised for and used at Skerryvore Lighthouse.*

construction of Skerryvore lighthouse. **[45]** It had been mutually agreed that this was too arduous a task for Robert who was by then sixty-five. In January 1843 Alan succeeded Robert as Engineer to the Board and for the next decade, until paralysis dictated his retirement, he was responsible for the design and construction of numerous other new lighthouses and a cast iron beacon at Covesea Skerries. **[46]**

Alan's reputation was based mainly on his design and execution of Skerryvore lighthouse, his definitive account of which, together with his notes on lighthouse illumination, were handsomely published in 1848.[41] Two years later these notes were extended and more widely propagated through *A rudimentary treatise on the history, construction and illumination of lighthouses,* dedicated to his *dear friend* Léonor Fresnel. **[47]** Both works were technically valuable to maritime engineers for a century.

[48] *Hynish dry-dock, Tiree, Argyllshire, c. 1844.*

Skerryvore Lighthouse, 155 ft. high on a dreadful storm-swept, reef exposed to the full fetch of the Atlantic 12 miles west-south-west of Tiree, was one of the world's greatest lighthouse achievements. It was erected and serviced from a purpose built harbour and base at Hynish to Alan's design. **[48]** The method of conducting the work was basically similar to that for the Bell Rock lighthouse using a temporary beacon barrack. This barrack erected in 1838, the first season's work, was totally destroyed by a storm soon after its completion. The eventual creation of the lighthouse by 1843, under great difficulties and at a cost of about £90,000, severely tried Alan's courage, patience

[49] *Skerryvore Lighthouse lamp.*

and health and fully exercised his undoubted ability.

This lighthouse was more scientifically designed than any of its predecessors, with sides curved in the form of *a solid generated by the revolution of a rectangular hyperbole about its assymptote as a vertical axis*[45] which had the lowest centre of gravity of various possibilities considered. The result was widely acknowledged to be the finest example for mass combined with elegance of outline of any rock tower. Alan's design strongly influenced that of the virtually identical Alguada reef lighthouse in the Indian Ocean from 1862-65. **[119]**

Skerryvore lighthouse's revolving dioptric apparatus, the optical elements of which were made in Paris under the immediate superintendence of Léonor Fresnel, was at the time the most advanced in the world. With Alan's innovation of prismatic rings instead of mirrors below the central belt its dioptric effect was greatly extended. **[47]** The light source was an intricate and beautifully executed oil lamp with four concentric wicks. **[49]**

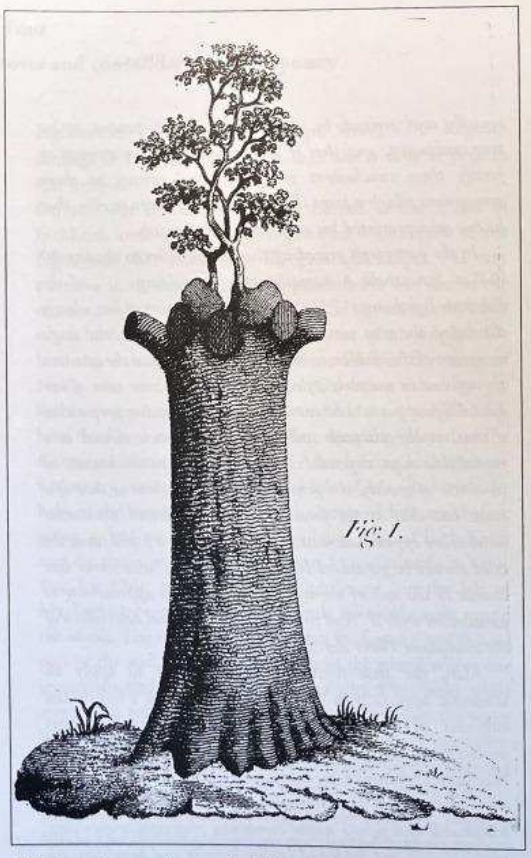
Alan further improved the efficiency of the dioptric system by constructing refractors in rhomboidal intead of rectangular pieces of glass thus obviating obscuration in any one direction. For the same reason he introduced inclined astragals into lanterns, a practice often adopted in later lighthouses and lanterns. **[96]** He also introduced an improvement in fixed dioptric apparatus by converting Fresnel's narrow lenses into a truly cylindrical drum and adding prismatic rings above and below the central belt. This feature, later improved by Thomas, was a development of **[47]** made possible by the manufacturing skill of Messrs. Cookson of Newcastle. The drum, by equally distributing light all round, extended the dioptric action

through the whole height of the apparatus.

In 1830 Alan, sponsored by Telford and other leading engineers, became a corresponding member of the Institution of Civil Engineers and, in 1838, a Fellow of the Royal Society of Edinburgh, serving as a member of its council from 1843-45. In 1840 the University of Glasgow conferred on him an honorary degree of LL.B. The Emperor of Russia and the Kings of Prussia and Holland presented him with medals in acknowledgement of his merit as a lighthouse engineer.

Alan's writings exhibit clarity and style. A confident example is his masterly critique of Smeaton's basic design analogy of the Eddystone Lighthouse tower with the trunk of an oak tree. *There is no analogy, he wrote, between the case of the tree and that of the lighthouse, the tree being assaulted at the top, and the lighthouse at the base; and although Smeaton goes on . . . to suppose the branches to be cut off, and the water to wash round the base of the oak, it is to be feared that the analogy is not thereby strengthened; as the* materials *composing the tree and the tower are so different, that it is impossible to imagine that the same opposing forces can be resisted by similar properties in both.*

It is obvious, indeed, that Smeaton has unconsciously contrived to obscure his own clear conceptions in an attempt to connect them with a fancied natural analogy between a tree which is shaken by the wind *acting on its* bushy top *and which resists its enemy by the* strength *of its fibrous texture and wide-spreading ligamentous roots, and a tower of masonry, whose weight and* friction *alone enable it to meet the assault of the* waves *which wash round its* base; *and it is very singular, that . . . he does not appear to have regarded those properties of the tree which he has most fitly characterized as "its elasticity" and the "coherence of its parts." One is tempted to conclude that Smeaton had, in the first place, reasoned quite*



[50] *Smeaton's tree trunk analogy for Eddystone Lighthouse design. From Smeaton's Narrative, 1791.*

soundly, and arrived, by a perfectly legitimate process, at his true conclusion, and that it was only in the vain attempt to justify these conclusions to others, and convey to them conceptions which a large class of minds can never receive, that he has misrepresented his own mode of reasoning.

In the paragraph preceding that which refers to the tree 80 [64 in Smeaton's *A narrative of the building . . . of the Edystone lighthouse*, 1791 - **50**], *he has, in point of fact, clearly developed the true views of the subject; and, with the single exception of the illusion to the oak, he has discussed the question throughout in masterly style. In a word, then, the sum of our knowledge appears to be contained in the following proposition - 'that, as the ultimate stability of a sea-tower, viewed as a monolithic mass, depends,* caeteris paribus, *on the lowness of its centre of gravity, the general notion of its form is that of a cone; but that as the forces to which its several horizontal sections are opposed decrease towards its top in a rapid ratio, the solid should be generated by the revolution of some curve line convex to the axis of the tower, and gradually approaching to parallelism with it.' And this is, in fact, a general description of the Eddystone Tower devised by Smeaton.*[46]

Alan, the first member of the family to apply an academic approach to his work, proved to be a lighthouse engineer of truly outstanding ability during his short professional life. On his death the Commissioners of the Northern Lighthouse Board recorded *their deep and abiding regrets for the loss of a man whose services had been to them invaluable and whose works combined profound science and practical skill and conferred lasting honour and benefit on his country.*[47] **[51]**

[51] *Skerryvore Lighthouse's commemorative tablet. From Alan's Account of the Skerryvore Lighthouse, 1848.*