

WASC 2209

Harrison Finley
Gunpowder Stock
Book

1871-76

WASC 2209

**MELFORT GUNPOWDER MILLS, ARGYLL:
A LETTER BOOK OF 1859-60**

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Abstract

The Melfort gunpowder mills, near Oban in Argyll, which operated from 1853 to 1874, were owned by Harrison Ainslie, a major iron-mining and smelting company based in Furness, Cumbria. A rare letter book covering an eight-month period in 1859-60 survives and provides an invaluable account of the work of the mills, their place in the local community and their national and international interactions. It contains 334 hand-written entries and the most significant of these are examined and discussed. In particular, priority is given to the acquisition of raw materials for making gunpowder and of other materials and equipment for operating the mills. An account is also presented of the sale of gunpowder to customers in Scotland and, through agents in Glasgow, worldwide, including Australia and Chile. The transport of gunpowder and other goods by road and ship, including both sail and steam powered vessels, and the recruitment of staff are also examined. Finally, the purchases of commodities for the company store are noted. Aspects of the contents of the letters that are considered to be particularly interesting are discussed and readers are encouraged to discover and research letter books associated with other industries. Appendices list the names and addresses of the recipients of letters and of the names and some details of the ships used.

Introduction

The Melfort gunpowder mills in Argyll were located at NGR NM 8414, on the west coast of mainland Scotland, 16km south of Oban and 1km north-west of the village of Kilmelford. The buildings stretch for about 1km along the valley of the River Oude before it enters Loch Melfort. The works were established in 1853 by Harrison, Ainslie & Co, based at Newland House, near Ulverston in Furness, then part of Lancashire but now in the south-west region of Cumbria.¹ This firm was mainly concerned with iron mining and smelting and since 1753 had, with their predecessors, operated the Bonawe or Lorn furnace (NN 009318) just south of Taynuilt on Loch Etive, 14km east of Oban. They also held extensive woodlands in Scotland to provide charcoal for both the Bonawe furnace and their furnaces in Cumbria.² In particular in 1838 they purchased over 5,600 acres (2,268ha) of coppiced woodlands at Melfort. The charcoal produced was at first used exclusively for smelting but it is also an ingredient of gunpowder and Harrison Ainslie required blasting powder for their haematite mines in Furness. This was the reason given for establishing the Melfort gunpowder works. However, they were no doubt aware that Britain was likely to become involved in the Crimean War, which started in 1853, so that there would be an increased demand for gunpowder for military use. At that time there were already three gunpowder works in Argyll: Glen Lean, at Clachaig (NS 1281), 7km north-west of Dunoon, Kames, at the villages of Kames (NR 9772) and nearby Millhouse (NR 9671), on the Kyles of Bute and Loch Fyne at Furnace (NN 0201) 10km south-west of Inveraray. These were established in 1832, 1839 and 1841 respectively.³ The locations of all these works are shown in figure 1.

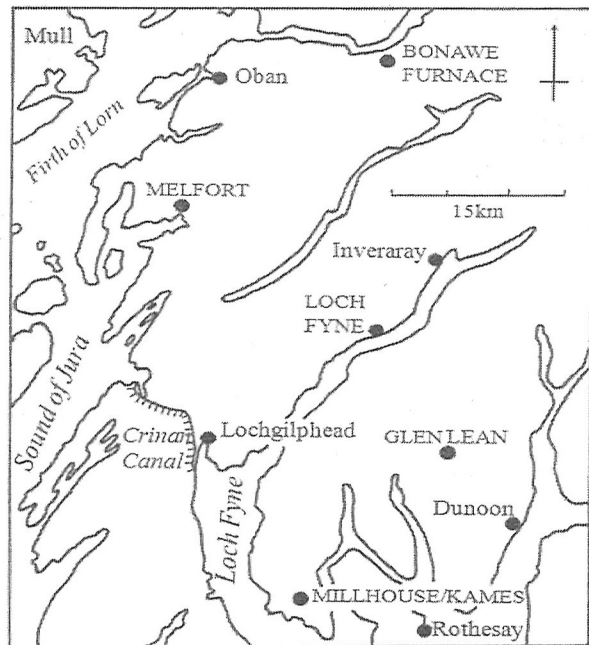


Figure 1. Location map of Melfort, Glen Lean, Kames and Loch Fyne gunpowder works and the Bonawe iron furnace in Argyll.

Accounts of the establishment of the Melfort gunpowder mills, explosions there in 1860, 1866 and 1867 and its closure in 1874, have been published and it is known that there were 68 gunpowder mill workers in 1871.⁴ Also, the 25 inch Ordnance Survey map published in that year provides an exceptionally detailed plan of the works, individual buildings being labelled. Figure 2 is based on this map. Otherwise, little or no information has been published on the customers, the suppliers of raw materials, the transport of gunpowder from the mills, particularly by sea, the management of the mills and the influence they had on the local community. It is therefore encouraging that in the present article an account can be given of the contents of a Harrison Ainslie letter book, compiled at the works in 1859-60. This is held at the Cumbria Record Office and Local Studies Library, Barrow-in-Furness, and provides a wealth of information about the mills.⁵

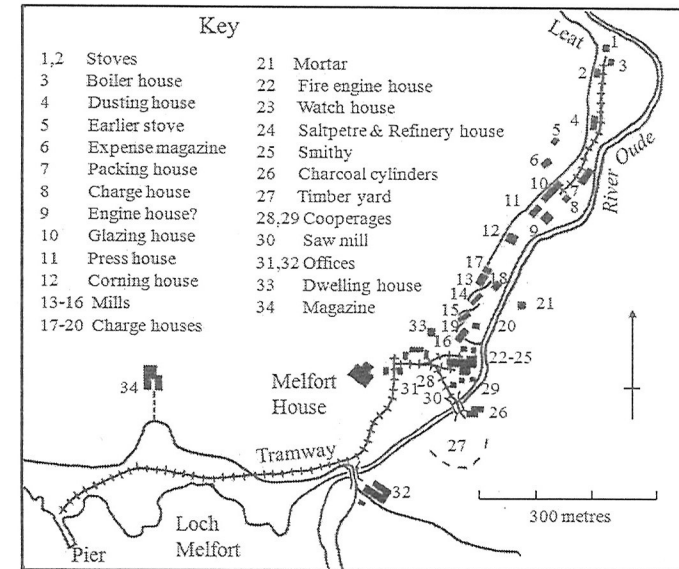


Figure 2. Sketch map of the Melfort gunpowder works in the early 1870s.

General Description of the Letter Book

The Melfort letter book contains approximately 760 pages, measuring 342 x 264mm and ruled with very faint lines 8mm apart. No watermarks have been detected in the paper. The book is 48mm between the boards, each of which is 5mm thick. There are marbled endpapers and the edges of the pages are also marbled. At the front of the book there is an index of the entries, mainly names and addresses of firms and individuals to whom letters were sent together with the page numbers where copies of these entries can be found. Further information about this index, including a full list of recipients, is provided in Appendix 1.

The letters start on page 1, which is the first right hand page after the index, and end on page 130. The remaining pages of the book, over 600, have not been used. The first letter was written on 13 June 1859 and the last on 16 February 1860. Most of the 130 pages

contain copies of either two or three letters but 13 have four letters and in four cases the letters occupy more than one page. They have clearly been written with quill pens and most of them are in black ink. However those written from 11 November 1859 to 5 January 1860, on pages 81 to 110, are in blue. In addition, all the page numbers on letter pages 1 to 110 are in blue. It is thus clear that the pages were not numbered before the period covered by blue ink started and therefore an index could not have been prepared before then. Indeed the ink used on the index pages for the names and addresses and the page numbers suggests that the index was in fact started in blue on 4 January 1860 and extended for the first time, in black, on 13 January 1860. One of the letters, written on 4 January, is about ink purchased from an Oban stationer and is discussed below.

Contents of the Letters

The book contains 336 hand-written items. These can be divided into 297 copies of letters sent to firms or individuals, 18 notes about other letters sent, 12 notes on money received from customers, seven copies of letters received and two records of amounts of gunpowder made, sold and in stock. All of these items appear to be written by the chief clerk William Murray. He also signed 189 of the originals on behalf of the manager Richard Roper Kelly⁶ and 41 in his own right. A further 44 were signed by Kelly himself and 21 by John Sinclair the manager of the company store, but 14 of these were countersigned by both Murray and Kelly. The rest of the items in the book are unsigned. The letters cover a wide range of topics, and notes on the information provided are presented below, where the following historic units have been used:

1 pound (£) = 20 shillings (s) = 240 old pence (d) = 100 new pence;

1 foot (ft) = 12 inches (in) = 0.305m;

1 ton = 20 hundredweights (cwt) = 2240 pounds (lb) = 1000kg (approx). However note that, to allow for wastage, a 1cwt barrel of gunpowder was said to contain 100lb and not 112lbs and correspondingly for other weights.

Purchase of Raw materials for Manufacturing Gunpowder

Gunpowder is a mixture of saltpetre, charcoal and sulphur, which are incorporated together with a small amount of water in a mill and then pressed, granulated, dried, polished and dusted.⁷ The separate buildings for carrying out these processes at Melfort are indicated in figure 2. For good quality powder the proportions of the three ingredients are about 75:15:10 but these may vary considerably, particularly for blasting powder. The length of time taken for incorporation varied between about two hours and eight hours depending on the quality of gunpowder being made.

Saltpetre, or simply 'petre', is mentioned in ten letters but none of these are orders for more saltpetre. Seven concern the sale of saltpetre refuse, one the purchase of cocks for saltpetre boilers, one a query about an earlier charge for saltpetre and one stating that the war on the Continent has raised the value of saltpetre. The amount of saltpetre refuse was substantial, one letter recording that 11 tons 4cwt was being sent to Glasgow and another that they had received £207.0s.5d for 12½ tons, about £16.11s.3d per ton. This refuse was generated when the incoming saltpetre, which was almost certainly imported in a 'rough' state from India, was refined using boilers in building 24 of figure 2. The refining process was usually repeated a few times and the waste then had to be disposed of. The apparent lack of orders for saltpetre suggests that the mills already had a large amount in store.

Charcoal, wood for making charcoal and cylinders in which it was made are referred to in eleven letters. Coppiced wood was used, particularly alder and willow. Five of the letters are to the owner of saw mills at Omagh in County Tyrone, who had offices in Londonderry and Donegal. He supplied peeled alder, willow and birch. Some charcoal wood was also acquired, through an arrangement made with a Dumbarton merchant, from Ardsheal, which is about 19km north-north-east of Melfort. However one letter turns down an offer, from a resident of Islay to supply charcoal, stating that they always manufactured it themselves. Also,

two letters record charcoal being sent to Alexander Kelly of Bonawe for smelting iron at the furnace.⁸ Finally, three letters to Carnlachie foundry in Glasgow concern the purchase of a total of ten charcoal cylinders 'exactly the same as the last lot'. These would have been housed in building 26 of figure 2, which is conveniently located next to the timber yard. A further five letters refer to 'coals' that, in context, seems to mean coal rather than charcoal.

Two letters to an agent in Glasgow complain that they had persuaded Harrison Ainslie in Furness to purchase 50 tons of sulphur, after Melfort had told them that they would not require any for nearly a year. Clearly they kept a very large stock at the works, the same situation that has been suggested above for the case of saltpetre. This sulphur would probably have been imported from Sicily. A further letter to a merchant in Glasgow informs him that they had sent 1cwt of sulphur waste and asked him to make an offer for larger quantities. The sulphur would have been refined in building 24 of figure 2.

The only other raw material involved in the manufacturing process was black-lead, which was used to polish or glaze the grains of gunpowder so that they became less hygroscopic. At Melfort building 10 of figure 2 was used for this purpose. Twelve letters were written to the North British Colour Co of Leith, Edinburgh, ordering two varieties of black lead, 'Dull' and 'HG', which probably stands for 'High Gloss'. These were sent in barrels or casks by train to Glasgow and then by steam ship to Oban. Several of the letters complained about delays in fulfilling the orders. The final large order was for 1 ton of HG and half a ton of Dull.

Other Materials Purchased for the Mills

Many of the letters are addressed to merchants in Glasgow who supplied a wide range of other materials for the works. For example, James Allan, to whom 20 letters were sent, provided brushes, files, grease, hoops, lead, linseed oil, locks, nails, oil, paint, saws, screws, staves and white lead. Many of the nails and screws were of copper

or brass as they were to be used in danger buildings where explosions were most likely and sparks had to be avoided. The staves and hoops were for making barrels in the cooperages (buildings 28 and 29 in figure 2). Alexander Causland was sent five letters and provided sieve rims six inches high and wire cloth. It therefore appears that the works completed the manufacture of the sieves they required. Most of the wire cloth was made of brass, and the sieves would have been used in the corning house (building 12) where incorporated and pressed gunpowder was granulated. The iron wire cloth supplied must have been used in the preparation of the raw materials rather than after they had been mixed together. There are seven letters to David Gibb, who was supplying rope, twine, canvas and bagging cloth. Gunpowder was often put into bags inside barrels to stop the powder escaping through possible gaps between staves. Leather and lime were purchased from other suppliers.

Eight letters are to Allan & Mann of the Port Eglinton Brick Works.⁹ They concern the supply and transport to Melfort of common red bricks, fire bricks and fire covers. In particular, in one letter 100 tons of common red bricks were ordered and unspecified amounts, typically to fill up a vessel, on four other occasions. Also, 1000 side-arch fire bricks, 4000 square fire bricks and 400 fire covers measuring 18 x 12 x 3in were ordered. One of the letters asks for a good bricklayer to be sent and a further five letters to other recipients concern bricklayers rather than bricks. Two of these offer work to individuals stating that two bricklayers were already employed, one requests that payment be made to a bricklayer's wife, one asks that bricks be delivered urgently as the bricklayers were waiting for them and, finally, one states that charcoal cylinders must be sent urgently as the bricklayers were waiting for them. This last letter clearly suggests that many of the bricks were used not for buildings but for brick structures supporting cylinders and perhaps other equipment in the raw materials buildings.

Five letters were sent to Mrs Miller, stationer of Oban. She appears to be the widow of James Miller who in 1837 was described as a

bookseller, bookbinder and printer and ran a circulating library and newsroom in Oban.¹⁰ The letters concern purchases of foolscap paper, a ledger, a package of quills, almanacs, transires, red sealing wax and ink. The order for the ledger is interesting because it suggests that the letter book itself had been purchased from Mrs Miller and that for quills tends to confirm that these and not pens with metal nibs were used for writing the letters. Transires were custom-house permits for removals of goods by coasting vessels. It is, however, the letter concerning ink that is particularly interesting. It is undated but was written after one on 31 December and before one on 4 January and reads:

'Dear Madam

I am requested by Mr Kelly to return to you the last ½ dozen Ink Bottles got, as this ink is not the kind he wanted.

Yours Respectfully

Wm Murray'

This presumably refers to the blue ink that, as noted above, was used in the letter book from 11 November until 5 January. It appears that Kelly had just become aware of its use and promptly asked for it to be replaced by black.

Another interesting group of three letters refer to salmon. One is to the Edinburgh Roperie & Sail Cloth Co ordering rope and twine for salmon nets, another to Messrs Cumstie of Oban ordering 20lbs of cork for salmon nets and returning useless corks supplied earlier and the third saying that a total of 68 salmon were being sent, apparently as presents, to two contacts in Glasgow.

Sales of Gunpowder

Fifty of the letters informed customers that their orders had been dispatched. A list of the eight types of gunpowder involved, the amounts of each type sold and suggestions for the meaning of the abbreviations used to describe them are given in table 1. The total amount of gunpowder involved was 196.04 tons and approaching

one-half of this (44.6%) was Fo and one-third (33.5%) was HGB. It seems likely that several of the other types were also used in quarries and mines but it is interesting that the mills were capable of manufacturing TP powder, which was the best quality made.

Table 1: Significant Amounts of Different Types of Gunpowder Sold to Customers

Type		Amount	%
Co	Common ordinary	13.75tons	7.0
Fo	Fine-grained ordinary	87.33tons	44.6
FFFo	Triple Fine-grained ordinary	6.26tons	3.2
HGB	Hard-Grained Blasting	65.7tons	33.5
HGCo	Hard-Grained Canon ordinary	8.25tons	4.2
HGCB	Hard-Grained Canon Blasting	11.75tons	6.0
HGFo	Hard-Grained Fine ordinary	2tons	1.0
TP	Tower Proof	1ton	0.5

Some of the meanings are tentative, e.g. 'C' could stand for 'Coarse' or 'Cannon' and 'o' for 'ordnance'.

The powder was supplied in five different sizes of barrels and two different sizes of canisters. The barrels contained 100lb (199 barrels; 5.2% of the powder), 50lb (2507; 32.9%), 25lb (8068; 52.9%), 20lb (200; 1%) or 12½lb (1566; 5.1%). Much of this powder was 'bagged' in fabric inside the barrels. The canisters contained 11lb (9200; 2.4%) or ½lb (3600; 0.5%). These canisters were used for the high quality FFFo and TP powder. They were usually packed in boxes of 50 11lb canisters or 100 ½lb canisters. Three letters concern orders for labels for these canisters.

Most of the powder was sold at 59 shillings for 100lb but there were discounts for large orders. Also, small quantities cost more, including 15s, for a ½-barrel of FFFo powder, equivalent to £6 for 100lb. Some was sold to individuals or small stores but most was delivered in large quantities to agents who exported it. In particular, Blackburn Low & Co of Glasgow, had arranged to take 5 tons per

month for export to Melbourne. However, it appears that it was unclear whether the agreement was with the Melfort works or with the parent company, Harrison Ainslie in Furness, and this led Kelly to write the longest letter in the book (2.3 pages). Blackburn Low also sent powder to Penang in Malaysia and Batavia (Jakarta) in Java, Indonesia. They wrote to Melfort pointing out that 'The war on the Continent has raised the value of saltpetre which will doubtless have a corresponding effect on gunpowder.'¹¹ Demand from the African Coast has dropped. We must depend principally on the demand from Madagascar.' There are also letters from James Leehman & Co in Mauritius explaining that there is 'No improvement in demand for gunpowder as Bourbon is at present suffering from visitations of cholera' and that 'The magazine is full and no demand'.¹²

Another agent was John H Swan of Glasgow, who arranged for Melfort gunpowder to be exported to Malta. However, Kelly was very dissatisfied with the service, as demonstrated by the following letter.

'There is something so superlatively absurd in the Glasgow shippers to Malta charging 3s.9d to 4s per barrel freight when it is done at from 1s.9d to 2s at Newport that we shall never allow ourselves to be duped to such an extent and now write to say that we shall not ship by the Clyde but shall send the powder away from Newport. ... The 20 tons for Malta will leave here now and Newport, I hope, next week.'

Harrison Ainslie shipped large amounts of haematite from Furness to Newport in Monmouthshire (Gwent) so it would have been easy to send gunpowder on the same boats.¹³

The company also had an agent, Robert Russel, in Newcastle upon Tyne to whom 25 tons of gunpowder was sent on a sailing ship, the Kelpie, that must have used the Forth & Clyde Canal. It was sent in ½- and ¼- barrels and consisted of Fo (48%), Co (8%), HGCo (8%), HGB (15%), and HGCB (21%) grades of powder. Russel gave

instructions about how the delivery should be made, using lighters, to Heworth Parish pier in Gateshead and from there over 20tons was to be sent by cart to Darlington.

One of the letters was to H E Drayson of 2 New Palace Yard, Westminster, whose father had been Superintendent of the Royal Gunpowder Mills at Waltham Abbey. Drayson jnr owned Maresfield gunpowder mill (TQ 4623) in Sussex from 1852 to 1858 and in 1859 established a new mill at Eyeworth Lodge, Fritham, (SU 232140) in the New Forest.¹⁴ The letter offers Drayson 228 ¼-barrels of common size powder and 65 quarter-barrels of musket size powder at 70s per barrel delivered to Bristol, less 10% discount for prompt payment. One can only speculate about why he might be interested in buying Melfort powder.

One of the fairly local customers was Malcolm Sinclair of Lismore, an island 12km north of Oban. A letter sent to him acknowledges a payment of £2 19s received for a barrel of gunpowder. It states: 'We regret much that Mr Sinclair should want this powder so long but from the want of water and the explosion which took place here, it could not be helped'. This payment had been made following a letter sent to Sinclair requesting immediate payment. Indeed Sinclair, a relative of the storekeeper at Melfort, appears to have been a problematic customer. Another letter asks him to collect four quarter-casks of gunpowder waiting for him at the steam packet office at Oban, as the manager had said that 'in future he will not take charge of any powder as this lot is lying there so long'. However, a later letter states that four ¼-barrels would be sent to Oban on the following day and left at the same office. This letter, sent in January 1860, included a bill for £16.2s.3d for gunpowder purchased between October 1856 and October 1858 but still ends with the statement: 'We shall be glad to attend to further orders'.

The two entries in the letter book recording the amounts of gunpowder made, sold and in stock are on a single undated double-page spread prepared between letters written on 4 and 5 January 1860. They provide monthly information between 25 March and 1

October 1859 and between 1 October and 31 December 1859. A transcript of these entries is provided in table 2. On 25 March about 62 tons of gunpowder was in either the factory magazine or the mills. This increased to 94 tons on 1 October and to 108 on 31 December. The monthly amount of powder made varied considerably from none in April and 4 tons in June to 77 tons in August, 79 in November and 102 in December. The reason for this could reflect the demand or more likely be because of maintenance work being carried out or lack of water to power the mills in some months. The total amount of powder made was about 476 tons. Similarly, the amount of gunpowder either sold or sent to Harrison's Ainslie's magazine at Barrow-in-Furness varied from about 8 tons in April to 105 in November, the total being about 430. Therefore just over 90% of the powder made was transported from the mills. This could suggest that business was quite good but the mills might not have been working to capacity. As the amount of powder sold directly to customers from Melfort was almost 200 tons, just over one-half of it was shipped to Barrow.

Table 2: Transcript (with Minor Changes for Clarification) of Pages 108 and 109 of the Melfort Letter Book, Recording the Gunpowder Made and Sold Between March and December 1859

Note of Gunpowder made, Shipped and Sold from 25th March to 1st Oct 1859

1859		tons	Cwt	lbs	1859		tons	cwt	lbs
March 25	To stock in Magazine	31	12	37½	April	By Consigned and Sold as under	8	4	12½
	To ditto on hand	30	3	0	May	Ditto	31	7	50
April	Making over ordnance Powder				June	Ditto	26	18	50
May	To Powder made	23	15	0	July	Ditto	44	2	0
June	To ditto	4	3	50	Aug	Ditto	50	3	91
July	To ditto	44	5	75	Sept	Ditto	47	12	87½
Aug	To ditto	77	7	87½	Oct 1	on hand	93	16	25
Sept	To ditto	90	18	25		[Total]	302	5	16
	[Total]	302	5	16					

Note of Gunpowder made, Shipped and Sold from 1 Oct 1859 to 31st December 1859

1859		tons	cwt	lbs	1859		tons	cwt	lbs
Oct 1	To stock on hand in Magazine	67	6	0	Oct 31	By Consigned or Sold during month	90	10	0
	To ditto in Works	26	10	25	Nov 30	By ditto	105	8	37½
Oct 31	To Powder rec'd to Magazine	54	8	0	Dec 31	By ditto	25	5	50
Nov 30	To ditto	78	17	28½		By Stock in hand	108	4	75
Dec 31	To ditto and on hand	102	6	50		[Total]	329	8	62½
	[Total]	329	8	62½					
Dec 31	Magazine Stock	72	12	25					
	Mills	35	12	50					
	[Total]	108	4	75					

Sent Duplicate of the above to Messrs Harrison Ainslie & Co by Ulverston

Purchases of other goods

The 21 letters from John Sinclair of the company store were addressed to five merchants based in Glasgow and were orders for arrowroot, barley, barley sugar, blacking, books, bran, butter, canary seed, candles, catsup, cayenne, cheese, clay pipes cream of tartar, flour, ginger cordial, ground ginger, heels, hemp seed, juice, meal, a meat saw, mints, mustard, paper (for wrapping tea, sugar and butter), pins, polishing paste, rice, salt, stationery, tobacco, oranges, snuff, soles, split peas, starch, sugar, tea, treacle, twine and washing soda. The letter ordering books and stationery is summarised in table 3.

Table 3: Books and Stationery Ordered for the Melfort Store on January 1860

12 McCulloch course of reading	200 pencils for slates
12 first collection by White	8 packets envelopes (2 sizes)
24 school testaments	1 gross quills
24 No. 3 lesson book by White	10 dozen mock valentines
24 No. 2 lesson book by White	10 dozen valentines @ 1d, 2d, 3d & 4d
36 No. 1 lesson book by White	2 packets envelopes for the valentines
12 Lennies grammar	1/2 ream ruled blue plain foolscap paper
12 pocket bibles @ 2/-, 2/3 and 2/6d	1/2 ream with money columns,
12 dozen penny ink bottles, black	1/2 ream school manuscripts
6 dozen pen holders	10 dozen shorter catechisms
6 dozen pencils to sell @ 1/2d	10 dozen mother catechisms
6 dozen pencils to sell @ 1d	1 box very best steel pens

Transport of Goods

Local transport of goods was by cart, almost entirely between Melfort and Oban. In particular, company carts would meet incoming steam ships from Glasgow at Oban harbour. Indeed the request that goods be sent on 'the first steamer to Oban' occurs in 55 of the letters. Some gunpowder was taken by cart from the mills to Oban but most was loaded on to sailing ships from the pier at Melfort. This is shown on the map of figure 2 and in the photograph of figure 3. Eighteen of these ships are mentioned in the letter book. Their names and some notes about the four that were used most frequently are given in Appendix 2. Ships sailing from Melfort or Oban to Glasgow would have made use of the Crinan Canal, shown in figure 1, thus avoiding a 210km passage around the Mull of Kintyre. Maximum dimensions of craft that could use the canal were 88 x 20 x 9.5ft draught.¹⁵ One letter notes that the journey should take 5 days.

Recruitment of Workers

One letter, written on 22 August 1859, was to Robert Henderson of the Kames powder mills,¹⁶ who had written seeking employment. Murray responded saying that Kelly was willing to give him immediate employment if he produced certificates of sobriety.

Another letter addressed to the Editor of the Inverness Courier asked them to print an advertisement for a drill sergeant, suggesting that a pensioned sergeant would be appropriate. The only other letters concerned with recruiting staff are those seeking bricklayers and are mentioned above.

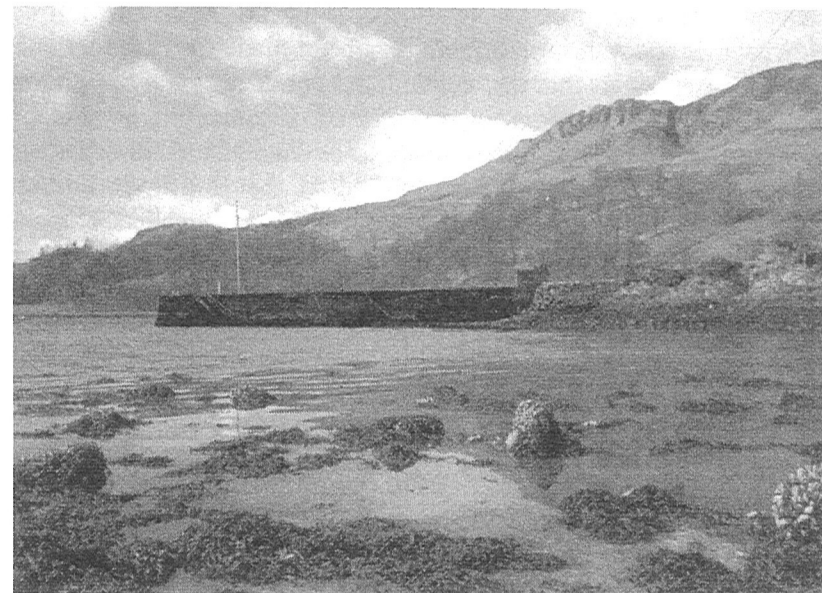


Figure 3: Photograph of the gunpowder works pier taken in 1986. Courtesy of Glenys Crocker

Discussion

The Melfort gunpowder letter book described in this paper is the only one that appears to have survived from the 21-year period during which the mills were active. It covers eight months of activity and the entries occupy 130 pages. However over 600 pages have been left blank. If copies of letters were written at the same rate in similar ledgers and if these were fully used, five further ones would have been needed and the surviving one would have been the second. It would be very rewarding if publication of the present paper led to the discovery of one or more of these volumes.¹⁷

It is interesting to speculate about why entries were made on only 130 pages of the ledger. The reason is probably linked to the fact that the last of these pages is glued down to the next but fortunately it could be read by an archive conservator using a light box. It contains two letters, one to Alexander Kelly of Bonawe, Richard Kelly's father, and one to Neil Robertson, captain of the Kelpie. However, in the index, an attempt has been made to erase the latter entry. This suggests that the Kelpie letter contained information that the company did not want to be disclosed. It concerns the transport of alder tree saplings, which appears to be innocuous. Nevertheless, the fact that the ledger was deposited in the Barrow-in-Furness record office seems to indicate that the Harrison Ainslie Company removed it from Melfort in mid-February 1860 and kept it at their headquarters in Furness. The problem could have been the ownership of the Kelpie, either Kelly & Co or Harrison Ainslie. It may also be relevant that one of the other ships used was the Mary Kelly named after Richard Kelly's mother or sister. The other ledgers might have been kept at Melfort until the works closed in 1874 and then been disposed of locally.

Some of the letters, particularly those written by Richard Kelly, the manager, are rather aggressive, threatening actions because payments had not been received for powder supplied, excessive charges having been made for goods and services, mistakes made in accounts and decisions made at Melfort apparently being overturned by agents in Glasgow or Harrison Ainslie in Furness. It is also interesting that the 13 letters sent to Alexander Kelly at Bonawe do not reveal that he was Richard's father and one also wonders whether he was related to John Kelly of Newport, Monmouthshire, to whom one letter was sent.

One of the reasons given by Harrison Ainslie for establishing the gunpowder mills at Melfort was that they were already using the coppiced woodland there for producing charcoal, one of the ingredients of gunpowder.¹⁸ In practice however it is clear from the letters that charcoal made from the local trees was not suitable so that wood had to be obtained from Ireland and elsewhere and new

plantations of alder established. This suggests that at the start of this venture the firm had no practical experience of the manufacture of gunpowder and must have recruited skilled workers from other gunpowder mills, probably those in Cumbria.

The purchase of large numbers of Allan & Mann bricks is of interest as the buildings at Melfort are almost entirely of stone. The only obvious bricks are those surrounding the doors and windows of building 9 in figure 2. Some of these bricks, which are stamped 'ALLAN & MANN, PATENT, GLASGOW' are shown in the photograph of figure 4. This building was not constructed until after the 25inch OS map of 1871 was surveyed and presumably before the works closed in 1874.¹⁹ It has been concluded therefore that most of the bricks purchased must have been used to house charcoal cylinders and other equipment within stone buildings or for the construction of service structures such as drains.

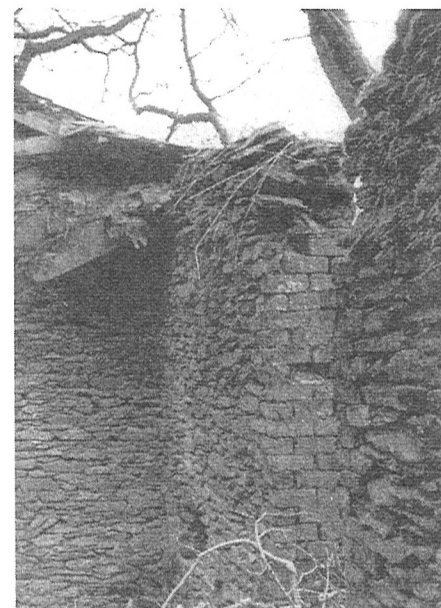


Figure 4: Allan & Mann bricks around an opening in a wall of building 9 in figure 2. Courtesy of Glenys Crocker.

The two entries in the letter book recording the amounts of gunpowder made, sold and in stock make no reference to financial matters. However they do enable an estimate to be made of the income from both direct and indirect sales during the nine-months period covered. Almost 200 tons was sold directly and the letters indicate that most of this would be priced at 59s for a barrel, although some would have been much more than this and large orders were sold at a discount. Assuming that 59s is a reasonable average, the total income would then have been almost £12,000. A further 230 tons was shipped to the Harrison Ainslie magazine at Barrow for distribution to other customers and for use in the company's iron mines. If this is again valued at 59s it was worth, approximately, a further £13,500, giving a total of £25,500, or £34,000 over a 12-months period. Unfortunately it has not been possible to make a corresponding estimate of the cost of operating the mills. A striking feature of the contents of the letter book is that they reveal how diverse and complex the management of a gunpowder mill could be. The book is, of course, mainly concerned with the sale and transport of gunpowder. There are also many orders for equipment, including charcoal cylinders and a crane for the pier, and materials, such as grease and paint, for running and maintaining the machinery and buildings. However, surprisingly, there are few orders for the purchase of raw materials for manufacturing gunpowder, particularly when compared with the large number for food, tobacco, stationery, books etc for the company store. Most of the recipients of letters were agents and dealers in Glasgow. Indeed, the company depended almost entirely on their Glasgow links. This must also have been true of the other three gunpowder mills in Argyll but, as shown in figure 1, these were much closer to Glasgow and did not have to use the Crinan canal. The only other gunpowder mills in Scotland at that time were at Roslin (NT 2736) and Gorebridge (NT 3461) within 15km of central Edinburgh.²⁰

In 1859-60 there were 33 gunpowder mills active in the British Isles so that commercially Melfort was in competition with many other manufacturers. It is therefore impressive that they had a significant

international trade. For example, through their Glasgow agents, they shipped gunpowder to Australia, Chile, Indonesia, Malta, Mauritius, Madagascar, Malaysia, Singapore and South Africa. However, several letters indicate that for various reasons some of these markets had problems.

Several of the letters are orders for labels to be attached to canisters of gunpowder giving the grade of powder contained and the name of the Melfort company. Many such labels and indeed canisters of other companies survive but unfortunately none are known for Melfort. It would be very encouraging if publication of the present paper resulted in the discovery of examples.

Following the period covered by the letter book the company appears to have continued to work at a more or less steady rate until the next detailed information becomes available. This is contained in a stock book, dated 1871-76, of the Harrison Ainslie magazine at Barrow.²¹ In 1871 the amount of gunpowder sent from Melfort to this magazine was about the same as in 1859. However, in succeeding years the amounts declined gradually but did not end when the mills closed in March 1874, as powder was still stored in the Melfort magazine. It was not until July 1875 that the last shipment arrived at Barrow. It was in 1875 that a new Explosives Act was passed and this imposed far greater restrictions on the operation of gunpowder mills. Harrison Ainslie may have anticipated this and decided that it would not be economic to continue work at the Melfort mills. Richard Roper Kelly was aged 40 when the Melfort mill closed; when he died in 1886 he was living in West Dulwich, London.²²

In conclusion, it is considered that the present paper provides an example of the enormous amount of information about industrial sites that can be deduced from company letter books. It is hoped that its publication will encourage others to examine the Melfort letter book in greater depth and to discover and research other letter books relating to the gunpowder and other historic industries.

Appendix 1: The Index of the Letter Book

The 24 pages of the index at the front of the letter book have cut-away fore-edges labelled, in vertical sequence with the letters of the alphabet, except that X, Y and Z are linked together on the last page and that M has been replaced by Mc. This labelling has been achieved by sticking small squares of paper with letters alternately printed in red or black in the appropriate places but some of these are now missing or loose. The entries start on left hand pages but in some cases, when a large number of letters and hence references to pages are involved, they spread across to the corresponding right hand pages. Of the 24 pages, those for I, J, Q, U, V, and XYZ are unused.

Perhaps not surprisingly, the page with the most entries is Mc with 21, although six of the names actually start with M and not Mc. Seventy-two of the 80 addresses involved are in Scotland, 25 in Glasgow, 13 in Oban, and 34 elsewhere, including Ballachulish, Bonawe, Dumbarton, Inverness, Islay, Leith and Mull. Of the remaining eight addresses, four are in England (Darlington, London, Newcastle and Whitehaven), two in Wales (Newport in Monmouthshire and Queensferry) and two in Ireland (Donegal and Londonderry). More than half of the letters (172) were to Glasgow and 40 were to Oban, including 11 to the Customs Officer.

The index is reproduced below except that the page numbers have been replaced by the number of letters involved, which ranges from one to 34, the average being just over four.

Allan, James Senr, Bothwell St, Glasgow. [Ironmongers] 20
 Allan & Mann Messrs, Port Eglinton Brick Works. 8
 Addams, James & Co., Tradeston, Glasgow. [Saw mills] 3
 Allan, A & J, 108 Candleugg St, Glasgow. [Wholesale grocers] 7
 Ardfinaig Granite by Ross of Mull. [Customer] 1
 Astley, F D P, Mains of Arishaig. 1

Braithwaite, J & J, Ironmongers, Whitehaven. 3

Blackburn, Low & Co, 135 Buchanan St, Glasgow. [Agents] 34
 Brown, Hugh, Plasterer, Oban. [Also slater] 1
 Ballachulish Stone Co, Ballachulish. 8
 Brown, Donald, Bowmore, Islay. [Offered charcoal] 1

Campbell of Auchindaurch. [Customer] 1
 Chapman, David, Port Hamilton, County Donegal. [Supplied wood for charcoal] 4
 Causland, Alexr, 5 Mitchell Street, Glasgow. [Supplied wire cloth and sieve rims] 5
 Cumstie, William & Sons, Oban. [Supplied cork and rope] 8
 Cameron, John & Party, Strontian. [Customer] 1
 Cross, Alexr & Sons, Seed Merchants, 53 Argyle Street, Glasgow. 2
 Campbell, Archd, Saddler, Oban. 4
 Campbell, Captain of the Melfort. 5
 Campbell, J & W, Merchants, Glasgow. 1

Dalgliesh, Archibald, Glenmore. [Customer] 1
 Donald, John & Co, 54 Argyle Street, Glasgow. 1
 Davidson, James, Weaver, Symington By Biggar. 4
 Drayson, H E Esq, 2 New Palace Yard, Westminster, London. [Gunpowder manufacturer] 1

Edinburgh Roperie & Sail Cloth Co, Glasgow. 5
 Editor of the Inverness Courier, Courier Office, Inverness. 1

Flint, Thomas, Lochgreen by Denny. [Customer] 13

Gregorson, Angus, National Bank, Oban. 1
 Gunn, Robert, 106 Union Street, Glasgow. 1
 Gibb, David, 78 Miller Street, Glasgow. [Supplied canvas and cloth] 7
 Gray, John, 13 Jenner Court, Glasgow. [Wholesale tobacconist] 4
 Greenfield, John, Bricklayer, Crinan. 1
 Griffiths, Richard Esq, Queensferry, near Flint. [Customer] 1

Henderson, Wm & Sons, Oil Merchants, New Wynd, Glasgow. 10

Henderson, Robert, Kames Powder Mills, Kyles of Bute. 1
 Harrison Ainslie, Messrs, & Co. 2
 Hunter, William, Merchant, Old Kirkpartick, Dumbarton. 1

Kelly, Alexr Esq, Bonawe. [Ironmaster] 2
 Kelly, John & Co, Newport, Monmouthshire. [Customer] 1

Lockhart, Miles Esq, Ardshead Drive, Bonawe. [Customer] 1
 Livingston, Neil, Bricklayer, 94 King Street, Tradeston, [Glasgow] 1
 Loxton, Mr Dudley. [Customer] 1

McIntyre, Messrs Dougall & Co, 65 Jamaica Street, Glasgow.
 [Shipping company] 11
 McLaren, Ronald, Oban. [Customer] 4
 McCulloch, S & W, 27 Argyle Street, Glasgow. [Wholesale
 grocers] 10
 McLane & McDonald. 1
 McKinnon, Niel, Merchant, Tobermory. [Customer] 6
 McIntyre, John, Salm Lime Works, Lismore. [Customer] 2
 Mitchell & Wallace, Carnlachie Foundry, Glasgow. 7
 McCulloch, Charles, Merchant, Easdale. 5
 McNair, Saddler, Oban. 2
 McIntosh, Peter & Sons, 129 Stockwell Street, Glasgow. [Leather
 merchants] 2
 Marshall, R, Customs Officer, Oban. 11
 McEwan, A, Esq, National Bank, Lochgilphead. 2
 Miller, Mrs, Stationer, Oban. 5
 Munro, Duncan, Joiner, 22 Graham Street, Bridgeton. 1
 McColl, John, Steam Boat Office, Dumbarton. 1
 Munro, Archd, Merchant, Millhouse. Cowal by Greenock. 2
 McArthur, Duncan, Esq, Oban. [Shipping agent] 2
 McLaurin [McLaren?], Ronald, Merchant, Oban. [Customer] 1
 McPhail, Duncan, Slater, Oban. 1
 McPherson, John, Merchant, Oban. 1
 Munro, John, Contractor, Strontian. 1

North British Colour Co, Leith. [Black lead] 12

Orr, Francis, & Sons, Stationers, Glasgow. 4

Parker, James, Oil & Grease Merchant, Glasgow. 1
 Pollock, Gilmour & Co, Glasgow. [Supplied staves] 2
 Penny, Charles Junr, Merchant, Glasgow. 2
 Parker, John, of the Dora. 1

Russel, Robert, Agent for Melfort Gunpowder, Newcastle on Tyne.
 2
 Railton, Mr, Commission Agent, Darlington. 1
 Robertson, Neil, of the Kelpie. 1

Swan, John, 153 Queen Street, Glasgow. [Agent] 28
 Sinclair, Malcolm, Sheep Island Lismore. [Customer] 5
 Smith, A & H, Eglinton Engine Works, Glasgow. [Supplied grease]
 3

Thompson, Joseph, Esq, Strand, Londonderry. [Customer] 6

Walker, Robert, Esq, Oban. 1
 Wilson, Matthew of The Earl of Glasgow. 1
 Wilkie, James, 21 King Street, Calton, Glasgow. 1
 Wyllie & Lockhead, Messrs, Cabinetmakers, Glasgow. 1

Appendix 2: Sailing Ships Mentioned in the Letter Book

Eighteen ships were used.²³ Appropriately, the most common vessel was the Melfort. She is mentioned in 32 letters up to 17 September but then only once, on 27 January. Some of the letters accompanied by transires, were sent to its captain, Duncan Campbell. She was a 36 ton sailing vessel with one mast, known as a smack or sloop, and was owned by Harrison Ainslie. She was built at Chester in 1856, sold in 1875, when the Melfort works had closed, and wrecked in 1888. Next came the Earl of Glasgow, with 29 letters spread over the whole period. She was a 35 ton smack built at Lairg in 1843 and wrecked on Walney Island, Barrow, in 1852. After salvage and

repair, she was bought by Harrison Ainslie in 1853. They sold her in 1866 and she foundered off Pembrokeshire in 1881. Then came the Kelpie, a schooner of 50 tons with a female figurehead. She was built by Wishart of Glasgow, registered in October 1859 and mentioned in 15 letters from 25 September to the end of the book. The sole owner from new was Richard Kelly of the gunpowder works. She is recorded in Lloyds Register in 1862 and 1867 and was sold in August 1869.²⁴ A kelpie is a water spirit, usually a horse, that haunted the rivers and streams of Scotland and delighted in the drowning of travellers. In spite of this it appears to be a common name for sailing ships. The Dora, owned by Harrison Ainslie, is mentioned in 8 letters. She was built at Ulverston, Furness, in 1834 and in 1852 had a crew of three, a master, a mate and a seaman. In that year she visited Barrow, Cardiff, Chepstow, Glasgow, Lancaster, Liverpool, Newport and Oban. She was described as a 55 ton schooner with two masts in 1854, was sold in 1861 and lost off Holyhead in 1862.

The other vessels, mentioned on only a few occasions, were Agnes & Mary, Cairngorm, Christina Turner, Dream, Elizabeth, Ellen & Sarah, James III, Jane, Kandy, Mary Kelly, Mayola, Silistria, and Venillia. In the 1850s Harrison Ainslie owned nine schooners and three sloops.²⁵ Of these ships, only the Melfort is mentioned in the 1871-6 stock book of the company's magazine at Barrow-in-Furness, bringing gunpowder from Melfort and taking some of it from there to customers elsewhere in Britain.²⁶

Acknowledgements

The author is greatly indebted to the late Mike Davies-Shiel of the Cumbria Industrial History Society for informing him of the existence of the letter book and providing photographic copies of its index and extensive notes on its contents. He also owes an immense debt to Peter Sandbach of the Cumbria Amenity Trust Mining History Society for providing information on the development of the Harrison Ainslie Company, the ships they used and for

photographs and transcripts of all the letters in the book. He also arranged for page 130 of the letter book, which had been glued to the next page, to be transcribed by Brenda Degbro, Cumbria archives conservator. Finally he provided valuable comments on earlier versions of this paper. Miles Oglethorpe, now of Historic Scotland, provided information on the Allan & Mann brickworks at Glasgow and also commented on an early version of the paper. Christine Roberts, manager of Melfort Village that now occupies the site of the mills, commented on surviving features. The staff of the Cumbria Record Office and Local Studies Library, Barrow, have been very supportive throughout the research. Finally, Glenys Crocker is thanked for many valuable discussions and suggestions.

Notes and References

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2. Riden, P., *A Gazetteer of Charcoal-fired Blast Furnaces in Great Britain in use since 1660*, (Merton Priory, 1993), 146-7, 149.
3. Crocker, G., *Gunpowder Mills Gazetteer*, (Wind & Watermill Section, SPAB, 1988), 4, 47-8. Electronic edition with additional data on www.millsarchivetrust.org.
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the permission of the Cumbria Record Office, Barrow, with the Business Archives Council of Scotland.

6. Kelly's forenames do not appear in the letter book. They are taken from other documents, including an announcement of a collection he made for a memorial to Richard Harrison published in Soulby's Ulverston Advertiser, dated 10 May 1860.
7. Crocker, G., *The Gunpowder Industry*, 2nd ed. (Princes Risborough, 1999, Shire).
8. Alexander Kelly was Richard Roper Kelly's father. Alexander's wife Mary was the daughter of Richard Roper, who became a partner of Harrison Ainslie & Co in 1820.
9. Hulme, J.R., 'A Glasgow Brickmaker in the 1860s', unpublished, c1980; Allan & Mann advertisement in Slater's Directory of Scotland, 1860, 157. (Copies provided by Miles Oglethorpe.)
10. Pigot's Directory, 1837.
11. The Franco-Austrian War began in April 1859.
12. Bourbon, now known as Réunion, is an island 200km south west of Mauritius.
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**A HARRISON AINSLIE GUNPOWDER
STOCK BOOK OF 1871-76**

Alan Crocker and Peter Sandbach

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2010**

A Harrison Ainslie Gunpowder Stock Book of 1871-76

ALAN CROCKER AND PETER SANDBACH

An analysis is provided of the contents of a gunpowder stock book compiled by Harrison Ainslie, a major Furness iron company, in 1871-6. It records the 14 types of gunpowder stored at a magazine on Headin Haw, an island on the foreshore at Barrow, and manufactured at the company's own mill near Oban in Argyll. It also records the gunpowder distributed to Poaka magazine, near their haematite mines on Lindal Moor, and to customers, including some in Cumbria, Wales, and County Durham. The contents of the stock book are described, important aspects being considered in detail. In particular the types and amounts of gunpowder involved are summarised and the transport of gunpowder on ships, carts and vans described. Appendices give information on the ships involved, and significant customers are discussed. Structural surveys of the two magazines are also presented.

HARRISON, Ainslie & Co, one of the iron mining and smelting companies in Furness, was established in 1812 when Matthew Harrison bought his way into Knott, Ainslie & Co. This company had been formed in 1785 when Dr Henry Ainslie married Agnes Ford, daughter of Richard Ford who, together with William his son, Michael Knott and James Backhouse had built the Newland charcoal-fired blast furnace (NGR SD 299798) in 1746. At this time there were already several furnaces in the area, including Backbarrow (SD 355846) founded in 1711 and Duddon (SD 197883) in 1736. The Newland Company built the Bonawe or Lorn furnace (NN 009318) in Argyll, 14km east of Oban, in 1753 and also took leases of neighbouring woodlands that provided charcoal for their furnaces. In 1812 these leases represented 72 per cent of the value of the newly established Harrison, Ainslie & Co. The new company was very successful and was able to buy the Backbarrow company in 1818 and the Duddon company in 1828. By that time it had a national monopoly of charcoal iron, any rivals who had not shut down having converted to coke-fired furnaces.¹⁻⁵ The locations of key sites in Furness and Argyll that are referred to in this paper are indicated in Figures 1 and 2 respectively.

In 1838 Harrison Ainslie purchased over 5,600 acres of coppiced woodlands at Melfort, 16km south of Oban. Clearly they needed more timber for charcoal for their furnaces but charcoal is also an ingredient of gunpowder, which they required for blasting in their haematite mines in Furness. This was the reason they gave for establishing a gunpowder mill at Melfort in 1853. However, they were probably hoping that some of their output would be used for military purposes. It was in 1853 that the Crimean War started and it was anticipated that Britain would become involved, which it did a year later. At that time there were already three gunpowder works in Argyll.⁶⁻⁸

The buildings of the Melfort gunpowder mills (NM 8414) stretched for about 1km along the steep valley of the River Oude before it enters Loch Melfort, 1km north-west of the village of Kilmelford. Accounts of the establishment of the mills, of explosions there in 1860, 1866 and 1867, and of the surviving buildings have been published.⁹⁻¹¹

Also, a Harrison Ainslie letter book of 1859-60, held at the Cumbria Record Office and Local Studies Library, Barrow-in-Furness, provides a wealth of information about its customers, its suppliers of raw materials, transport of gunpowder from the mills, particularly by sea, the management of the mills and the influence they had on the local community.¹² An analysis of the contents of this book is to be published.¹³ The 25 inch Ordnance Survey (OS) map of 1871 also provides an exceptionally detailed plan of the mills, individual buildings being labelled.

Manufacture of gunpowder at Melfort ended in 1874 but no information has been published about the way in which Harrison Ainslie handled this. It is therefore encouraging that in the present article an account can be given of the contents of a

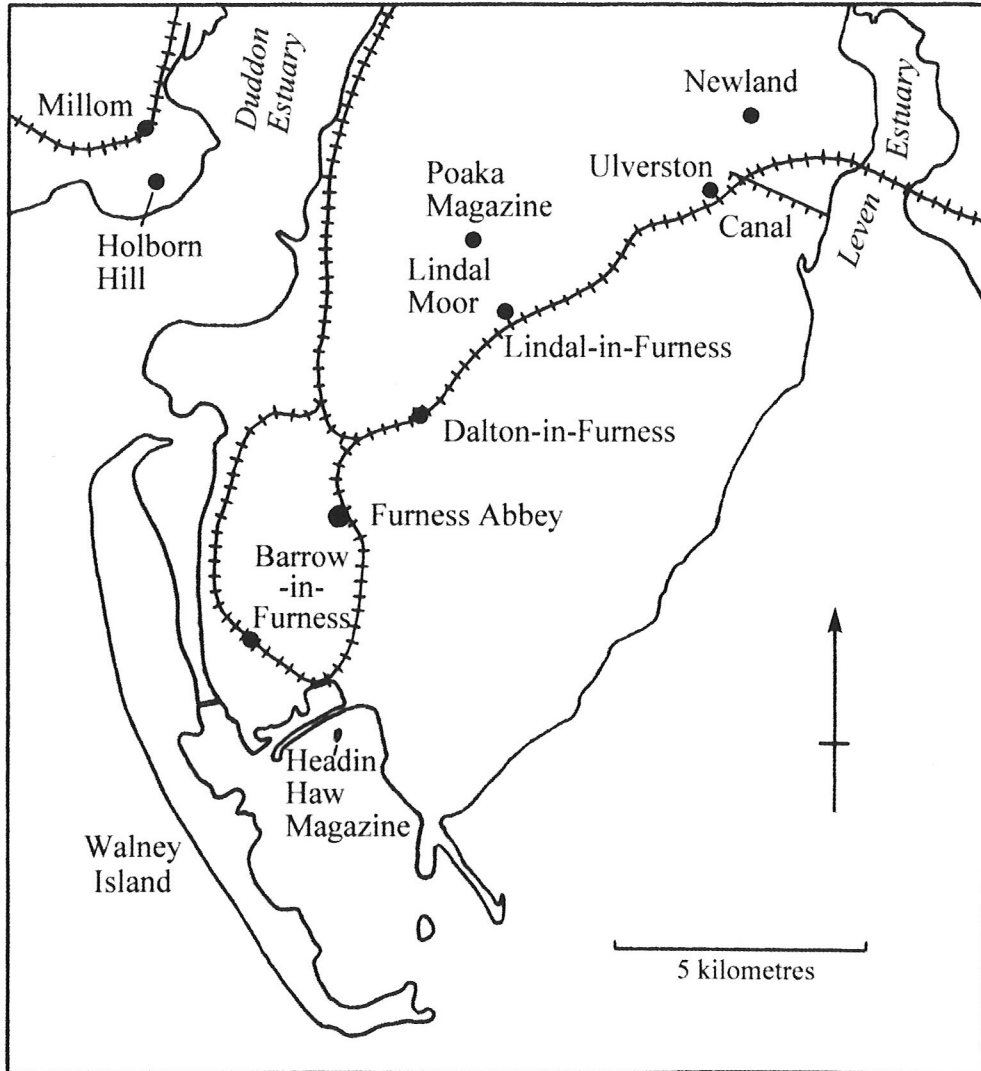


FIG. 1. Location map of the most relevant sites in Furness.

contemporary gunpowder stock book, again held at the Barrow Record Office.¹⁴ It records the quantities of gunpowder shipped between 1871 and 1875 from Melfort to a Harrison Ainslie magazine at Barrow and its subsequent distribution to customers and to a second magazine on Lindal Moor, near the company's haematite workings. The locations and remains of the two magazines are discussed in detail below.

The gunpowder stock book

The index

The gunpowder stock book has overall dimensions 272 x 399 x 46mm and nearly 450 pages of machine-made paper manufactured in 1868-9 by Thomas and John Hollingworth at Turkey Mill, Maidstone, Kent.¹⁵ The first 23 leaves of the book were prepared for an index but only those for the letters B, C, F, H and N have been used. They contain abbreviations for the 14 types of gunpowder stocked and the locations in the book where deliveries to and from the magazine are recorded. Originally the entries were on 32 double-page spreads numbered on the right-hand pages but the leaves bearing 2 to 7 have been torn out. A further 163 double-page spreads are unused. A summary of the contents of the index is provided in Table 1 including definitions, in some cases uncertain, of the abbreviations used for the types of gunpowder, and the corresponding spread numbers.

Of the 32 spreads used one is for blasting powder (B), four for cannon powder (C), ten for fine powder (F), 16 (reduced to ten) for hard-grained powder (H) and one for unmarked powder (N). However, subdivisions indicate that ten spreads of the hard-grained powder (reduced to four) were also for blasting. In general, fine powder was used for small firearms and fuses, cannon or coarse-grained powder for large guns and for blasting in mines and quarries and glazed powder if it was to be stored for a considerable time.¹⁶ It is interesting that the Melfort works was supplying such a wide range of different grades of gunpowder.

TABLE 1. Alphabetical list of the 14 entries in the index of the gunpowder stock book, with the numbers of the corresponding double-page spreads in brackets.

B	Blasting (Bright, i.e. glazed, Best) powder (59).
<i>CO</i>	Cannon (Coarse-grained, Common) Ordinary powder (48-50).
<i>CO</i> *	Cannon (Coarse-grained, Common) Ordinary powder (100).
F	Fine-grained powder (42).
FA Africa	Fine-grained powder as exported to Africa during the slave trade (90).
FFFO	Triple-fine-grained ordinary powder (92-93).
FFO	Double-fine-grained ordinary powder (102).
FO	Fine-grained ordinary powder (37-40).
FS	Fine-grained sporting powder (46).
HGB	Hard-Grained Blasting powder (1-9, but 2 right to 8 left torn out).
HGBX	Hard-Grained Blasting extra powder (70).
HGCB	Hard-Grained Cannon Best powder (79).
HGCO	Hard-Grained Cannon Ordinary powder (26-30).
NM	No Mark, meaning unmarked small packets of powder (44).

* The code *CO* is preceded by two superimposed \cup symbols, one above the other. The significance of this is not known or how this differs from *CO*, which is written in italic.

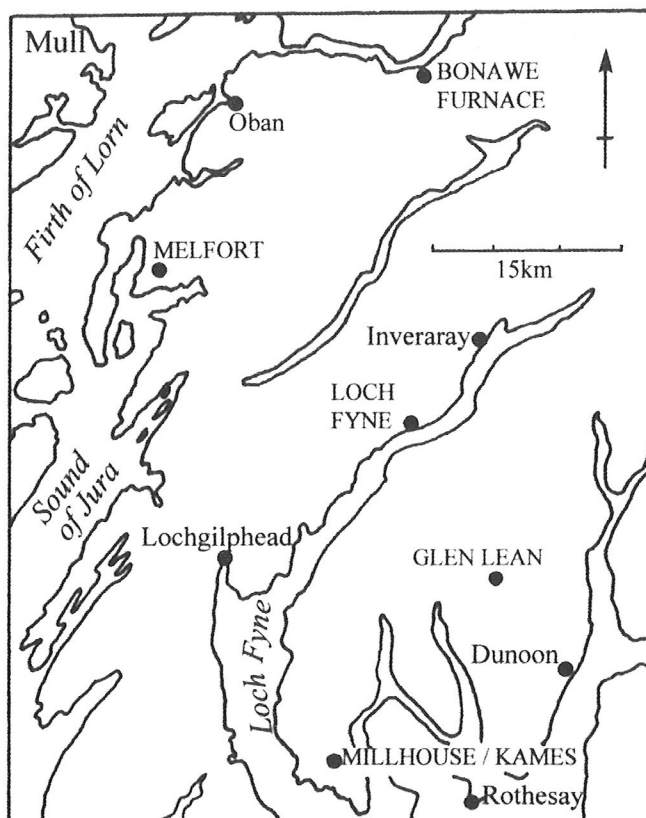


FIG. 2. Location map of sites in Argyll. Bonawe furnace and the four gunpowder works are identified in capitals.

Layout of the entries

Entries on the left-hand pages of the double-page spreads record deliveries of gunpowder by ship from Melfort to Headin Haw, the Harrison Ainslie magazine at Barrow. Those on the right-hand pages record deliveries by ship, cart, van or on foot, from this magazine to customers or to the company's Poaka magazine, near their iron mines on Lindal Moor. Dates are always given, together with the amounts of gunpowder involved, normally measured in barrels, containing 100lbs, half barrels and quarter barrels. The names of ships and the owners of carts and vans are stated and also the names and locations of customers. Table 2 gives transcripts of typical entries taken from the left and right pages of the first double-page spread.

The gunpowder magazines

In September 1853, Harrison Ainslie applied for planning permission to the churchwardens and the overseers of the poor of the parish of Dalton to build Headin Haw and Poaka magazines.¹⁷ It appears that Poaka was approved promptly but problems arose with Headin Haw. This is on the foreshore at Barrow and was owned by the Duke of Buccleuch. At high tide it is a small island that Lord Burlington claimed

TABLE 2. Transcripts of typical entries from the first double-page spread in the stock book.

Left page:	24 February 1871, <i>Per</i> : Smack 'Melfort'. <i>To</i> : Headin Haw Magazine. <i>Barrels</i> : 80. <i>Halves</i> : 80. <i>Quarters</i> : 700.
Right page:	12 January 1871, R S Roper. <i>Per</i> : 'Lorn'. <i>To</i> : Newport. <i>Barrels</i> : 28. <i>Halves</i> : 14. <i>Quarters</i> : 0.

to own and stated that his tenants had had the use of it for years when unloading coal and stones. The dispute was not resolved until December 1854 when construction of the magazine started.¹⁸ It is not of course surprising that Harrison Ainslie made this planning application at the same time as they were establishing their gunpowder mill at Melfort.

Headin Haw (SD 2147 6750) is located, as indicated in Fig. 1, 500m south of the centre of the southern embankment of Cavendish Dock, which was built in 1879.¹⁹ It is shown as an island in Fig. 3, but at low tide is surrounded by stony sand and mud known as Roosecote Sands. The island and magazine are marked on the second edition of the 25 inch OS map of 1890, a retouched detail of which is shown in Fig. 4. At mean high water the island has maximum dimensions of about 47m east-west by 66m north-south. At low tide it can be reached by wading across wet mud for about 300m before reaching a shingle bank stretching approximately east-west towards the island. When the magazine was operational this bank would have formed part of a track used at low tide by carts taking gunpowder to Poaka magazine and elsewhere. As indicated in Fig. 4, the magazine was built near the centre of the island. It was aligned roughly east-west, had a three-sided western end and a porch at the east.



FIG. 3. Photograph of Headin Haw island taken at high tide in September 2008, looking south-east from the embankment of Cavendish Dock. (Photograph by Glenys Crocker).

A survey of Headin Haw island, carried out in 2008, revealed that the magazine was built on a raised platform surrounded by stone revetments about 1m high. These are in a ruinous state and only a few upstanding but low parts of the magazine survive. They show that it was constructed from limestone masonry and rubble, with slate levelling and ornamental sandstone courses. The remains are partly covered by fallen rubble and vegetation so that it is difficult to make accurate measurements. However, the overall dimensions of the platform are about 18m by 13m, the interior of the

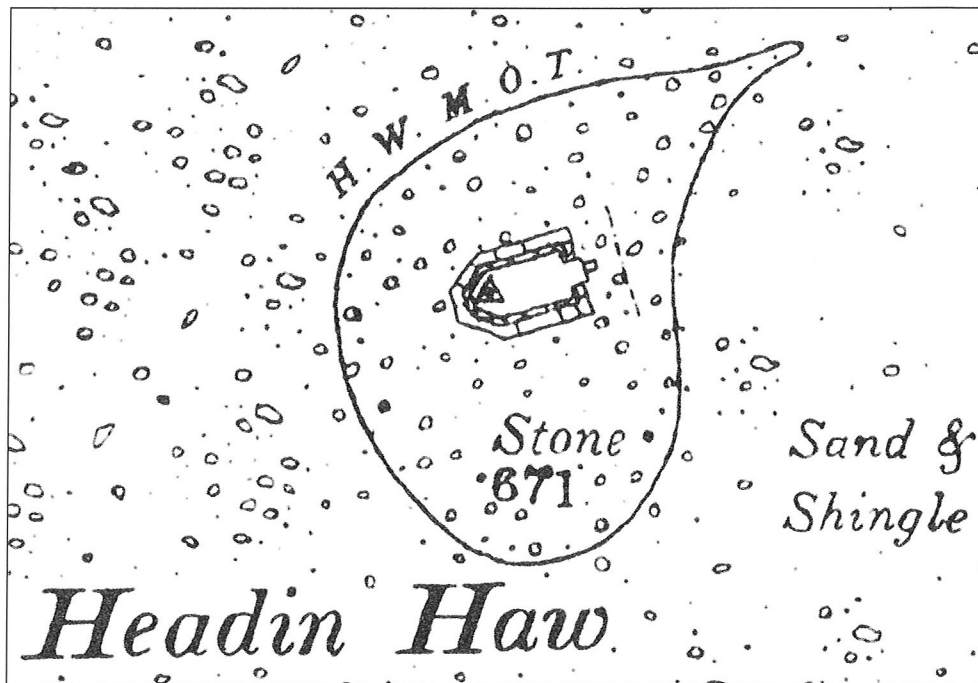


FIG. 4. Detail of the second edition of the 25 inch Ordnance Survey map (1890), showing Headin Haw island at mean high water and the gunpowder magazine. The area shown is 136m across. (*Retouched*)

magazine is about 13.3m by 5.6m and its walls are about 1.1m thick. A plan of the building is shown in Fig. 5 and a photograph of the south-west corner looking north-east is shown in Fig. 6. The foundations of the outer walls of the magazine in Fig. 5 are the same as those in Fig. 4. However, additional features are marked at the western end of the building that originally appears to have consisted of a regular octagonal structure. The significance of this is considered below.

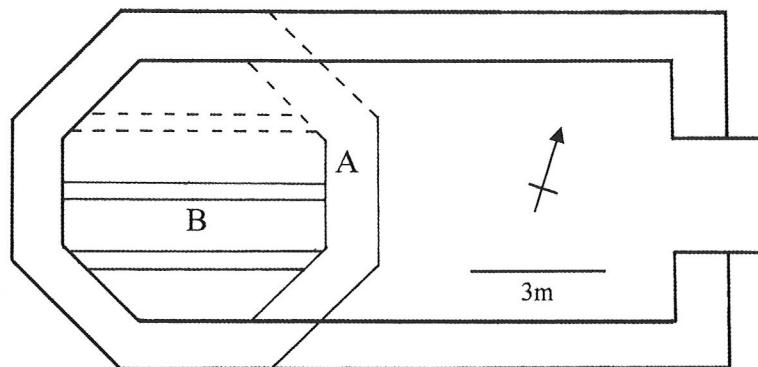


FIG. 5. Plan of Headin Haw magazine as surveyed in 2008. The bold lines of the outer foundations are as shown in Fig. 4. The finer lines at A and B are additional features, broken lines indicating conjectural structures.

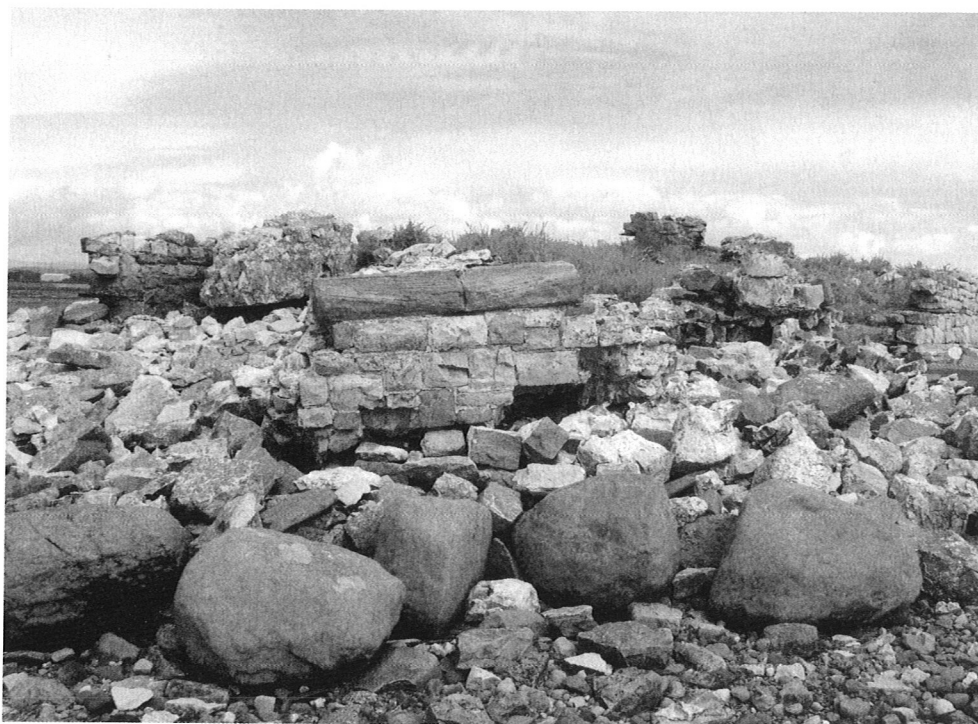


FIG. 6. Photograph of Headin Haw taken from the south-west. Parts of the revetment walls of the island are in the foreground, at the right and at the left. A few upstanding fragments of the Harrison Ainslie magazine building are also visible, the highest one being at the eastern end of the island.

(Photograph by Peter Sandbach.)

The specific name 'Poaka magazine' has not been discovered on maps but the stock book states that it was on Lindal Moor, where Harrison Ainslie had extensive haematite workings. In particular, they leased from the Duke of Buccleuch and Lord Muncaster most of the Main Vein. This runs from Snipe Ghyll (SD 245773) through Whinfield to Low Field (SD 260760). They did not however lease Poaka Open Works (SD 244773) 350m north-east of the village of Marton (SD 241771), which itself is only about 250m east of Poaka Beck. Nevertheless, the magazine must have been located nearby and it is considered that it was a building (SD 2434 7758) shown in a field immediately north of the Open Works on the second edition of the 25 inch OS map of 1890. A retouched detail of this map is shown in Fig. 7. The site is represented by inner and outer rectangles aligned roughly east-west and linked together at their western ends. It is interesting that local residents refer to this building as 'the powder house'.

A building on the same site is shown on modern maps and this was surveyed in 2008. A plan is given in Fig. 8 and a photograph taken from the south-east in Fig. 9. It is built of stone and slate on ground sloping down to the south-west and has a ridged roof. The western end has open sides and there are several indications that this is a later extension of the enclosed eastern part of the building. For example, it has a different timber roof-structure, different ridge tiles, corrugated iron rather than slate

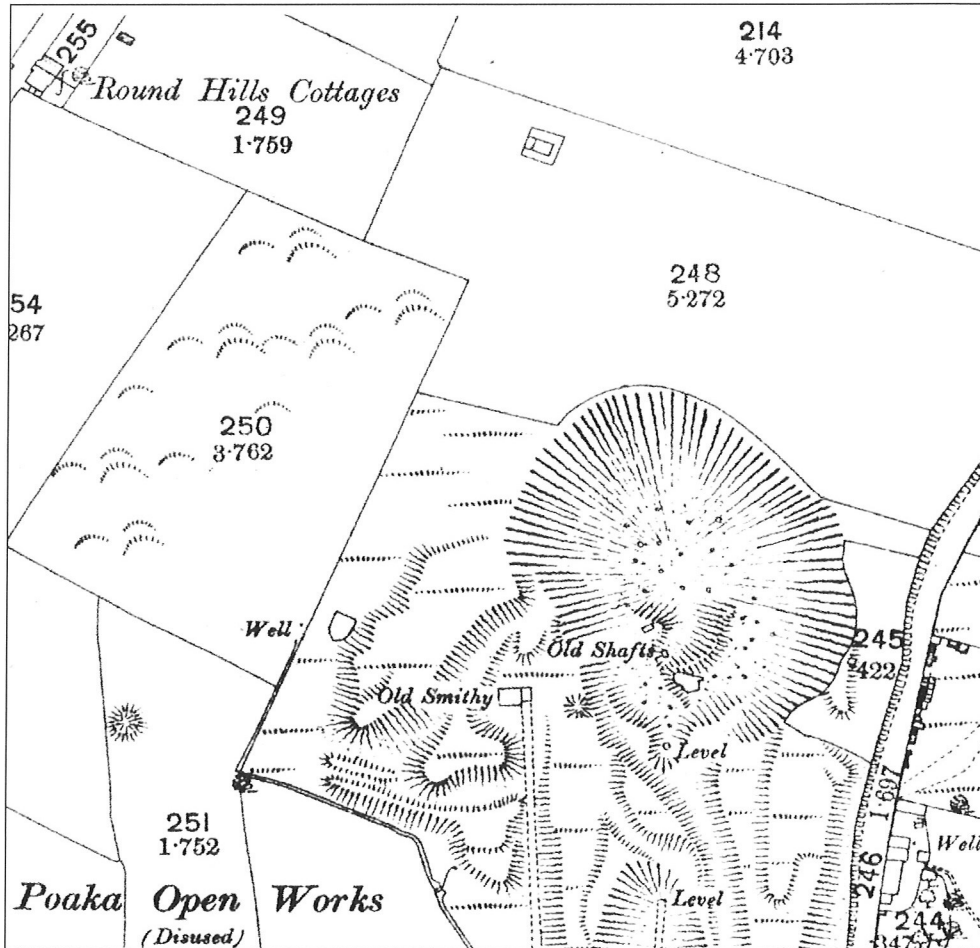


FIG. 7. Detail of the first edition of the 25 inch Ordnance Survey map (1890), showing Poaka opencast haematite workings and north of these, in the field numbered 248, a building which is considered to have been the Poaka Magazine. (Retouched)

on the south side of its roof, and some firebrick in its only wall. The original west wall of the building, which must have had a door, was demolished when the extension was built. This enclosed part of the building has several features that suggest that it was the magazine. For example, low-down sills in the side walls indicate that it would have had a timber floor to keep the gunpowder barrels dry. Also, wooden wedges in the walls show where a matchboard lining was fixed. This would have been lime-washed to keep the interior clean. Again, no iron nails appear to have been used, the roof timbers being joined with wooden dowels.

The exterior of this part of the building measures 6.2m by 4.4m, consistent with the inner rectangle on the 1890 map. The walls are about 0.45m thick and therefore the interior space would have measured about 5.3m by 3.5m. This means that it was about one-quarter the size of the Headin Haw magazine, which is to be expected as

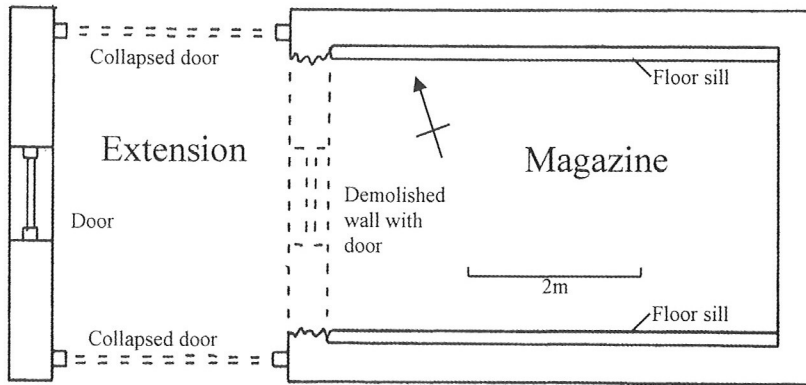


FIG. 8. Plan of Poaka magazine and its extension to the west, as surveyed in 2008. The doorway in the demolished wall is conjectural.



FIG. 9. Photograph of the building considered to have been the former Poaka Magazine on Lindal Moor, from the south-east. (Photograph by Dave Robson.)

it only received part of the gunpowder that arrived from Melfort. The side walls are about 2.2m high from the former wooden floor and the ridge is about 1.1m higher. Access to the magazine by cart could have been from a minor road about 175m to its west serving Round Hills Cottages or from a road about the same distance to the east. The journey by road from Headin Haw to Poaka magazine was about 14km.

Some significant dates

The stock book was commenced on 2 January 1871, when the gunpowder in storage at the Headin Haw magazine was recorded. There were eight types of gunpowder and

the quantity of each is given in Table 3, the total being 106,975lbs or almost 50 tons. Appendix 1 discusses how this could have been stored in the magazine. It is concluded that the barrels and any other containers must have been stacked to 2m or more above floor level. It is striking that of the 2,772 barrels only 4 per cent contained 100lbs of gunpowder and 9 per cent 50lbs but 87 per cent 25lbs. This may have been because it was far easier to manhandle the small barrels, or kegs, when moving them on and off boats, to and from magazines and also underground.

The first delivery of gunpowder to Poaka magazine was on 10 January 1871 and the last on 19 April 1876, which is the latest entry in the book. The first gunpowder sold to a customer was entered on 3 January 1871 and the last on 1 February 1876. The first shipment from Melfort arrived on 24 February 1871 (Table 2) and the last on 12 July 1875. The first gunpowder sent by ship from Headin Haw was on 12 January 1871 (Table 2) and the last on 30 November 1874. On 1 January 1876 ten types of gunpowder were held in the magazine. The quantities are summarised in Table 4, the total being 18,701lbs or 17.5 per cent of that held at the beginning of 1871.

TABLE 3. Stock of gunpowder held in Headin Haw magazine on 2 January 1871.

Type*	barrels	halves†	quarters†	lbs	Type*	barrels	halves	quarters	lbs
B	31	60	206	11,250	HGB	36	36	765	24,525
CO	40	40	40	7,000	HGBX	0	0	370	9,250
FA	0	900†	500†	23,000	HGCB	2	0	520	13,200
FFFO	0	0	143	3,575	HGCO	4	112	367	15,175

* The notation used for 'Type' is defined in Table 1.

† For 'FA [Africa]', 'halves' and 'quarters' in the stock book were replaced by '1/5' and '1/10'.

The grand totals are 113 barrels, 248 halves, 2,411 quarters, 900 fifths, 500 tenths and 106,975lbs.

Transport of the gunpowder

The stock book records six ships, *Lorn*, *Mary Atkinson*, *Melfort*, *Norseman*, *Warsash* and *Whitriggs*, that were used to transport gunpowder from the mills at Melfort to the Headin Haw magazine. One of these, *Norseman*, was a steam ship but the other five were sailing ships. *Melfort* was a smack or sloop with one mast and the remaining four were schooners, which were larger with two masts. Some notes about these vessels, including the dates when they made deliveries, are given in Appendix 2.²⁰ Usually several of the grades of gunpowder listed in Table 1 were delivered at the same time. One vessel, the *Melfort*, with 13 shipments dominated these deliveries. The *Warsash* made two and the other four vessels one each. Also the number of deliveries decreased dramatically from 8 to 7, to 2 to 0 between 1871 and 1874. Then two shipments arrived in 1875 when the remaining gunpowder in the magazine at Melfort was delivered. During this period both *Melfort* and *Whitriggs* were sold.

Four of the six vessels were named after Harrison Ainslie sites: *Lorn*, their furnace at Bonawe in Scotland, *Warsash*, their furnace on Southampton Water in Hampshire (SU 4905), *Melfort*, their gunpowder mill and *Whitriggs*, one of their mines on Lindal Moor (SD 245761). Also, late in her career, *Mary Atkinson* was part owned by the company but probably had no connection with the firm when she was named. At

present no definite information is available on *SS Norseman*. Five letters sent to Captain Campbell of the *Melfort* appear in the *Melfort* letter book of 1859-60. These accompanied transires, which were custom-house permits for removals of goods. Warsash furnace, built in 1868, was the last charcoal-fired blast furnace to be built in Britain but was short-lived, closing in 1877.²¹

TABLE 4. Stock of gunpowder held in Headin Haw magazine on 1 January 1776.

Type*	barrels	1/2	1/4	1/10 [†]	1/20 [†]	1/33 [†]	lbs
CO	0	0	1	0	0	0	25
F	0	0	0	100 [†]	200 [†]	0	2,000
FFFO	0	0	35	0	0	0	875
FO	6	20	106	0	0	0	4,250
FS	0	0	78 [†]	1 [†]	0	0	1,960
HGB	2	1	92	0	0	0	2,550
HGCB	10	0	73	0	0	0	2,825
HGCO	0	34	89	0	0	0	3,925
NM	0	0	0	0	0	63 [†]	191

* The notation used for 'Type' is defined in Table 1.

† In packets not barrels.

The totals are 18 barrels, 55 halves, 474 quarters, 101 tenths, 220 twentieths, 63 thirty-thirds and 18,701lbs.

Fifteen ships, *Brothers*, *Buony*, *Diamond*, *Elizabeth Ann*, *Industry*, *John William*, *Liffey Maid*, *Lorn*, *Melfort*, *Newland*, *Ocean Pearl*, *Sarah Jane*, *Susanah*, *Warsash* and *Victoria*, are named on the right-hand pages of the stock book as delivering gunpowder from Headin Haw magazine to customers. Brief notes on these are given in Appendix 3.

Gunpowder was also transported from the Headin Haw magazine by cart, by van (suggesting transport by rail) or on foot. For example, over one-half of the entries are for powder being carried on company carts, mostly in quarter barrels, to Poaka magazine. In addition Gradwell's carts were used to take powder to Duddon.²² Vans were used to send gunpowder to the Hodbarrow Mining Co. at Holborn Hill, a village that is now part of Millom, 10km north of Barrow, to Whitehaven and to Aycliffe, 8km north of Darlington in County Durham. Finally, Thomas Hunter, a Barrow contractor involved in building the docks,²³ sent his 'Own Man' to carry powder on foot to Hawcoat, 1km west of Furness Abbey.

Gunpowder customers

A large number of customers are recorded in the stock book but these have not been researched in great detail. However, a few of the more significant or interesting ones are mentioned here. The biggest customer was M. Leyland of Wigan who, for example, in the period January to June in 1871 was sent about 13 tons of gunpowder (125 barrels, 80 half barrels and 85 quarters), presumably to be used in the coalmines of Lancashire. This was shipped from Headin Haw on the *Newland*. The last consignment to him was sent on 6 January 1874. Another important customer was the Hodbarrow Mining Co. at Holborn Hill. Haematite mining continued at this site until 1968.²⁴⁻²⁶ J. & J. Braithwaite took powder by van to Whitehaven, Moor Row, and Woodend

Station, all in the Cleator Moor area. Shipments were also made to R. S. Roper (Table 2) and William Churchill at Newport in Monmouthshire (Gwent).²⁷ Another customer in Wales was Thomas Roberts & Son at Queensferry. Both Newport and Queensferry also feature in the 1859-60 Melfort letter book.

Richard Kendal, an Ulverston ironmonger, delivered to Ulverston, Whittriggs, Stainton, Holborn Hill, Millom and Crooklands using William Gradwell's carts. The customers also included: William Ashburner Jr, an ironmonger, cabinet maker and upholsterer of Barrow; the Hunter family, contractors of Barrow; John Townson of Duddon, John McKay of Aycliffe, all delivered by van, and J. Jackson of Chester. W. E. Walker of Runcorn and Ellesmere Port was sent one of the last shipments on the *Diamond* on 30 November 1874.

Discussion

The first question to be considered is why Harrison Ainslie decided to establish a gunpowder mill at Melfort in 1853. The reason they gave was that they needed the powder for use in their iron mines in Furness but there were at that time four gunpowder mills within 32km of their mines on Lindal Moor: Basingill (SD 5187), Elterwater (NY 3305), Gatebeck (SD 5586) and Lowwood (SD 3584).²⁸ Indeed, the Lowwood mills were only about 1km from their furnace at Backbarrow. Presumably they had previously purchased their gunpowder from one of these four mills, probably Lowwood. It seems certain therefore that they opened the Melfort mills because they were confident that Britain would become involved in the Crimean War and that they would be able to supply gunpowder for use by the British forces. However, this war ended in 1856, and as revealed by the 1859-60 Melfort letter book, they had to rely on selling gunpowder to other customers and there was much competition. In addition there were several fatal accidents at the gunpowder works and new legislation was being introduced which made it necessary to locate dangerous buildings farther apart on the site. It is not therefore surprising that Harrison Ainslie decided to close the works in the early 1870s. Indeed several other mills closed at the same time.

The period in which the Headin Haw and Poaka magazines were in use coincided with Barrow's rapid expansion. In 1850 only 661 people lived in the village of Barrow, which was a minor part of the parish of Dalton. However in 1867 it became a borough and by 1871 its population, which included Dalton, was 18,911.²⁹ It was at the beginning of this year that the gunpowder stock book was commenced. It seems unlikely however that the growth of Barrow affected local feelings about the presence of a gunpowder magazine containing some 50 tons of powder only 500m offshore. This was a relatively small amount of powder compared for example with that stored at Liverpool, where the magazine was forced to move several times.³⁰ This was the main magazine used by several Cumbrian mills including Elterwater, Lowwood and Gatebeck.

The purpose of stock books is to record the amount of goods in store and the amount disposed of, but not the value of the goods. Therefore the gunpowder stock book provides no information about the charges Harrison Ainslie were making for the various grades of powder they sold. This would have depended on the type of powder,

the best costing up to three or four times that of the cheapest. It was also much influenced by how much was needed at the time for military purposes and the price of the principal ingredient, saltpetre, which was being brought into London by the East India Company. Discounts would have been offered for large orders, regular orders and for cash but extra charged for small barrels, tins and canisters. However, it seems likely that in the early 1870s the average cost of a barrel containing 100lbs of blasting powder was about £3.³¹ The value of the powder stored at Headin Haw when the stock book was commenced would then have been about £3,200.

It is fascinating to speculate about why six leaves have been torn out of the stock book. It is tempting to suggest that it happened because Harrison Ainslie felt that they needed to hide some of the information they contained, perhaps the names of customers. However, if this is the case, why was it only done for the hard-grained bright powder when many customers purchased several types of powder at the same time so that their names occur in other places in the book? Also, why were only six leaves (12 pages) removed so that the first three and last three pages of the HGB section survive? Of course it may simply have resulted from an accident, perhaps a major spill of ink, but there is no evidence of this in other parts of the book.

As Lord Burlington's tenants had previously used Headin Haw island for unloading coal and stones, part of the revetment could have been used as a wharf for transferring gunpowder from ships. If so, the section at the eastern end of the island, close to the magazine door, would have been used. However, it seems unlikely that relatively large ships bringing gunpowder from Melfort or taking it to distant ports could have reached the island, even at high tide. It is suggested therefore that barrels were unloaded from these ships, when at anchor, into smaller vessels that could have moored at the island.

The plan of Headin Haw magazine in Fig. 5 shows that at its western end there had originally been a regular octagonal structure. The exterior walls of this were 1.1m thick and the interior distance between pairs of opposite parallel walls was 5.65m. The foundations of the eastern end of this octagon, marked A in the figure, are lower than the ground level in the adjacent part of the magazine but the other parts are upstanding a little. There are also foundations of three east-west stone walls 0.4m thick running across the octagon. These would appear to have been the supports for a timber floor to the building. It is interesting to consider the possible date of this structure. The simplest suggestion is that it represents the original magazine built in 1854-5 that was found to be too small and therefore extended at a later date. Another possibility is that the building was associated with Lord Burlington's activities on the island, being used perhaps as a store for coal or a shelter for a storekeeper. However, a more romantic but perhaps unlikely explanation is that the structure formed the foundations of a watchtower built by the monks of Furness Abbey. Headin Haw is located about 4.3km south of the abbey and the same distance north-north-west of Piel Castle. This was crenellated by the monks in the early fourteenth century when there were frequent Scottish raids. It seems plausible that at the same time they could have built a lookout on Headin Haw in case attackers escaped detection when passing the castle. An archaeological excavation of the structure should be able to clarify this issue.

As explained in the text no documentary information has been discovered to show conclusively that the building shown in Fig. 9 was Poaka magazine. Certainly its structure and local tradition confirm that it was a gunpowder magazine and it is not far from Poaka Beck and close to the Poaka opencast mine. However, this mine was not operated by Harrison Ainslie. It is hoped that further research will clarify this issue. Also, it would be satisfying to be able to establish when the extension to the western end of this building was constructed.

Information about the ships used to transport gunpowder to and from Headin Haw are provided in the text and further details are available in most cases in Appendices 2 and 3. However it was considered to be most appropriate for the present paper to concentrate mainly on the period covered by the stock book. Also no attempt has been made to make a comprehensive study of all the customers referred to in the stock book. However, it is hoped that publication of the present account will stimulate others to research these aspects of the economic history of the Harrison Ainslie company.

In conclusion, it is appropriate to summarise the fortunes of Harrison Ainslie and their industrial sites following the closure of the Melfort gunpowder mills in 1874. Substantial remains of these mills survive and some of the buildings are now used by the Melfort Club for self-catering holidays. The Duddon furnace had already closed in 1857 although it ran briefly in 1871. It is a scheduled ancient monument and one of the three most impressive charcoal furnace sites in Britain.³² One of the others is the Bonawe Furnace that closed in 1876. It is now in the care of Historic Scotland and open to the public. The third site is the Dyfi furnace in Cardiganshire. Newland furnace closed in 1891 and the substantial remains are now cared for by the Newland Furnace Trust, which is closely associated with the Cumbria Amenity Trust Mining History Society. Harrison Ainslie became a limited company in 1893 but went into receivership in 1903. The company was reformed with new owners but again went into receivership in 1914. The Charcoal Iron Company was then established by the receiver in 1917 but only to operate the Backbarrow furnace. This was the last in Britain to use charcoal but was converted to coke in 1921 and eventually closed in 1966.

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Notes and References

- ¹ J. D. Marshall, *Furness and the Industrial Revolution*, 2nd ed. (Michael Moon, Beckermets, 1981) 19-41.
- ² J. D. Marshall and M. Davies-Shiel, *The Industrial Archaeology of the Lake Counties*, 2nd ed. (Michael Moon, Beckermets, 1977) 28-51.
- ³ P. Riden, *A Gazetteer of Charcoal-fired Blast Furnaces in Great Britain in use since 1660*, 2nd ed. (Merton Priory, Cardiff, 1993) 146-7, 149.
- ⁴ P. Sandbach, 'Brief History of Harrison Ainslie', in *Harrison Ainslie's Shipping Interests*, <http://lindal-in-furness.co.uk/History/harrisonainslie.htm>
- ⁵ M. Davies-Shiel, 'Backbarrow Furnace and its History from 1868-1967', in C. Brooks and C. Irwin, (eds.), *Master of Them All*, (CIHS, Carlisle, 2007), 117-134.
- ⁶ The earlier gunpowder mills in Argyll were (1) Glen Lean, at Clachaig (NS 1281), about 10km north-west of Dunoon, (2) Kames, at the villages of Kames (NR 9772) on the Kyles of Bute and nearby Millhouse (NR 9671), and (3) Loch Fyne at Furnace (NN 0201) about 10km south-west of Inveraray. These were established in 1832, 1839 and 1841 respectively. At Furnace the substantial remains survive of the Craleckan furnace, built in 1755 by the Duddon company but shut down by 1806 (see ref. 3, 149-150).
- ⁷ J. Robertson, 'The Powder Mills of Argyll', *IA Review*, 12(2), (1990) 205-213.
- ⁸ G. Crocker, *Gunpowder Mills Gazetteer*, (Wind & Watermill Section, SPAB, London, 1988), 4, 44-8. Electronic version with supplements at www.millsarchive.com
- ⁹ Royal Commission on the Ancient and Historic Monuments of Scotland, *Argyll Volume. 2: Lorn*, (RCAHMS, 1975), 34, 292-3.
- ¹⁰ Robertson, ref. 7.
- ¹¹ A. Crocker, 'A Note on the Industrial Archaeology of the Melfort Gunpowder Site' (appendix to ref. 7) *IA Review*, 12(2), (1990) 213-15.
- ¹² CRO (B), BDB/2 20, *Melfort Gunpowder Letter Book, 1859-60*.
- ¹³ A. Crocker, 'Melfort Gunpowder Mills, Argyll: A Letter Book of 1859-60', *Scottish Business and Industrial History*, 25, Series 2, 2010.
- ¹⁴ CRO (B), BDB/2 5/3, 'Gunpowder Stock Book'. The catalogue entry for this ledger is incorrect. It states that it covers the period from 1877 to 1875; it is actually from 1871 to 1876.
- ¹⁵ The watermark in the paper is a fleur-de-lis within a shield surmounted by a crown with the italic initials 'T&JH' underneath. The associated countermark is 'Original Turkey Mill' with, in some cases, the date '1868' and, in others, '1869'. See D. Hunter, *Papermaking, the History and Technique of an Ancient Craft*, 2nd ed., (Pleiades, London, 1947) 474, 477 and T. Balston, *William Balston Paper-maker, 1759-1849*, (Methuen, London, 1954) 28.
- ¹⁶ G. Crocker, *The Gunpowder Industry*, 2nd ed. (Shire, Princes Risborough, 1999).
- ¹⁷ CRO (B), BPR5/c/12, application to build gunpowder magazines at Headin Haw and Poaka. A preliminary note on these magazines has been published: P. Sandbach, *The Mine Explorer*, 6, (2008) 131-3. In the stock book their names are always given as 'Headen Haw' and 'Powka'. However, the standard spellings are Headin Haw and Poaka and in this paper these versions have been used.
- ¹⁸ CRO (B), BD/BUC/22/23/1, letters recording dispute between Duke of Buccleuch and Lord Burlington concerning the ownership of Headin Haw, September 1853 to December 1854.
- ¹⁹ See Marshall and Davies-Shiel, *Industrial Archaeology*, 197.
- ²⁰ Much of the information on ships in this article is reproduced from Sandbach, 'Brief History' and from <http://www.mightyseas.co.uk/marhist/furness>
- ²¹ See Riden, 'Gazetteer', 143; Davies-Shiel, 'Backbarrow Furnace', 118.
- ²² William Gradwell was a general contractor and builder and played a major role in the development of Barrow. He established his firm in 1855 and employed 750 men in 1872 (see ref. 1, 275, 284, 356).
- ²³ See Marshall, 'Furness' 215, 314.
- ²⁴ See Marshall and Davies-Shiel, *Industrial Archaeology*, 128.
- ²⁵ E. Holland, 'Hodbarrow Mine - Industry within an Industry', in G. Brooks and C. Irwin, (eds.), *Master of Them All*, (CIHS, Carlisle, 2007), 93-104.
- ²⁶ D. R. Davis, 'Millom - The End Game', in G. Brooks and C. Irwin, (eds.), *Master of Them All*, (CIHS, Carlisle, 2007), 107-114.
- ²⁷ Richard Stephen Roper was the grandson of Richard Roper who became a partner of Harrison Ainslie in 1824 and died in 1860.
- ²⁸ Old Sedgwick gunpowder mills (SD 5187) had closed in 1850 and New Sedgwick (SD 5188) did not open until 1857.

²⁹ See Marshall, *Furness*, 198, 353.

³⁰ A. G. Crocker, 'The Liverpool Gunpowder Magazines', *Industrial Heritage*, 29(2) (Summer 2003), 8-15; reprinted in *Lancashire History Quarterly*, 7(2) (Summer 2003), 11-18.

³¹ This figure has been deduced from various catalogues and invoices issued by gunpowder manufactures in the late nineteenth century and held by one of the authors (AC).

³² See Riden, *Gazetteer*, 1, 110, 149.

APPENDIX 1

Storage of gunpowder in Headin Haw Magazine

The plan of Headin Haw magazine shown in Fig. 5 indicates that the total floor area was about 72m². However part of this, probably a central strip about 1m wide along the length, would have been reserved for access so that about 60m² was available for storage. Gunpowder weighing 100lbs occupies about 0.045m³, which includes the pores between the grains.¹ The height and average diameter of gunpowder barrels were approximately equal. Letting this quantity be x, the volume will be $\pi x^3/4 = 0.045\text{m}^3$. Hence $x = 0.39\text{m}$ for 100lb barrels. This gives the internal dimensions of the barrel and allowing for the thickness of the wood, the rims and the curved shape of the staves the overall external dimensions would be near 0.5m.² Therefore about 240 barrels of this size could be stored in a square array on the floor of the magazine. However, the stock book records that nearly 107,000lbs of gunpowder, equivalent to 1,070 barrels of 100lbs or nearly 50 tons, was in store on 2 January 1871, so the barrels must have been stacked in at least four layers to a height of about 2m or more. The same conclusion is reached if allowance is made for the fact that many of the barrels contained only 50 or 25lbs of gunpowder.

Notes: ¹ O. Guttman, *The Manufacture of Explosives*, (Whittaker, London, 1895), vol.1, 285-8.

² Photographs of gunpowder barrels are consistent with this estimate. See for example those on pages 22 and 25 of Crocker, *Gunpowder Industry*.

APPENDIX 2

Ships that delivered gunpowder to Headin Haw Magazine

<i>Lorn</i> :	schooner; 69 tons; ¹ bought new from Parkes at Ellesmere Port in 1864; last ship owned by Harrison Ainslie; wrecked on the Isle of Man 1890; one delivery 5 February 1875.
<i>Mary Atkinson</i> :	schooner; 96 tons; built by John and William White at Ulverston 1868; 81 feet long; 21 feet wide; 10 feet deep; lost at sea 1880; one delivery 12 July 1875.
<i>Melfort</i> :	smack; 36 tons; built at Chester in 1856 for Harrison Ainslie; sold to Belfast owners 1875; stranded at Lough Swilley in 1881; 13 deliveries 24 February, 4 April, 12 May, 22 June, 14 September, 27 October, 27 November 1871; 30 January, 13 March, 6 April, 12 September, 1 October 1872; 3 May 1873.
<i>Norseman</i> :	steam ship; Master Rose or Rouse; probably a 56 ton iron vessel built 1864 and owned by James & John McFarlane ² and others; not found in Lloyds Register or Lancaster shipping registers; sold to Queensland 1875; one delivery 15 August 1873.
<i>Warsash</i> :	schooner; 58 tons; bought new from William White at Ulverston 1869; 72 feet long, 19 feet wide, 8 feet deep, square stern; J. Geldart master 1870; sold 1890; destroyed by fire 1919; two deliveries 6 March, 29 July 1872.
<i>Whitriggs</i> :	schooner; 77 net tons, built for Harrison Ainslie at Liverpool in 1856; crewed by a master, a mate and two ordinary seamen; sold May 1874; one delivery on 19 September 1871.

Notes: ¹ The tonnages quoted are net register tons and the master's name for particular voyages have been traced through Soulby's *Ulverston Advertiser*.

² P. N. Thomas, *Steamships 1835-1875 in Contemporary Records*, (Waine Research Publications, Wolverhampton, 2008). Information on a CD accompanying the book.

APPENDIX 3

Ships that transported gunpowder from Headin Haw Magazine¹

<i>Brothers:</i>	schooner; master Stirzaker; may be the 71 ton vessel built in Ulverston in 1849 by Petty & Postlethwaite and part owned by Fishers, who held some shares in 1865. ²
<i>Buony:</i>	flat; 38 tons; built at Lytham in 1841 by Nicholas Bannister; registered at Preston; various owners and masters; broken up at Liverpool in 1891.
<i>Diamond:</i>	master Hilton; probably wherry; 43 tons; built at Burscough ³ in 1832; registered at Fleetwood and in 1845 at Preston; when the master was Richard Iddon; ⁴ sold in 1871 and again in 1880; ashore at Ballyferris, on the coast 32km east of Belfast, in 1881. Alternatively schooner; 52 tons built at Saltney on 1858; owned by William Posslethwaite when foundered on Walney Island following a collision in 1882.
<i>Elizabeth Anne:</i>	master Williams; probably schooner; 97 tons; built by Rawlinson & Reay at Barrow in 1858; bought by James Fisher in 1872, lost 1877. ⁵
<i>Furness Maid:</i>	schooner; 42 tons; built at Barrow by Ashburners in 1862; managed by William Ashburner until 1876; sank off Arran in 1891.
<i>Industry:</i>	master Iddon; could be sloop; built at Ulverston in 1825; bought by Joseph Rawlinson, iron ore merchant of Dalton, in 1853; a 17 ton vessel with this name was working in 1862.
<i>John William:</i>	master Iddon; there are too many vessels named <i>John William</i> or <i>John & William</i> to be able to identify this vessel.
<i>Liffey Maid:</i>	schooner; built in 1865 by Kelly at Dublin for J. Fisher & Sons; sold in 1881.
<i>Lorn:</i>	See Appendix 2.
<i>Melfort:</i>	See Appendix 2.
<i>Newland:</i>	smack; 28 tons; built at Tarleton ⁶ near Preston in 1859; named after the Harrison Ainslie furnace at Newland; sailing light from Greenodd in 1864 struck a railway viaduct across the Leven Estuary at Plumpton (SD 322785) and broke five columns; ⁷ sold in 1874.
<i>Ocean Pearl:</i>	schooner; 51 tons; built at Hesketh Bank ⁸ in 1858; registered at Preston; owned by James Ashcroft of Tarleton in 1870; registration transferred to Barrow in 1876 and to Wexford in 1896, when she was lost in a collision.
<i>Sarah Jane:</i>	Several vessels had this name and it is uncertain which of these is mentioned in the stock book.
<i>Susannah:</i>	master Perrin; could be 48 ton schooner <i>Suzannah</i> of Stranraer; built at Perth in 1863; owned by Sir John McTaggart and Charles Dormant, shipmaster of Drummore, 26km south of Stranraer; sold in 1877.
<i>Victoria:</i>	master, Martin; One <i>Victoria</i> frequently in the area was the 52 ton schooner built by Schollick at Greenodd in 1838; owned by E. Winder & Son and operated a regular service from Liverpool to Ulverston until 1865 when bought by George Porter, who transferred the registry from Liverpool to Barrow; bought by Andrew Jones Woodhouse, brick manufacturer, in 1869; broken up at Barrow in 1877.
<i>Warsash:</i>	See Appendix 2.

Notes: ¹ For tonnages and masters' notes, see Appendix 2, Note 1.

² James Fisher, who was the first ship owner in Barrow and shipping agent to H. W. Schneider, built a large fleet very quickly. His firm was known as J. Fisher & Sons in 1876.

³ Burscough is 6km north-east of Ormskirk at the junction of the Leeds and Liverpool Canal and its Rufford Branch that leads to the Ribble estuary.

⁴ Thomas Iddon had a coal yard at Greenodd in the 1860s and there are many references to him in the Lowwood papers held at Heritage First! (formerly Ulverston Heritage Centre). He managed vessels but did not own them. Members of the Iddon family were often masters of the vessels.

⁵ N. Watson, *Around the Coast and Across the Seas: the Story of James Fisher and Sons*, (St Matthew's Press, Leyburn, 2000).

⁶ Tarleton is at the end of the Rufford branch of the Leeds and Liverpool Canal, 5km south of the Ribble estuary.

⁷ A photograph of a train crossing the Leven viaduct soon after its opening in 1857 appears between pages 224 and 225 in Marshall, *Furness*.

⁸ Hesketh Bank is 3km north of Tarleton.

