

A Harrison Ainslie Gunpowder Stock Book of 1871-76

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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

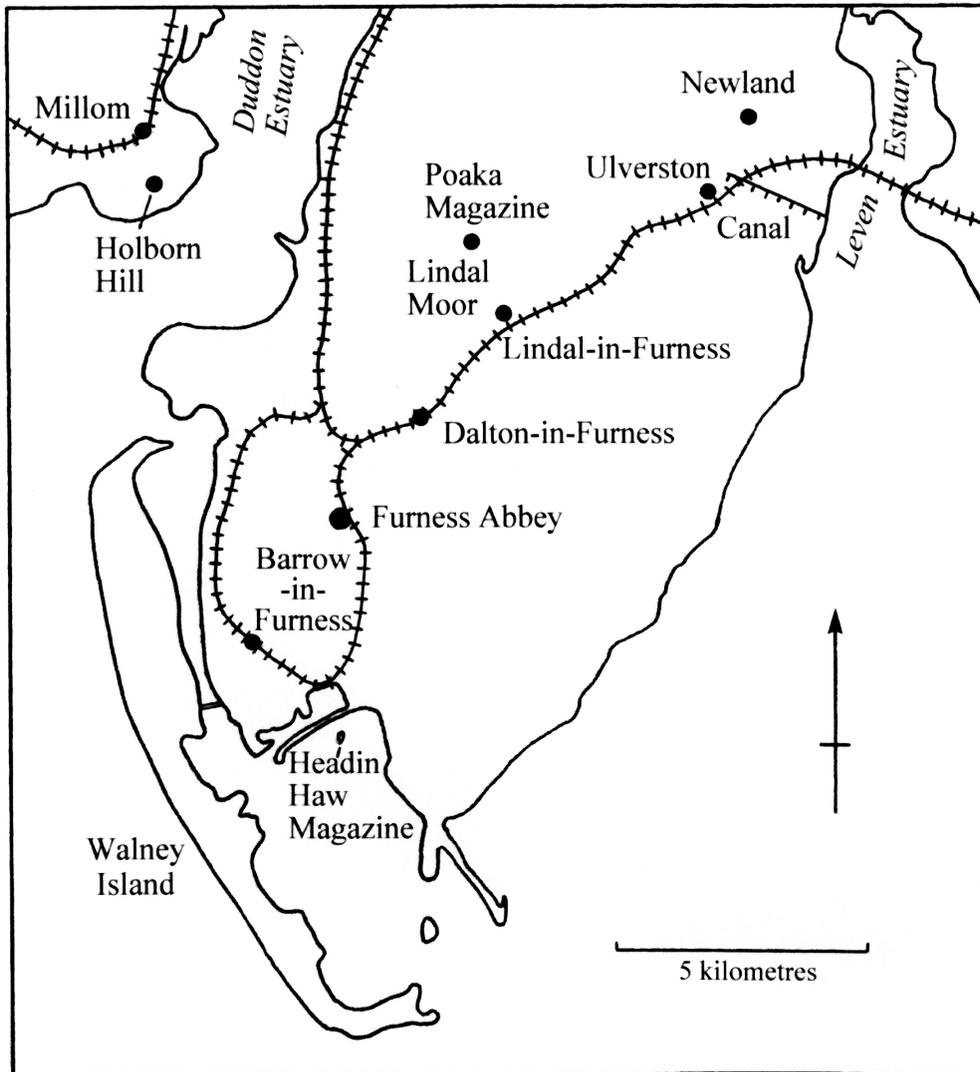


FIG. 1. Location map of the most relevant sites in Furness.

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.

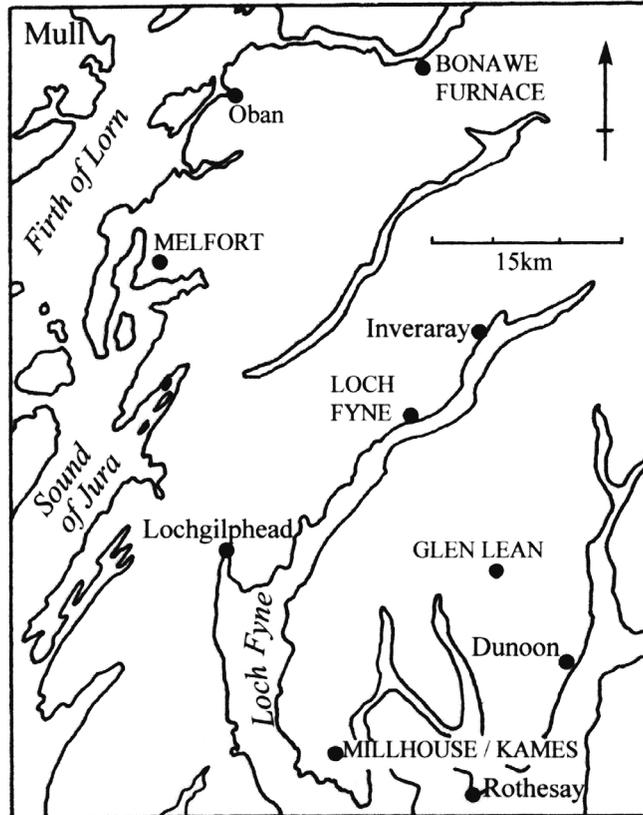


FIG. 2. Location map of sites in Argyll. Bonawe furnace and the four gunpowder works are identified in capitals.

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> : Headen 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

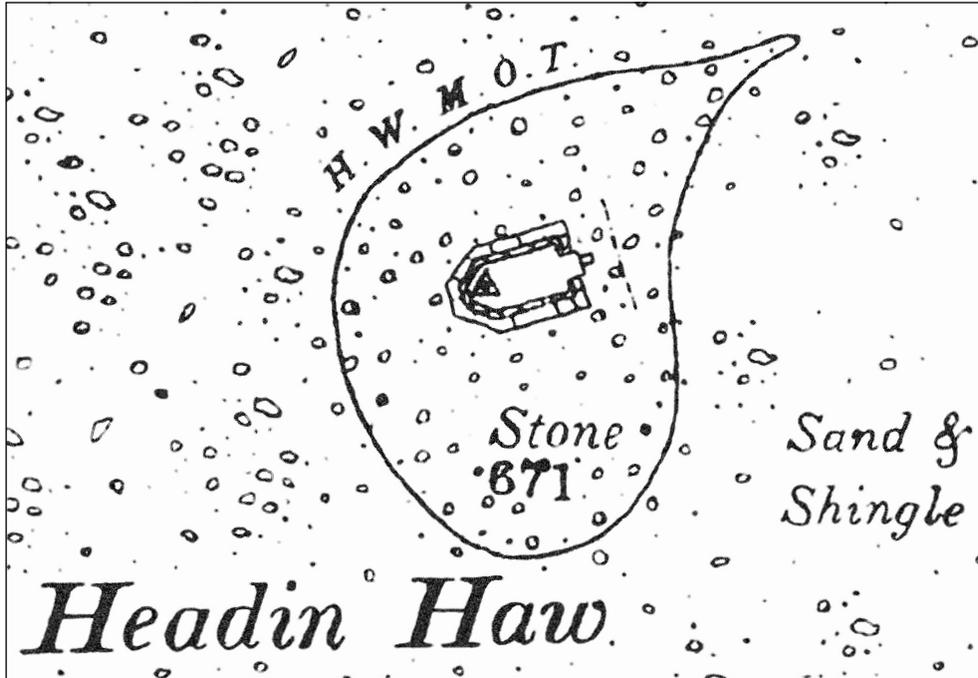


FIG. 4. Detail of the second edition of the 25 inch Ordnance Survey map (1890), showing Headin Haw island at mean high water and the gunpowder magazine. The area shown is 136m across. (*Retouched*)

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.

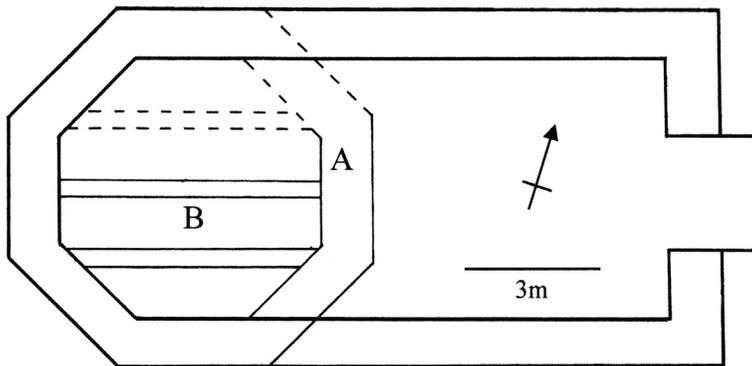


FIG. 5. Plan of Headin Haw magazine as surveyed in 2008. The bold lines of the outer foundations are as shown in Fig. 4. The finer lines at A and B are additional features, broken lines indicating conjectural structures.



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

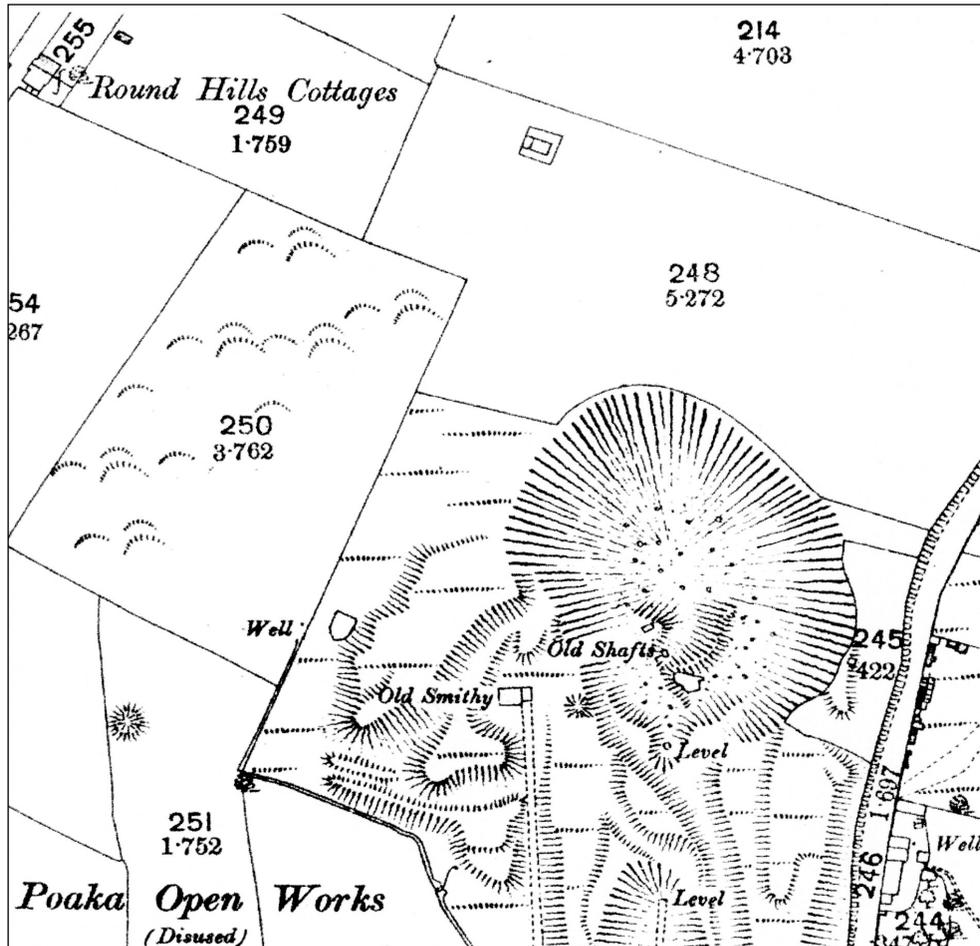


FIG. 7. Detail of the first edition of the 25 inch Ordnance Survey map (1890), showing Poaka opencast haematite workings and north of these, in the field numbered 248, a building which is considered to have been the Poaka Magazine. (*Retouched*)

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

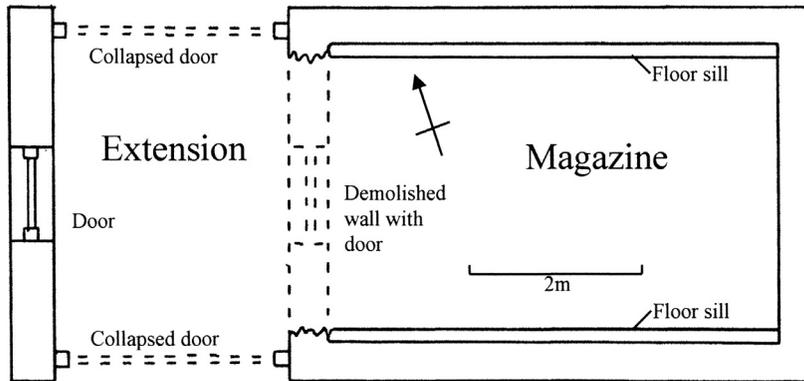


FIG. 8. Plan of Poaka magazine and its extension to the west, as surveyed in 2008. The doorway in the demolished wall is conjectural.



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: Bassingill (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, Beckermet, 1981) 19-41.
- ² J. D. Marshall and M. Davies-Shiel, *The Industrial Archaeology of the Lake Counties*, 2nd ed. (Michael Moon, Beckermet, 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 $\pi x^{3/4} = 0.045m^3$. Hence $x = 0.39m$ 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.

