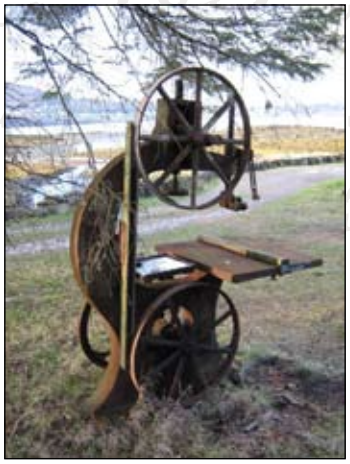

NEW TECHNOLOGY AND THE 19TH CENTURY SCOTTISH SAILING FISHING FLEET

DR D.E. ATKINSON & DR R.G.W. PRESCOTT

THE SCOTTISH FISHERIES MUSEUM ST AYLES ANSTRUTHER

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& JOHN McCARTHY

illustrations by

John McCarthy and Caroline Norrman

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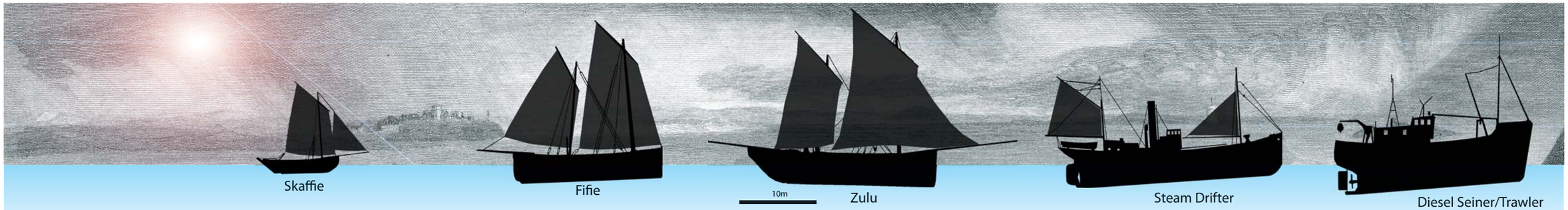


1750 The Board for Manufacture and Fisheries offers bounties for the fitting out of new herring busses

1778 First mechanised net-loom patented in England

1820 James Paterson invents practical net-loom and opens networks in Musselburgh

The Washington Report of 1849 recommends that all offshore vessels be fully decked, following a great loss of life in the great storm of 1848. The small open **skaffies** are increasingly decked from this point onwards

The **Zulu** design is developed in 1879 combining some elements from Skaffies and Fifies

1834 Wilhelm Albert invents wire rope

The National Lifeboat Institution sponsors the building of several decked **Fifie** style boats in 1867, leading to widespread use of the design

1882 First **steam drifter** built in Leith

1901 First diesel engine fitted to Scottish fishing vessel

1913 **steam drifters** at peak of use

After WWII the British herring industry goes into serious decline and mosts boats are forced to leave British waters

During the 1970s stocks becomes so so depleted that the herring fisheries are closed for six years

During the 1950s and 1960s diesel boats and trawling begin to replace steam drifters and drift netting

American War of Independence (1775-1783)

Napoleonic Wars (1803- 1815)

Dutch herring industry destroyed

Crimean War (1853-1856)

World War I (1914-1918)

World War II (1939-1945)

1750 1800 1850 1900 1950 2000

Skye boatyard

Montrose Rope and Sail Works

Cardy Net Works, Lower Largo

MacDonalds Brothers Foundry, Portsoy

1789 - Coins of this date have been discovered built into the walls of the ropewalk

1843 Alexander MacDonald born

1844 David Gillies born

1848 James MacDonald born

1867 David Gillies founds Cardy Networks

1886 Net making ceases at Cardy Networks

1887 MacDonalds Foundry moves to Loch Soy

1899 James Paton buys part of Montrose Ropeworks

1904 MacDonalds invent steam propulsion device

1908 MacDonalds develop steam capstan and line hauler

1911 Trading ceases at Cardy Networks

Death of David Gillies

1936 A major fire damages buildings at Montrose Rope and Sail

Circa 1950 ropemaking ceases at Montrose Rope and Sail

1973 The Jardine family move into Cardy House

Introduction

BACKGROUND TO THE SERIES OF RESEARCH INVESTIGATIONS

The Scottish Fisheries Museum (SFM) has extensive collections illustrating the range of trades involved in operating a fishing economy in the 19th century. The collections cover, inter alia, boatbuilding, sail-making, rope-making and the manufacture of fishing gear. Much of this material is displayed in the galleries and the museum is keen to enhance the visitor experience by providing greater insight into these craft practices, setting the displays in a wider context. As an example of this, the SFM has recently introduced a training programme on traditional boatbuilding and repair, in collaboration with Adam Smith College in Fife, which will enhance the static displays of ship-wrights' tools in the museum. The research projects reported below carry this contextual work further by exploring the subtle changes taking place in the design and operation of the sailing fishing fleets in the 19th century, as new technology infiltrates this traditional field at a gathering pace.

The research will broaden the range of contextual information we have about specific aspects of the museum's collections, particularly in relation to the impact of new technology on the material culture of Scottish fisher communities. There are four separate research projects included in the study:

- A record of a small vernacular boat-yard in Skye
- Early developments in the industrial manufacture of herring drift nets
- The application of steam power to line-haulers and capstans
- The development of rope- and sail-making in 19th century Montrose

There is considerable synergy between the four projects so, rather than submit separate reports for each one we propose to cover all aspects of the four projects in this single report, thus drawing attention to the cross-connections between them. Together they illustrate the complex nexus of causal factors influencing developments in these traditional activities over the last two hundred years.

Chapter 1

A small vernacular Boat-yard on Skye

Throughout much of the modern era, vernacular boatbuilding yards have been essentially ephemeral in nature. Little more was required for a craftsman to build a wooden fishing boat than an open space near the water's edge and a bag of hand tools. At the beginning of the 19th century there were numerous small vernacular boat-yards around the coast, building small fishing vessels in this way. Most of the small boats in the SFM collection come from boat-yards of this type. When they close down, such yards may leave behind little in the way of archaeological or documentary information.

Mechanical devices for working wood, such as saws, planers and morticing machines, came into production in the early 19th century and, in larger industrial units such as the Royal Dockyards or the major commercial ship-building yards, were usually powered by steam or water power, often belt-driven from shafting running throughout the establishment. Bentham's steam-powered sawmill at Chatham and Brunel's suite of machines for the Portsmouth Blockmills are good

Illus 1
Marine chart showing the location of the boatbuilding site on Skye

Illus 2

1st edition Ordnance Survey showing the location of the boatbuilding site on Skye

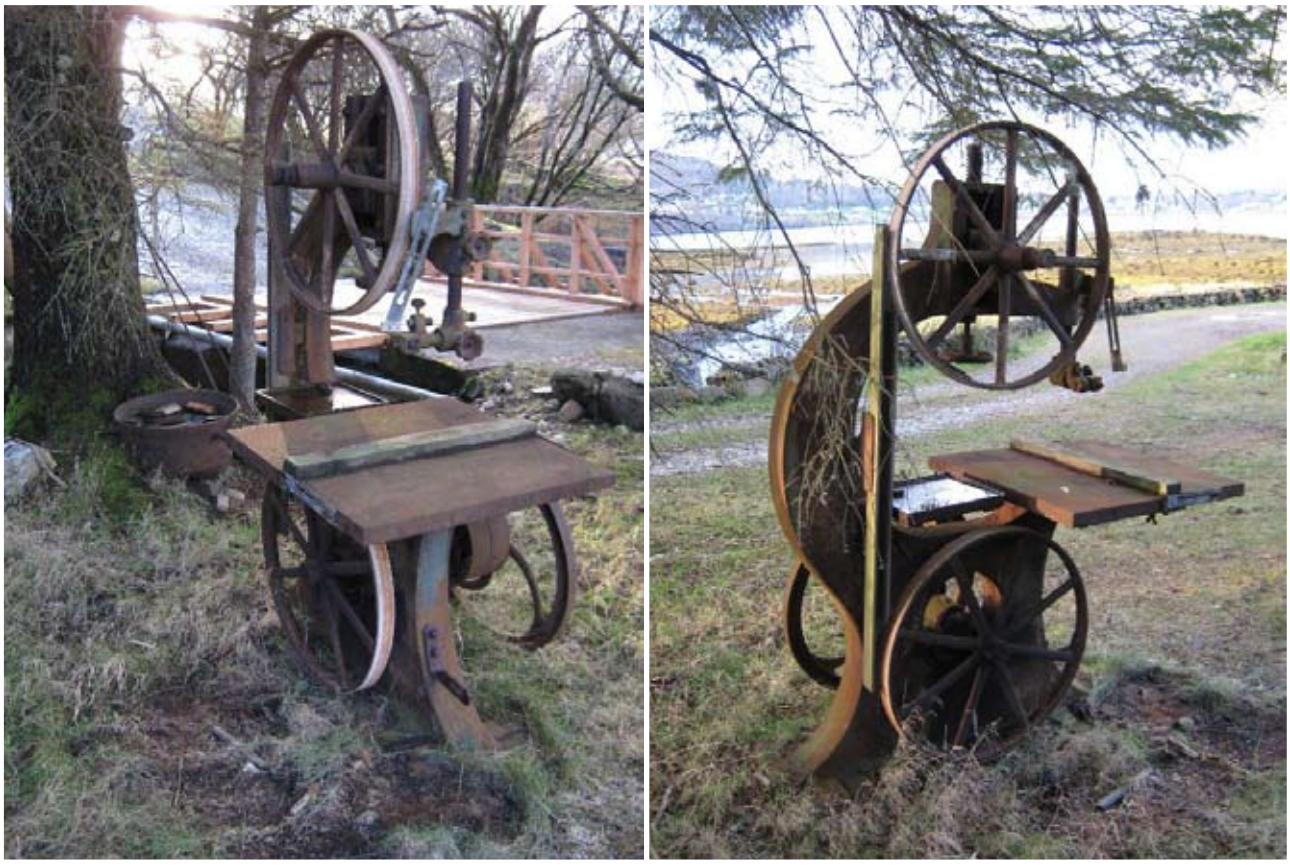
examples of such developments. Attempts to extend mechanisation to vernacular boat-yards came later. The first powered saw in an Anstruther boat-yard was only introduced within living memory and was powered by town gas. Smaller yards in more remote locations could not afford to invest in mechanisation, either because their turnover did not justify the expense, or because there may not have been a suitable power source available to drive expensive machinery.

The aim of the project described below was to record a boatyard near Portree in Skye which built small yawls for the local fisher-folk. Because of its relative isolation and difficult access, the yard never developed the use of power tools. The yard closed down some years ago and the present owner of the property has invited the SFM to take away an interesting band-saw, which was operated solely by manual power. Our intention was to combine the up-lift of the machine with the opportunity to make a survey and record of the yard, and to gather as much oral evidence as possible about its operation and the boats that were built there.

FIELD-WORK

The site location is depicted on the accompanying series of maps and plans (Illus 1 and 2). Vehicular access to the site involves crossing a burn which discharges into the bay to the west of the site. The project was seriously affected by severe weather earlier in the year, which destroyed the bridge across this burn, thus denying access to the site. Field work has therefore so far been restricted to two reconnaissance visits on foot, to discuss the project with Mr Wightman, the current owner, and to make plans for the eventual survey and transport of the band-saw.

Illustrations 3 and 4 show the present position of the band-saw. It now lies in the open, though it was apparently protected originally by some form of timber cover. Oral testimony informs us that, when the yard was building boats it was the boat-builder's wife who powered the saw by means of a crank handle while her husband fed timber through the saw. Following discussions with the

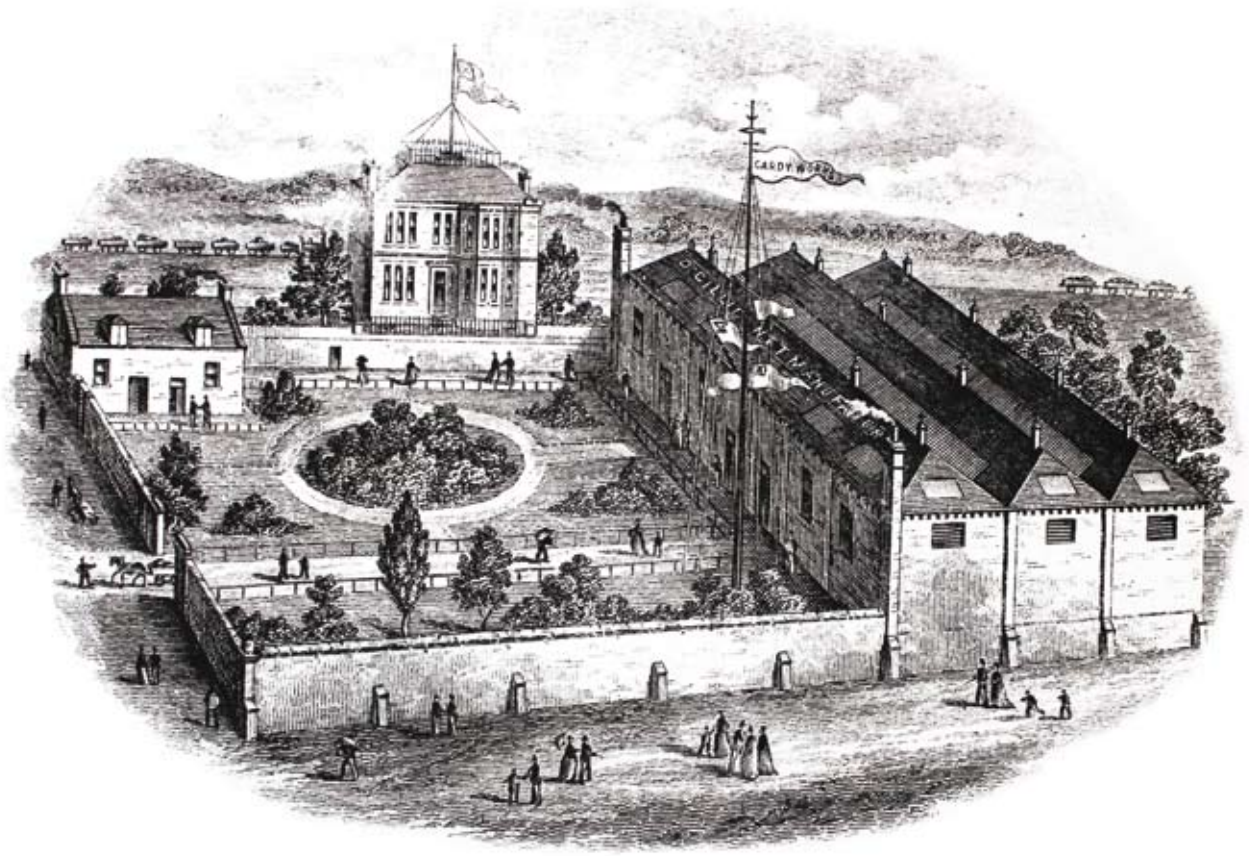


Illus 3 & 4
Views of the bandsaw located *in situ* at the site of the boatbuilding yard

Illus 5
New bridge over burn at site of boatyard

owner, and while awaiting an opportunity to return to the site with the necessary transport, an effort is under way to draw up a list of boats built there, and also to contact individuals who worked in the yard and who might be able to supply details of how it operated.

The problems with weather and access to the site earlier in the year have resulted in a lengthening of our timetable. The damaged bridge has now been rebuilt (Illus 5) and we shall make arrangements to visit the site, complete the survey and recover the band-saw as soon as possible. This part of the present document is therefore an interim report and a fuller supplementary report on this particular project will be provided when the survey is completed later this year.



It's busk ye, my lads, get you up on deck
And take up your stations for hauling the nets
And mind you pull together boys, all through the night
And sweat in your oilskins until it's daylight

At the heaving and hauling and shaking the nets

It's when we start hauling we're living in hopes
The boy in the locker, the lads on the ropes
And the fellas in the hold who are pulling the nets
And shaking the herring out onto the deck

(excerpt from The Net Hauling Song
by Ewan MacColl © Stormking Music 1969)

Chapter 2

Early industrial developments in the manufacture of herring drift nets

This chapter looks at developments in the manufacture of herring drift nets during the 19th and early 20th century, a story in which Scotland played a major part. The transition from hand-knotted nets to machine-made nets is described and the persistence of hand-loom operation (i.e. without the application of water or steam power to drive the machinery) is reported. A case study of an independent net manufacturing firm based in the town of Lower Largo which operated for some 40 years serves to illustrate the nature and scale of the industry. The project comprised an initial desk-based assessment followed by site visits to extant buildings, structures and manuscript collections, as well as a review of museum collections in Edinburgh and Fife.

Illus 6

The Montrose Herring Fleet at dawn, hauling their nets and racing to port with the catch, seen in a painting from the 1880s by W Findlay of Ferryden (Prescott Collection)

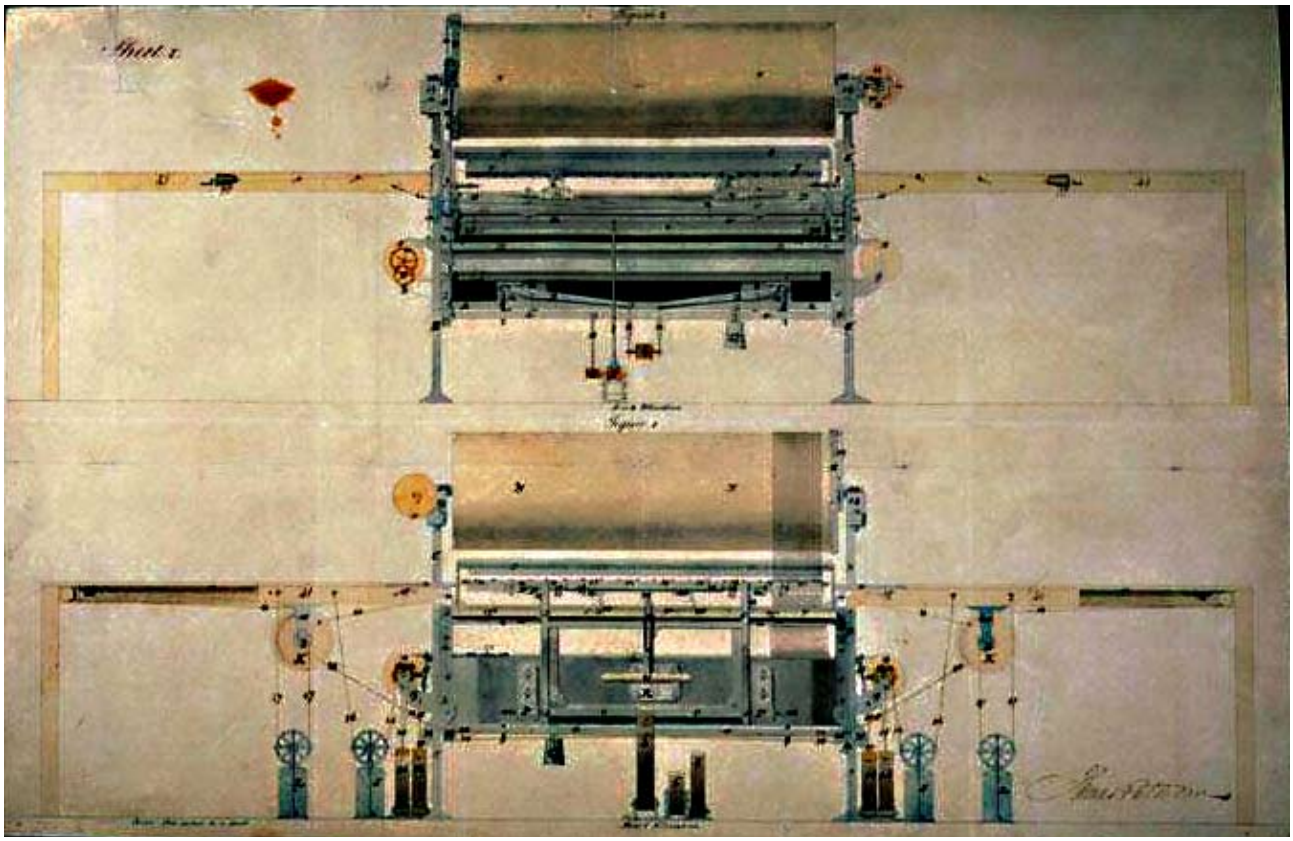
Illus 7
A portrait of James Paterson some time before his death in 1850
(Licensor www.scran.ac.uk)

HERRING DRIFT NETS

At the beginning of the 19th century most Scottish fishermen operated in small open boats with crews of three or four men. In the herring fishery each crew member contributed his own hand-woven hemp nets. A fleet of herring nets comprised a number of these individual net panels, joined together by head and foot ropes. The principle of herring drift nets was to ensnare the fish in the meshes of the nets rather than encircle a large shoal of fish as in seine-net fishing. Once the fleet of nets was shot on the fishing grounds, the boats lay to their nets rather as they might lie to a sea anchor, the vessel slowly drifting to leeward of the fleet, hence the term 'drift netting'. The fish swim into the net, which hangs as a barrier near the surface of the sea, suspended at intervals by net floats or 'boughs'. The size of the mesh ensures that there is only enough room for the head and gills to pass through the openings in the net and thus the fish become trapped. For this reason the size of each mesh is of crucial importance. There were typically 30–35 meshes per yard in a herring net (McLeod, 1). Before mechanisation, net-making was a cottage industry carried out by hand, usually by the wives of the fishermen. Hemp or flax was the usual material and a single net could take up to five weeks of painstaking work to complete (Bremner 1869, 312). The nets were usually the second greatest expense for a fisherman, after the boat, and could be very heavy, even more so when full of fish, and wet. It would take many hours to haul in the nets, a tough job commemorated by Ewan McColl in *The Net Hauling Song, 'And mind you pull together boys, all through the night, And sweat in your oilskins until it's daylight'*. Another onerous task associated with these nets was the constant need to dry them out and treat them, to prevent rot. Large areas of beach-front in the fishing villages of this period were dotted with large poles or 'gallowses' where the nets could be hung out (McGowan 2003, 88). Up to around 1840 a solution, derived from the bark of the oak or birch tree, was used to preserve the nets; the process was known as barking. Later on different chemicals came into use but the process retained the same name. Alum solution was sometimes used, particularly for winter fishing, as it bleached the nets white and was thought to make them more difficult for the fish to spot at that time of year. Also used was Catechu (Burmese Cutch), an imported product derived from the trunk of the acacia tree, which stained the nets dark brown. The great weight and expense of the nets was a major factor limiting the growth of the Scottish herring industry, limiting the space on the boats to store fish and placing an enormous physical strain on the crew. Important developments during the 19th century were to greatly ease the burden for fishermen and opened the way for the development of larger boats which in turn led to numerous other innovations in construction, rigging and fishing gear. (Illus 6)

JAMES PATERSON AND THE INVENTION OF THE NET-LOOM

The first patents for a mechanised net loom were registered in England in 1778 but they were not widely adopted (Miller 1994, 82). Over forty years later a much more efficient design for a net-loom was patented in Scotland by James Paterson, a tradesman from Musselburgh (Illus 7). Paterson was a cooper by trade and his work had brought him into close contact with the fishermen of the Lothian coast. The concept of a mechanised net-loom occurred to him at an early age but it was not until many years later, after a period in the army (he fought at the Battle of Waterloo) that he was able to return to Scotland and begin experimenting with designs. This

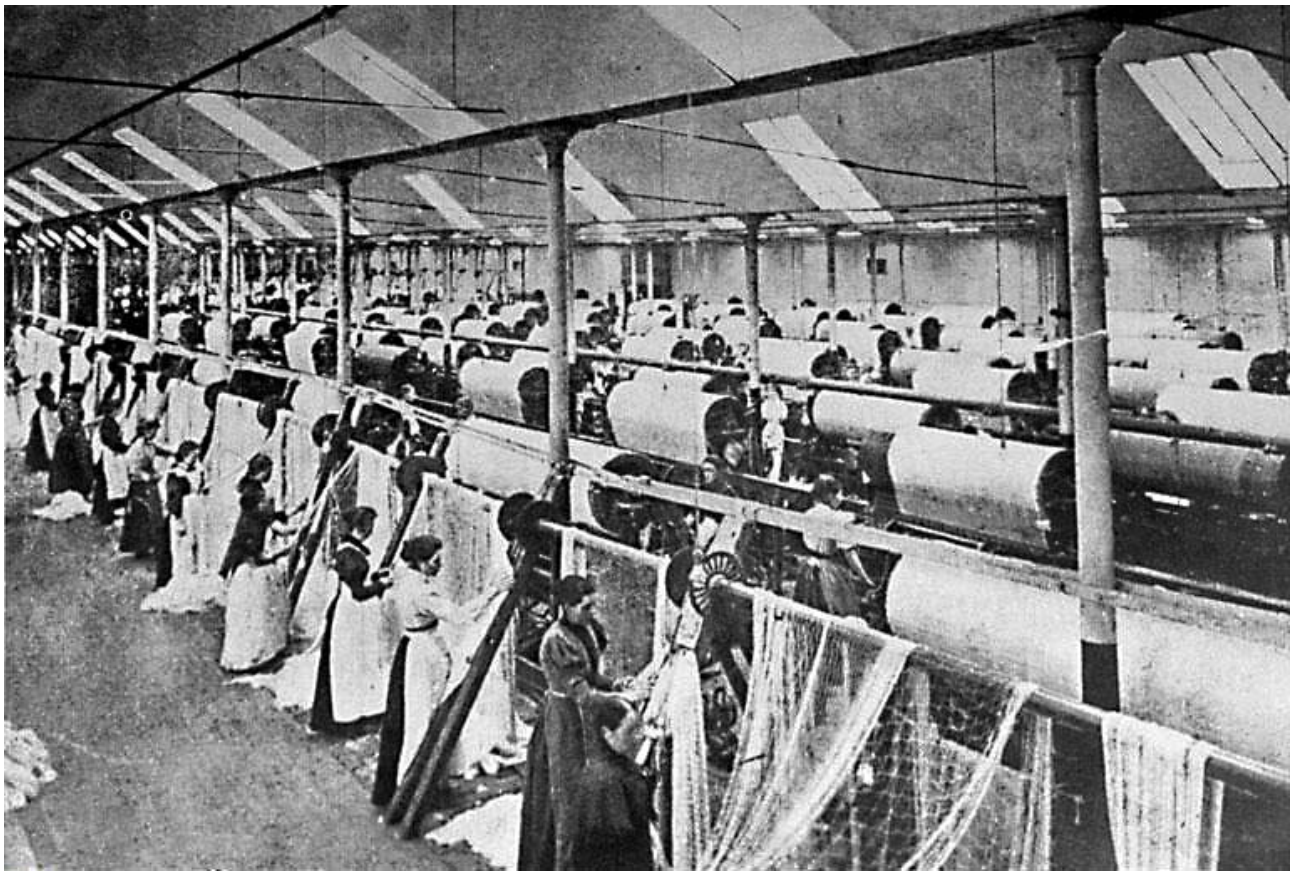


Illus 8
The patent drawing for James Paterson's net-loom (www.scran.ac.uk)

proved to be a difficult and frustrating task despite the help of a gifted blacksmith whom he had hired to assist him. Eventually a working model was completed and this initial design was able to produce nets as fast as a dozen people working by hand (Illus 8). In 1820 Paterson opened a mechanised net factory in his home town of Musselburgh. Although fishermen were initially sceptical of the new nets, the advantages soon became clear and by 1839 Paterson had eighteen looms in operation and employed 50 people (Illus 9). During the early years of mechanised net manufacture the design of the net-loom was a closely guarded secret and a great effort was made to prevent the operators of the loom from making sketches of the machinery. It is even said that Gaelic speakers were employed to reduce the chance of the design being stolen. Despite all these precautions a rival operation was set up in Musselburgh in the early 1830s although the owner subsequently left the country to avoid prosecution by Paterson for patent infringements (Bremner 1869, 314–5).

The process of making nets using machinery was quite complicated. Cotton and occasionally hemp were processed into twine and wound onto large spools or bobbins to feed the looms. An explanation of the workings of one of Paterson's net-looms survives from 1869:

> *'Each loom requires the space of three or four common power looms. Though called a loom the apparatus has no resemblance to the ordinary weaving machine being more like the knitting frame, indeed some portions of the two are identical in shape and name. The part which forms the mesh consists of an arrangement of hooks, needles and sinkers, one of each being required in the making of every knot. In a loom capable of working a net 400 meshes in depth there are consequently 1,200 moveable parts directly employed in the formation of each row. The looms are from six to eight feet in width and about six feet in height. The hooks and needles are ranged horizontally at a height of three feet above the floor. The mechanism by which they are put into operation is of a peculiar and complicated kind. Indeed it is obvious that the machine, however well it may accomplish its work at the slow rate at which it is worked, is not yet perfect, the clumsy looking system of weights*



Illus 9
Women operating net looms in the factory in Musselburgh (www.scran.ac.uk)

springs and levers and the singular movements which the operatives have to make in order to bring them into play are decidedly primitive and a long way behind the automatic spinning machinery situated in another part of the establishment.

Messrs. Stuart have made and patented various improvements on the original loom but there is still scope for the exercise of skill in the way of effecting further amendments. It is at least possible to adapt the machine to be moved by steam or water power. The mode of working the loom may be briefly described. The operative moves a lever which draws the last completed row of meshes off the sinkers and transfers them to the hooks. Another lever is moved and the meshes are caught by the needles. The effect of these changes, and the movement of other parts of the machine, is to twist the lower part of each mesh into a loose knot. The foot of the operative touches another lever and a steel wire is thrust across the machine through all the knots. There is a hook the end of this wire, or shuttle as it is called, into which the end of a piece of twine is fixed. The wire is then withdrawn and it goes takes the twine along with it. Now the sinkers play part. They consist of thin slips of brass having a hook or notch formed on the upper end, and is situated between the needles. When the twine has been drawn across through the loops of the meshes, the sinkers are released in succession and as they descend each draws down the cross thread into a loop sufficient to form two sides of a mesh, the other two being formed by the same parts of previous row. One or two movements more remove the knots off the needles and draw them firmly, thus completing the operation.

In forming each row of meshes the worker has to press upon half a dozen levers in succession and pass from one end of the machine to the other. The occupation is consequently an unusually active one. As the work proceeds the net is wound upon a self acting cylinder which forms the upper part of the machine. There is an index attached to the cylinder which records the progress of the work. When a sufficient length of netting has been made it is unwound from the cylinder and taken to the 'guarding room', where

> *several rows of stout twine are worked on what is to be the upper side of the net. That is called the guarding and its purpose is to withstand the friction of the 'back rope'. It has not been found possible as yet to put on the guarding in the loom and accordingly girls are employed to work it by hand. The net is next carefully examined and any defect made good. It is then neatly folded up and in that condition goes into the market, the subsequent operations necessary to fit it for use being performed by the fishermen.'*
>
> *(Bremner 1869, 317–18)*

There are two examples of 19th century net looms in the collections of the National Museums of Scotland. The details are as follows:

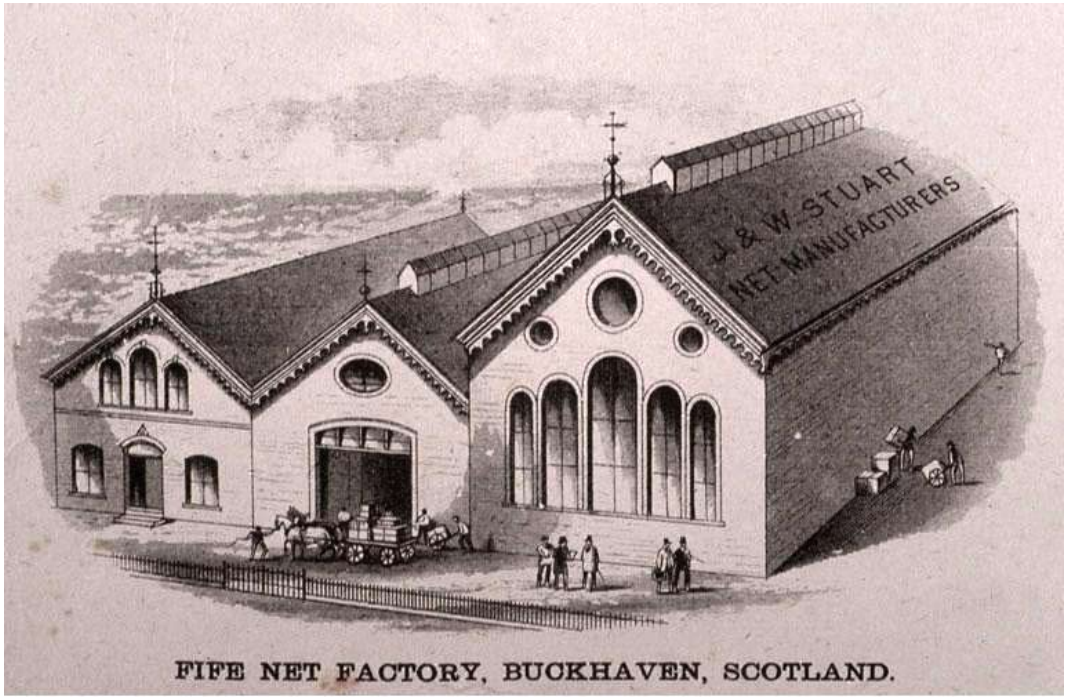
1)	Accession no.:	W.1999.209
	(Other no(s):	W.W#.0009
	Legal status:	permanent collection
	Object name:	Loom, net
	Description:	Net loom
	Dimensions:	4300mm L x 1600mm W x 1800mm H
	Department:	Scotland and Europe: Scottish Modern History: Scottish Modern Collections
	Location:	Port Edgar: P004: R003

(Note: Despite the 1999 accession number there is a suggestion in another version of the record that it was acquired in 1960. There is also a book of photographs that may be associated with this loom. The photos seem to be of '*James Paterson's Scotch Net Loom manufactured 1840, photographed at J&W Stuart's Esk Mill*')

2)	Accession no.:	W.1994.57
	Legal status:	PERMANENT COLLECTION
	Object name:	Loom, herring net
	Description:	Loom for herring-nets, by Hugh Quin, 1883
	Maker:	Hugh Quin
	Department:	Scotland and Europe: Scottish Modern History: Country Life Collections
	Location:	National Museum of Rural Life: Kittochside

IMPACT ON THE FISHING INDUSTRY

The mechanisation of net-loom manufacture was especially relevant to drift nets which, unlike trawl nets, were made in regular rectangular panels. The mechanisation of net making in the 19th century revolutionised the industry and although both hand-made and machine-made nets were initially similar in price, improvements to the design of the net-looms gradually drove down the cost of a machine-made net. The transition from hand woven nets to those of the 'manufactories' was a slow one. Initially this may have been due to the need for improvements to the design of the net-looms which could not replicate the knots used on hand woven nets until around 1840. Another major factor was the resistance to innovation among fishermen. Their reluctance to embrace any new technologies was perhaps understandable given the cost of a fishing net and the fact that it was in many cases their own wives who had made nets to supplement the family income and who would now suffer loss of earnings. Perhaps for this reason it was to take several decades for hand-knotted drift nets to fall out of use entirely (Bremner 1869, 312–5).



Illus 10

Stuarts, successors to James Paterson the inventor of net-looms, opened another net works in Buckhaven in 1882 (www.scran.ac.uk)

At around the same time as Paterson's machine nets were becoming popular, cotton began to replace hemp as the main material used in nets. Cotton nets were a third of the weight of the old hemp nets. Between trips to the fishing grounds, both cotton and hemp nets had to be dried, but the lighter weight of the cotton nets allowed them to dry faster. On the downside cotton nets were more fragile and required mending more often but fishermen were willing to put up with this for the advantages they brought (Miller 1994, 71). The American Civil War (1861–1865) interrupted the supply of cotton briefly but supplies were quickly re-established after the war (Sutherland 1985, 43). Cotton meant that vessels which had previously used hemp nets could now carry more than twice as many nets as before and thus take in many more fish in the same amount of time. Fishermen now found that their boats were no longer large enough to hold such catches and there was a strong demand for larger boats. Larger boats in turn meant more space for nets with the end result that between 1800 and 1880 the length of the fleet of nets carried by Scottish fishing vessels increased from around 240 yards (220m) up to 2,500 yards (2.3km); an increase of over 1000% (Sutherland 1985, 43). These larger boats were of different design to the small open boats of the early 1800s, with the fully decked 'Fifies' and 'Zulus' coming into use.

In 1851 Paterson died and his factory and patent were sold to his former rivals J & W Stuart, Net Manufacturers (*The Scotsman* January 22nd 1851). They continued to expand the business and dominate the industry, opening factories in Buckhaven and Great Yarmouth, and by 1869 employed a largely female work force of 800 people (Illus 10). By the same date a large number of competitors had also emerged employing an estimated total of about 2000 people across Scotland and operating around 600 net-looms (Bremner 1869, 319). One of the most notable of these competitors was David Gillies of Lower Largo, who established the Cardy Net Factory in 1867.

LARGO AND LOWER LARGO BEFORE THE NET FACTORY

Largo (also known as Upper Largo or the Kirkton of Largo), Lower Largo and Lundin Links are three small settlements close to each other by the north shore of the Firth of Forth. Despite their close proximity they are historically distinct entities. Upper Largo (east of Keil Burn) became

Illus 11

Lower Largo as it appeared on Roy's map of 1747-55 (NLS)

a Burgh of Barony in 1513 and had a parish school by 1623. However Roy's map of 1747-55 shows it as a very small settlement (Illus 11). Lower Largo first appears in Blaue's Atlas of 1642 as 'Largow Burnemouth'. It does not seem to have been a haven of any significance at this time as it was ignored by a comprehensive Cromwellian survey of ports undertaken in 1655. Roy's map of 1747–55 shows that Lower Largo was larger than its namesake and was arranged in a linear pattern along the coast road. The road running through it was an important transport route in the area and served as a postal road, with a coaching inn built in 1794. Lundin Links, to the immediate west of Lower Largo, began as a settlement around Lundin Mill and was first mapped by Blaue in1642. Industries in the three towns in the eighteenth century included linen and salt manufacture (Smith 2001, 578–9). A survey of the area at the end of the eighteenth century recorded that the fishing industry had prospered up to around 1775 when the majority of inhabitants were fishermen but had declined to such an extent that there were no longer any fishermen in Largo by the end of the century. A stone quay also existed by this date, capable of serving ships of up to 200 tons (Sinclair 1791–99). Despite this there was little shipping, fishing or industry in the parish in the first decades of the 19th century, save for a small salmon fishery and a flax mill employing 85 people (NSA 1834–45, 441). Indeed, the presence of the flax mill may have influenced the initial foundation of the Cardy Net Factory.

DAVID GILLIES AND NET MANUFACTURE IN LOWER LARGO

A photograph of David Gillies at the age of forty-two taken with his workers shows him with his 'dashing Dundeary whiskers' (Bruce-Watt 1986, 46) (Illus 12). Born David Selkirk Gillies in 1844, he was a direct descendant of Largo's most famous son, Alexander Selkirk (1676–1721) who is thought to have been the inspiration for Daniel Defoe's 'Robinson Crusoe'. David had three brothers, James, Robert and William (Eunson and Band 2000, 118). William and Robert are

Illus 12

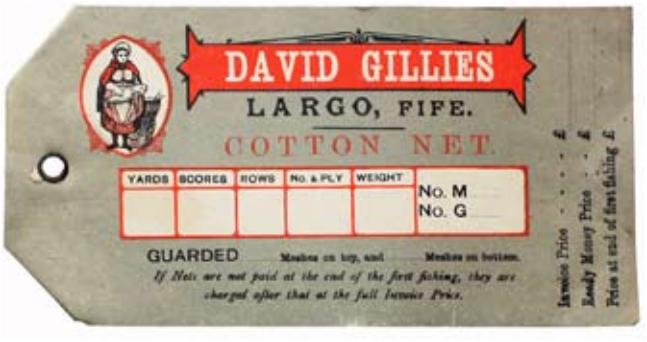
The staff of the Net Works circa 1885. Although the machine operators were exclusively female, the posts of gardener and Network Manager were held by men. David Gillies himself appears to be the man at the top of the photograph with the large moustache (RCAHMS)

known to have been keen sailors and musicians while James was known as 'James the Whaler' and spent his life at sea as a ships carpenter (Bruce-Watt 1986, 49). David himself left school at the age of 13 and at the age of only 24 designed and built the factory at Cardy (Jardine 1982, 77). He had been apprenticed to A. Boswell and Co. a firm of hemp and flax spinners based in Leven. At one point Boswell bought a small number of net looms, apparently around the time of the American Civil War (1861–6) when cotton was scarce and net prices were high due to a naval blockade of the Confederate States by the Union Navy. David Gillies later remarked of these machines that 'nobody took much interest in them except himself'. He was given control of the net manufacturing and selling operation and as Boswell's agent, sold his nets to the fishermen of Largo during this period (Gillies 1964, 1). As well as manufacturing nets, canvas samples produced by Gillies from the 1880s and now in the Scottish Life Archive show that he operated as a canvas agent, selling English and American cotton canvas. He became a wealthy man and at one point is known to have been the major shareholder in five large sea-going ships (Jardine 1982, 77).

Gillies' factory, known as Cardy Net Works, was established in 1867, just as the American Civil War had ended. At the time there were about 14 net manufacturers operating in Scotland (Bremner 1869, 319). Gillies either bought or were given a small number of net-looms by his former employer, Boswells, when he struck off on his own. He also took four net workers with him to help train his new recruits (Gillies 1964, 1). Gillies built the factory with the assistance of his three brothers. They built a blacksmith's forge on the site for him and helped him with the woodworking (Eunson and Band 2000, 118). The factory initially employed 25 women and girls who operated the net-looms by hand, the works being without any source of power (Smith 2001, 578). Sales were very successful, particularly in the early years and before long there were 36 machines operated by 60

women, some of whom commuted from as far away as Buckhaven (Eunson and Band 2000, 118). (Illus 13)

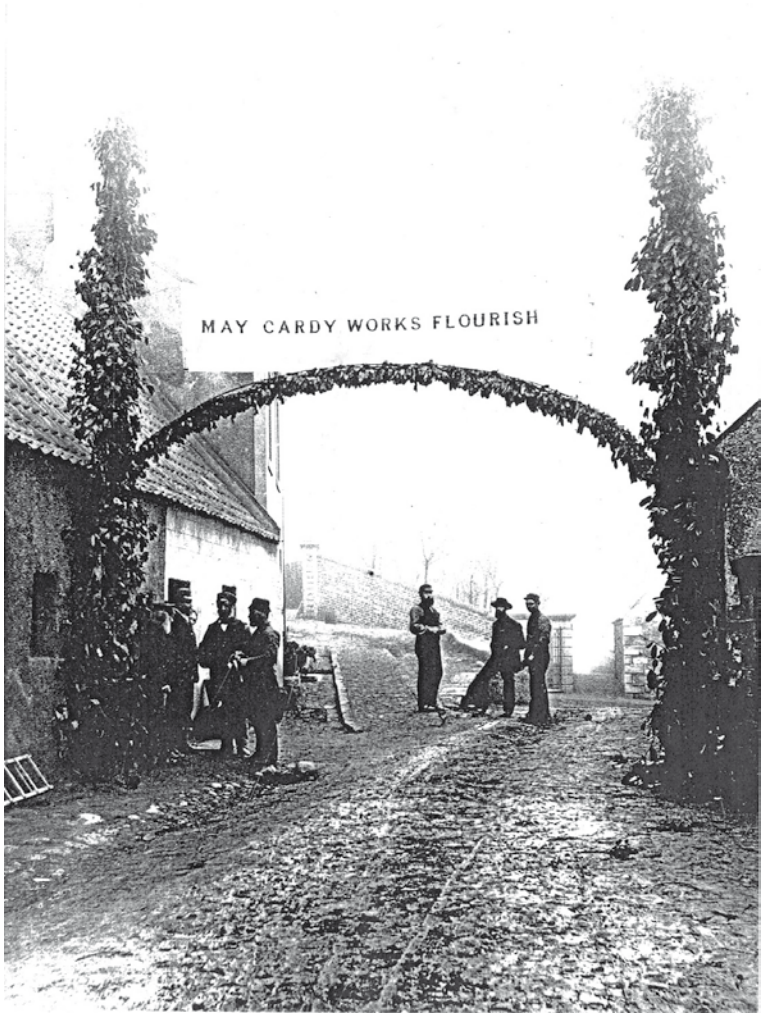
Such was the demand that a night shift was introduced and the final total given for net-looms by David Gillies' son was 38 (Gillies 1964, 1–2). The early success of the Net Works allowed David Gillies to finance the construction of Cardy House in 1871 and the erection of a statue to his famous great-great-grandfather Alexander Selkirk in 1885 (Illus 14). However falling sales in the early 1880s meant that the manufacture of nets ceased around 1886 and the buildings were left almost exactly as they had been on the final day of operation until they were converted into housing in 1999-2000 (Smith 2001, 578).



Illus 13

The label from a bundle of nets produced at Cardy Net Works which is preserved in the Scottish Fisheries Museum at Anstruther

During its relatively short period of operation the net manufactory was a central part of life in Lower Largo and long after it had ceased operating David Gillies was something of a patriarch for the townsfolk. He appears to have acted as a legal advisor to them and preserved the records of the town (Jardine 1982, 72). He also acted as the point of contact between those who had emigrated and those left behind in Lower Largo. Emigrants would address their correspondence to Cardy House for forwarding to the relevant person. When there was a death in the Largo community Gillies would sometimes sell the property in Largo on behalf of the relatives living abroad and forward the proceeds to them (Jardine 1982, 76). Gillies' paternalistic role is also apparent in the layout of the buildings at Cardy, which appear in illustrations of the time as an almost utopian community. The Net Works and associated buildings are enclosed within a high protective wall. Working conditions were good and even the leisure of the workers was catered for, with a rose garden and bowling green laid out to the west of the factory, and the whole complex was watched over from the imposing Cardy House. In this respect David Gillies appears to be a latter-day exponent of benevolent industrialism following in the tradition of men like the early socialist mill-owner Robert Owen of New Lanark (which itself became a major centre of net manufacture under the ownership of Birkmyre and Sommerville in the late 19th century).



Illus 14

A photograph taken in 1885 on the day the Alexander Selkirk statue, paid for by David Gillies, was unveiled. The photo illustrates the importance of the works to the prosperity of the town (RCAHMS)

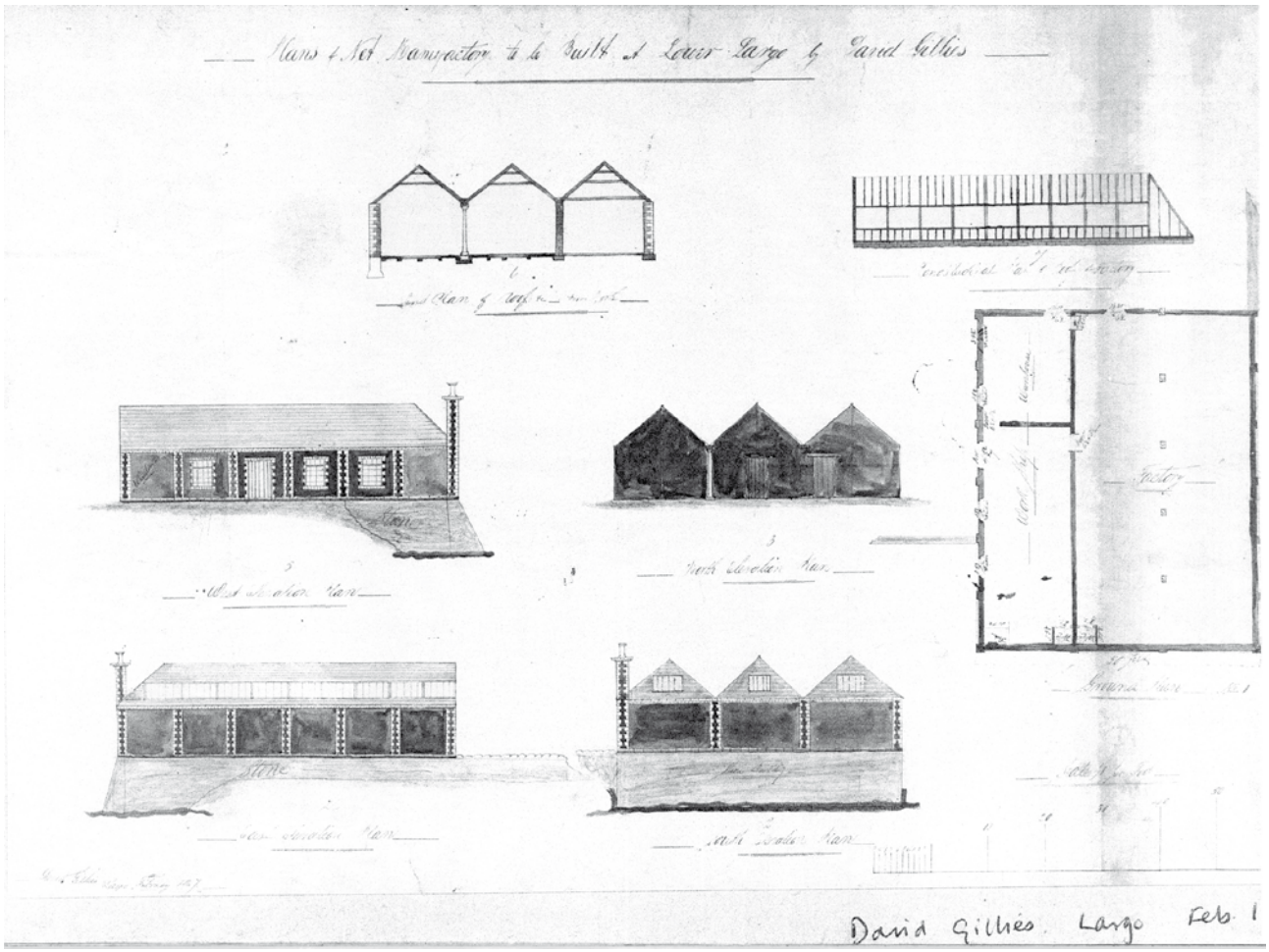
Illus 15

A poster dating to circa 1885 showing Cardy Net Works from the south. Visible in the painting is Cardy Cottage, Cardy House and the Net Works. The bowling green and enclosing wall are also clearly visible. The railway, dating to 1856 can be seen in the top left (www.scran.ac.uk)

THE BUILDINGS

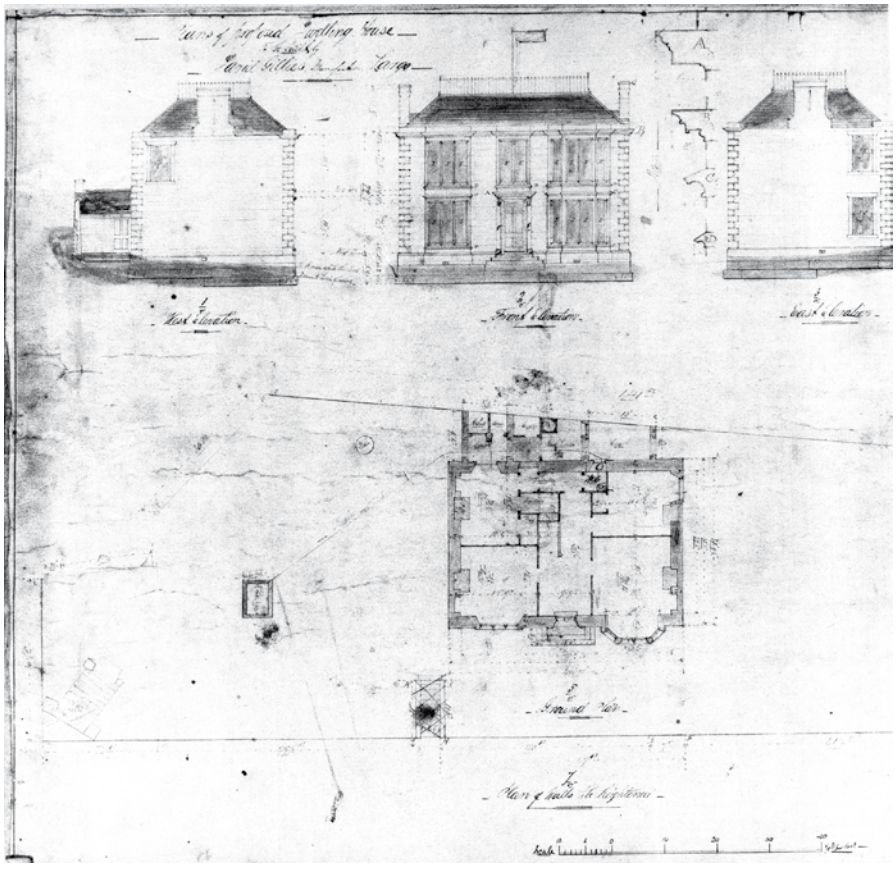
An engraving of the factory made some time between 1871 and 1880 survives in several forms and was used on invoices, posters and business cards by David Gillies, some of which were printed in colour. Illus 15 shows a poster in which the buildings and garden are depicted in an oval vignette as viewed from the south. The buildings are arranged around the walled garden, with the three-gabled factory to the east, Cardy House to the north and Cardy Cottage (the manager's house) to the west. Two large flagpoles are depicted, one at the southern end of the walled garden and the other rising from the roof of Cardy House, both sporting '*Cardy Works*' house flags.

The buildings have changed little since their construction (Illus 16 and 17). The net works itself was the earliest part of the complex (1867) and was comprised of 3 parallel ranges of brick sheds built on a rubble base. Similarities are noted between the layout of the Cardy complex and examples from elsewhere such as the net works at Buckhaven (Illus 10). The whole site is on a south facing slope down to the shore of the Firth of Forth and the factory and south wall of the garden are reinforced with buttresses. The south wall is blank except for a ventilator. The brick walls are interrupted on the west face by ten bays, five windows, two brick lintelled doors (now boarded) and pilaster strips. A modern garage door has been inserted into this face. At the north end there is an open cartshed. The roof is piended at the south and gabled to the north with a series of continuous rooflights on the two easternmost of the ranges and interrupted rooflights



Illus 16 (above)

'Plans of Net Manufactory to be built at Lower Largo by David Gillies'. These drawings date to the 1860s (RCAHMS)



Illus 17 (right)

'Plans of proposed dwelling-house to be built by David Gillies, manufacturer, Largo'. These drawings date to between 1871 and 1873 (RCAHMS)

Illus 18

A view of the factory floor around 1880 showing the mainly female workforce and the large net-looms (RCAHMS)

on the westernmost. Since the engravings of the 1870s several chimneys along the roof line have been removed but the roof appears unchanged otherwise. The factory complex is now B-listed. While it was in operation the net works was divided into two areas. The main working area which held the net looms occupied the two eastern ranges which had a central row of columns running between them. The western range was divided into a workshop, a forge, a small warehouse and an office at the northern end (Hay and Stell 1986, 99).

Cardy House was built in 1873 to serve as the residence for David Gillies and had a commanding view across the net works. It was laid out as a two-storey 3-bay villa. It has a polished ashlar front with rusticated quoins and dressings and has its carriage entrance to the north-west of Cardy Cottage. A low balcony holds a small figure of Atlas and other statuary survives in the gardens and grounds. Cardy House is B-listed. Prior to the removal of many of the interior furnishings in the early 1990s it was described as 'one of the most evocative homes in Scotland' due to the fact that the recent occupants had preserved almost everything just as they had found it and there were few signs inside that the twentieth century had ever happened (Bruce Watt 1986, 46).

Cardy Cottage was built in 1875 to serve as a combined gardener and factory manager's house. It is formed of a pair of semi-detached two-bayed single storey cottages with attics. It has two central doors, and a slate roof. The cottage is now C (S) listed and appears to have been preserved in close to its original condition.

The garden wall was added in 1872, with a wide wagon entrance near the south-west corner. This entrance is flanked by two stugged ashlar square corniced gatepiers and forms part of the factories' B-listing. The garden is depicted in two slightly different forms in the surviving engravings from the 1870s. Some (including the poster above) show a square path in the centre

with four paths leading away from the centre of the square while others show it with a circular path in the centre and only two paths leading east and west. Both arrangements show a path along the south of the garden leading from the net works entrance to the gates of the walled garden. This was presumably the main thoroughfare for supplies and for sending out finished nets. The garden provided a bowling green for the women from the factory (Bruce-Watt 1986, 52). The complex as it appears today holds great significance due to its survival almost in its entirety, and with its original layout (Illus 19). It stands as a testament to a successful vernacular industry thrust into the heart of the industrial age.

Illus 19

A similar view showing the factory as it was after ownership had passed to the Jardines. Although the machinery had been removed huge amounts of material from the operational days of the factory had been stored and much of it is now held by the Scottish Fisheries Museum (RCAHMS)

THE END OF NET-MAKING IN LOWER LARGO

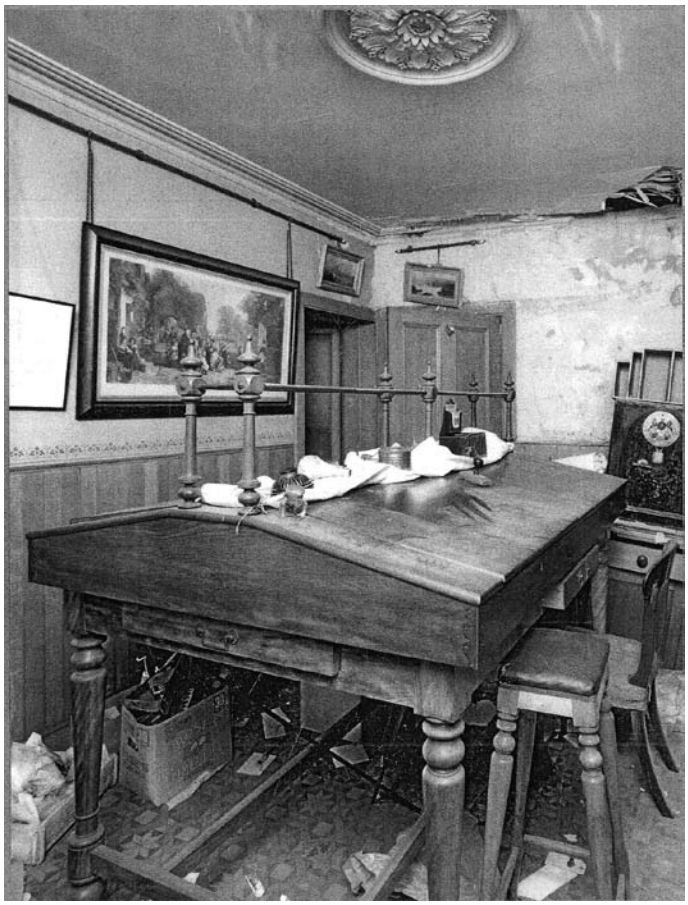
The 1870s and 1880s were a hard time for Scotland's herring fishery due to the depletion of stocks. David Gillies had been part of a deputation to the Lord Advocate on behalf of the Scottish herring industry to protest against the practice of trawling for sprats and herring fry in the Firth of Forth (*The Scotsman* January 25th 1877). In 1886 the factory closed down due to the diminishing demand for fishing nets and sailcloth (Jardine 1982, 76). Gillies continued to sell nets until 1911 but never attempted to reopen the factory despite a recovery in the fishing industry. This appears to have upset some of the locals, who badly needed employment, and during the first decade of the twentieth century an effigy of Gillies was carried in procession along the beach to the spot in front of Cardy House and set on fire. David Gillies passed away in 1923 and made one last philanthropic gesture in his will, leaving the sum of £1000 to the Edinburgh Royal Infirmary with a subsequent donation of the same amount by his wife who survived him (*The Scotsman* March 6th and December 23rd 1923). During WWI the factory building was used for billeting troops, and found employment again during WWII as a storehouse for the town's rations (Eunson and Band 2000, 119). In 1950 Isabella Gillies, David's wife passed away and the house passed to their son James Gillies (1898-1973). In 1919 David Gillies' daughter (also Isabella) had married Thomas Jardine (*The Scotsman* October 3rd 1919) and in 1973 Cardy house came into the possession of their descendants (Bruce-Watt 1986, 49).

> *'The home they entered was like something from Great Expectations, although with fewer cobwebs, frozen in a time warp for a hundred years. Every part of the plenishing chosen by David Gillies was still in place, along with complete domestic records. In the factory the machinery had long since been sold, but everything else was just as it had been left when the works closed. Drift nets, bundles of sailcloth and green glass floats lay in their original packaging, along with unopened packets of business cards, labels and advertising posters, ordered shortly before the stoppage' (Eunson and Band 2000, 120).*

The Jardines preserved the property as they found it and restored much of it to its original state but sadly in 1986 Mr. Jardine passed away and in 1989 Ivy Jardine was forced to sell the property and the furnishings were separated from the house (*The Glasgow Herald* December 9th 1989). In 1992 the factory building was converted into accommodation and although it retains much of its external appearance the interior has been extensively remodelled. It is now described as

'a luxurious contemporary home ideal for a large family' (www.cardy-nethouse.co.uk Accessed 13/05/2010) (Illus 20).

Net manufacture changed drastically after World War II. Synthetic fibres such as polypropylene have replaced natural fibres such as hemp and cotton. These synthetic materials are cheaper, do not have to be dried or 'barked' and are significantly lighter and stronger. Modern fishing vessels rely on mass-produced synthetic nets, often originating many hundreds of miles away from their home ports, and the manufacture of nets has largely died out in Scotland.



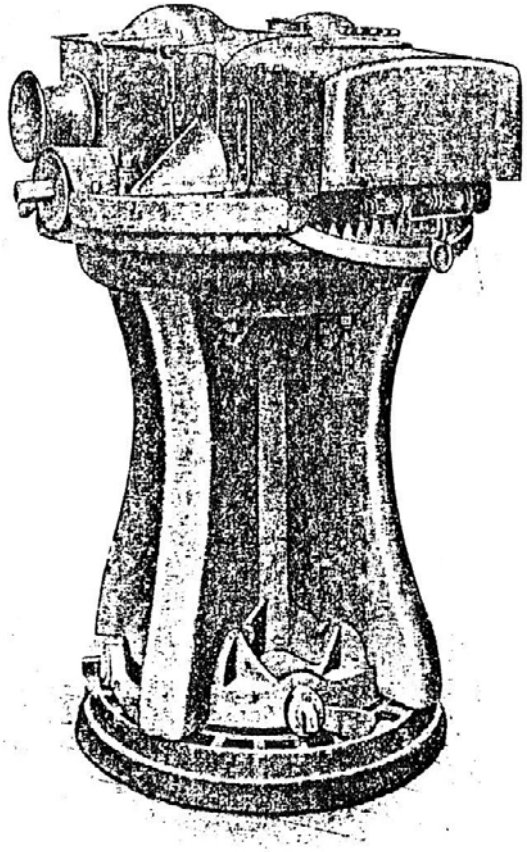
Illus 20

An office in one of the buildings at Cardy Net Works which despite retaining its original furnishing and décor had fallen into a decrepit state with holes in the ceiling and accumulated junk. The photograph is though to date to 1973 (RCAHMS)

DISCUSSION

Machine-based net-making is a special Scottish industrial story. It is fortunate that our national museum collections reflect this story in some detail, and that, in the Cardy Net Factory we have an astonishing survivor of this story, at the boundary between the vernacular and the truly industrial zones. David Gillies' Cardy Net Works was in some respects typical of the kind of industry to be found in Scottish coastal towns of the late 19th century. The rapid changes and expansion of the fishing industry lead to larger boats and a whole host of small industrial operations springing up. Despite the fact that Stuarts, the main manufacturer of nets in Scotland, had bought the patents from James Paterson, the inventor of the net-loom, and were operating from several different sites around Scotland, they were not able to prevent competition from smaller independent companies like Cardy Net Works. It is remarkable that this manufactory operated at such a late date entirely using hand-looms, unassisted by any form of power other than that of the largely female work force. The Cardy Works is an extraordinary example of a proto-industrial, benevolently patriarchal undertaking surviving late into the 19th century. With the help of his family David Gillies created a small boom in the local economy and was able to finance the construction of Cardy House, one of the most substantial buildings in Lower Largo at the time, furnishing it with statues, paintings and furniture of high quality. At the same time he strived to improve the lives of his employees and those in the town as a whole in a manner typical of many 19th century Scottish philanthropists. Despite the limited life span of the factory the legacy of David Gillies and the Cardy Works remains in the structures and in the many objects and records which have been preserved by his descendants and in Scotland's museums. The period in which the Net Works flourished saw enormous changes in the way the Scottish fishing fleet operated and David Gillies and the other manufacturers of nets served as an essential catalyst to that process.

The desk-based assessment concluded that the original buildings constructed for use in the net works are still largely unchanged although the interiors have been remodelled and a large amount of material relating to the operation of the net works, which had lain undisturbed since the closure of the factory, was removed in the early 1990s. Fortunately much of this material has been preserved in the Scottish Fisheries Museum (see Appendix 1) and the National Museum of Scotland.



MacDonald Brothers, Engineers, a weel-kent local name,
There was a day this firm could claim, a far much wider fame;
Their craft and skill was aye weel-socht, for work both far and near,
They had the patent on machines for haulin' fishin' gear.

The Shetland men had haulers, but these were wrocht by han',
MacDonalds' folk improved on this and they devised a plan;
For wi' pistons and wi' pinion, they did a job worthwhile,
And made line haulers that are wrocht by either steam or ile.

And as MacDonalds' name has been, seen on the Seven Seas,
Whaurever Great Line fishermen haul in their lines wi' ease;
Frae Greenland's icy rock-bound shore, doon tae the Spanish Main,
Whaur' men gang tae the sea in ships, a livelihood tae gain.

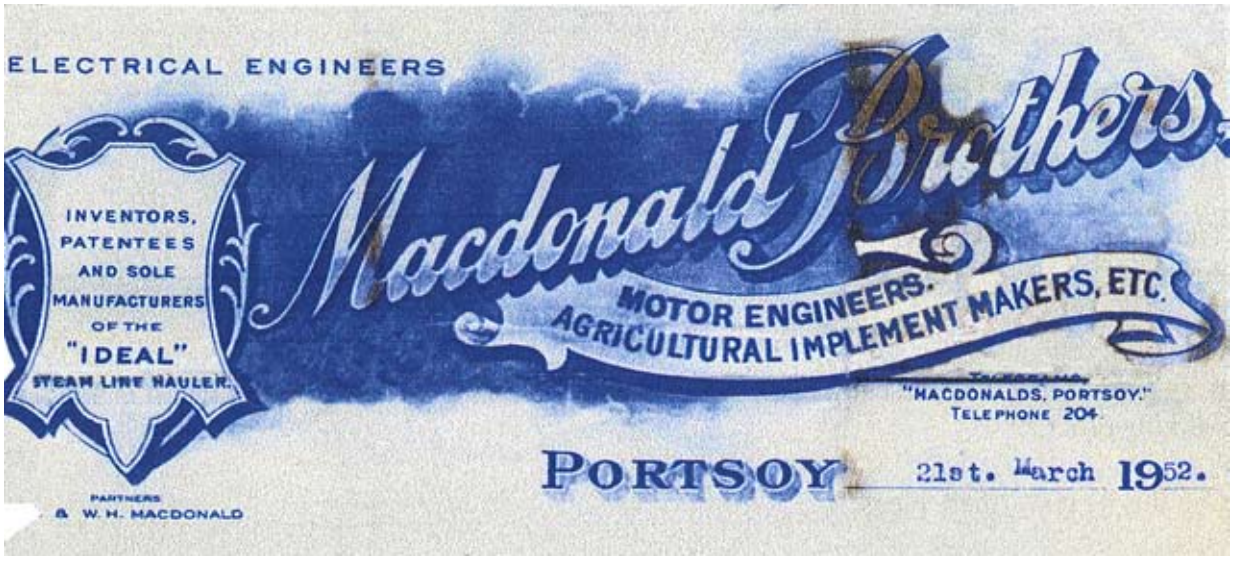
(Slater 1978)

Chapter 3

The application of steam power to line-haulers and capstans in sailing fishing boats

This chapter looks at aspects of the use of steam technology in late 19th and 20th century sailing fishing vessels in Scotland. The progressive increase in size of Scots fishing luggers over this period placed great burdens on the crew, who had to shoot and haul longer fleets of cotton drift nets and cope with the added weight of heavier spars, sails and rigging in these larger boats. The simple hand capstans of the earlier, smaller vessels were no longer adequate. The solution lay in the application of steam power to this heavy work. The first effective steam capstan marketed for use in herring drifters was that designed by the East Anglian firm of Elliott & Garrood, who went on to establish a near monopoly in this market, both in English and Scottish vessels and even overseas. However, a foundry in the small coastal burgh of Portsoy, (nr Banff), Aberdeenshire competed effectively in this market with their own design of steam capstan which sold widely among herring fishing communities along the Moray Firth and the northern coasts. They also produced steam line-haulers for use at the great-line fishing. A case study of this small engineering firm serves to illustrate the development of this technology.

The research comprised an initial desk-based assessment, a site visit for two days in March 2010 to the locations occupied by the MacDonald Brothers Foundry in Portsoy, a review of relevant collections (documents, photographs and machinery) at the Scottish Fisheries Museum and the Salmon Bothy Heritage Centre in Portsoy, as well as the collection of oral testimony



Illus 21

An advertising bill of the foundry dating from 1953 which demonstrates the longevity of the line hauler design

via the Portsoy Local Library and a meeting with a local historian and former employee of the MacDonald Brothers Engineering works. The research also included the consultation of original Patent Applications via the Mitchell Library in Glasgow, describing Patents granted for the designs of steam machinery for use on fishing vessels.

PORTSOY HISTORY, 16TH -20TH CENTURIES

Portsoy is the principal village in the parish of Fordyce which is situated in one of the few sandy bays along this rocky stretch of the north coast of Aberdeenshire. It was chartered as a burgh of barony by the Ogilvie family circa 1550 and a harbour was built by them at around the same time. An inner harbour was added by their descendants in 1692 and Portsoy became a trading port, known in particular for its quarries of fine green serpentine, some of which was used in the building of the Palace of Versailles. These quarries also yielded asbestos which was used in the making of 'incombustible cloth' (Heron 1791, 124). In 1769 a bleachfield was set up to facilitate the manufacture of thread (Smith 2001, 780), and further ancillary trades included the presence of a rope works along the shore to the east of the town. With the construction of the harbour, fishing soon became an important industry in the town and towards the end of the eighteenth century there were around half a dozen fishing vessels, each with a crew of six men (Pennant 1774, 151) although it was also recorded that Portsoy was losing many of its young men to the naval service (Sinclair 1791–99, 50).

A new stone harbour was built in 1830 (Smith 2001, 780) and by the mid 19th century the fishing fleet comprised ten boats, each said to have a crew of around four. The larger of these boats were used for cod and herring fishing which was carried out at a greater distance out to sea. These would typically be rented from the owner for an annual fee and the owner would supply a new boat every seventh year. On average each man earned thirty pounds annually but occasionally a large catch of herring would increase this. Trade was also important in the 19th century and during the 1830s it was recorded that eight to ten boats a year would visit from the Baltic, taking away cargoes of herring and grain (NSA 1834–45, 190). However the trend for larger trading boats led to a decline in the use of Portsoy with its relatively small harbour. This was offset to some extent by the growth of smuggling in the late 18th and early 19th centuries which gave higher returns but carried greater risks. In 1859 the railway came to Portsoy with a siding which serviced the harbour (Smith 2001, 780) and by 1881, at the peak of the herring boom there were 50 herring boats operating from Portsoy and a population of 2000 (Smith 2001, 780).

Decline and revival: the fishing industry at Portsoy first began to decline after the opening of the spacious Cluny Harbour at Buckie in 1877 (Smith 2001, 780). By the 1930s the fishing industry in Portsoy had declined to such an extent that one author wrote, 'of all the ports on the south side of the Moray Firth, Portsoy strikes the visitor as being perhaps the most derelict' (Anson 1930, 188). Trade had also declined to such an extent by 1910 that the harbour siding was lifted and turned into a footpath and the railway was finally closed in 1968. Fishing in Portsoy had ceased altogether by 1955 and by 1971 the population was down to 1700. Fortunately recent years have seen a reversal of this trend and the town has revived greatly with the advent of tourism from the 1960s onwards (Smith 2001, 781). Portsoy is now established as the annual venue for a Festival of Traditional Wooden Boats.

THE MACDONALD FAMILY OF ENGINEERS

The MacDonald brothers, Alexander (1843–1916) and James (1848–1913), were born in Blackjug (Glassaugh) in the parish of Fordyce and learnt to work metals from their father who was a blacksmith (*Banffshire Reporter* January 26th 1916). In 1878 they came to Portsoy and first established their foundry at the junction of Seafield Street and South High Street. These premises appear to have become increasingly too cramped and in 1887 the business was moved a few hundred metres east to a much larger site on the shores of Loch Soy. After this date the business went from strength to strength, manufacturing a range of agricultural machinery and engineering products for the fishing industry. (Illus 22 and 23)

Illus 22

The staff of MacDonalds Engineers outside the entrance to site 2 beside Loch Soy around the turn of the century (image courtesy of Portsoy Library)

Alexander married Jane H. Valentine (*c.* 1862–1903) who owned the Station Hotel on Seafield Road, only a stone's throw away from the foundry. They had two sons, Hugh and Alexander Valentine, who both worked in the foundry and a third, Henry James, who died in infancy in 1903 at only six weeks of age. Alexander Valentine (1900–1970) would go on to manage the foundry alone when his brother Hugh left for America in 1923 (*Banffshire Reporter* January 26th 1916). In 1924 he married a local girl, Mary Ewing (1900–1973) from Cullen Street who was to become known as a keen local historian.

The impact that the MacDonalds had upon the growth and development of Portsoy appears to have been significant. Their foundry produced an eclectic range of products and they were important employers in a town the size of Portsoy, maintaining a staff of more than a dozen people (see Illus 21 and 22). The partners are said to have travelled extensively to promote their designs (*Banffshire Reporter* January 26th 1916) and also appear to have taken an active role in the local community. Alexander MacDonald Snr served on the Town Council for three years and was also a member of the Fordyce School Board and the Fordyce Parish Council. His obituary tells us that in his politics he was 'an ardent Liberal and steadily upheld that cause' (*Banffshire Reporter* January 26th 1916). The *Banffshire Reporter* also recorded a speech by James MacDonald made at a luncheon in 1902 where he remarked upon the poor state of the fishing industry in Portsoy at the time, which had one of its harbours and several of its fishermen's cottages lying unused. He called for fishermen to be invited to come to live in the town so that Portsoy might grow and expand to the same extent as that seen in neighbouring towns like Portknockie, Findochty and Portessie (*Banffshire Reporter* February 19th 1902). Alexander Valentine continued his father's tradition of taking an active interest in local politics and was involved in raising the funds and organising construction of an outdoor theatre and a swimming pool.

In 1968 the foundry closed and Alexander Valentine MacDonald, last of the MacDonald family engineers to run the company, passed away within two years (*Banffshire Journal* July 14th 1970).

Illus 23

The staff of MacDonalds Engineers outside the same entrance in 1921.
Back Row: William Murray, J. Wallace, John Barclay
Second Row: Alex Barron, pat Nicol, Freddy Wilson, Bob Gray, J. Hendry, Charles Ritchie, William J. Smith, A. Gunn
Front Row: Alex V. MacDonald, Elizabeth Barron, James MacDonald (Slater 1997, 34)

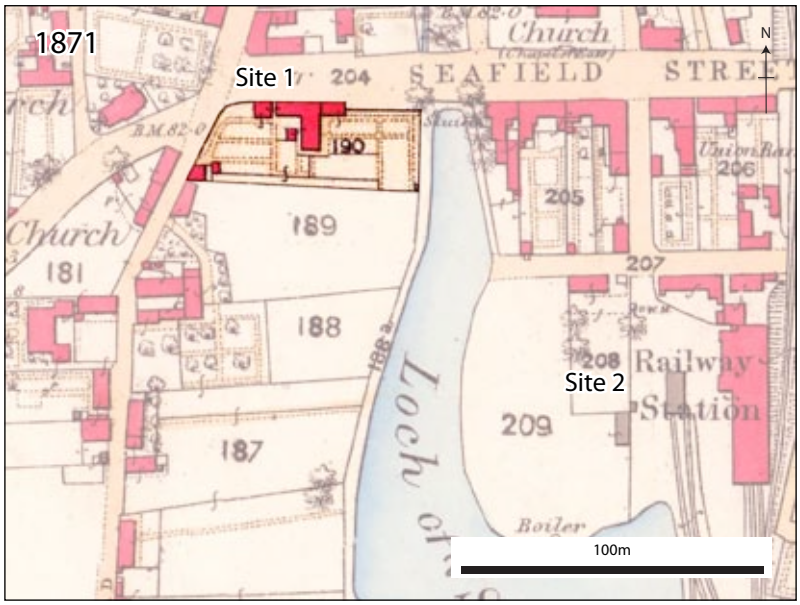
His obituary lists a formidable set of his interests and activities including bowling, shooting, football, gardening, ornithology, and also credits him with the construction of Portsoy's first radio set.

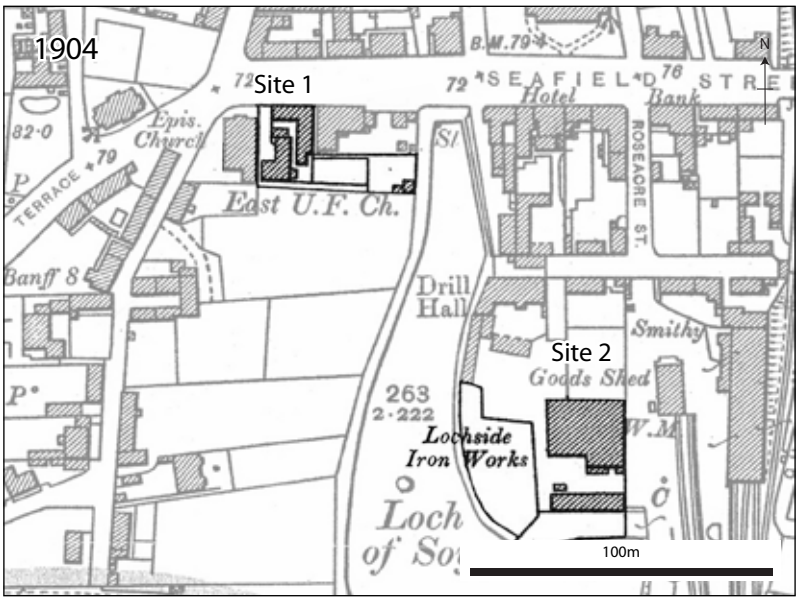
LOCATION OF THE MACDONALD BROTHERS WORKS

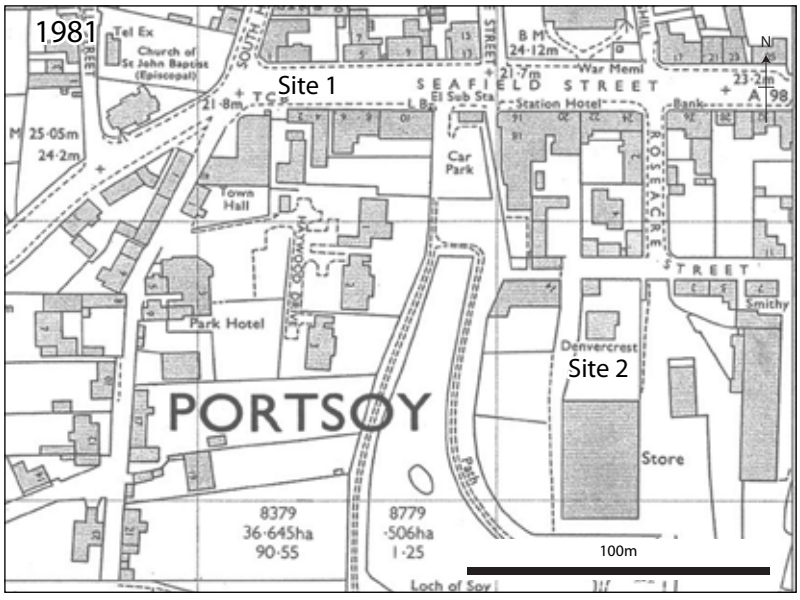
There are known to have been two sites for the MacDonald Brothers Foundry in Portsoy, although some reports mention a third unspecified location (*e.g. Banffshire Reporter* January 26th 1916). The desk-based assessment identified two sites occupied by the foundry. Subsequent field work confirmed that one of these is still in use as a bakery while the second comprises a potato warehouse superseding any upstanding remains relating to the foundry. (Illus 24)

Site 1 (occupied by the foundry 1878-1887)

For a period of 11 years after the foundry initially opened it was located on Seafield Road. Unfortunately the area was not mapped during their occupation of the site and we cannot be certain of the exact layout of the foundry at this point. What we do know is that there was significant development of the site between the date of the 1st edition of the Ordnance Survey in 1866 and the 2nd edition in 1902, by which time the single large plot was subdivided. This subdivision is likely to have occurred at the time the MacDonalds occupied the site. The foundry site is still occupied by a building, dated to 1830,







Illus 24

Ordnance Survey map progression showing the site of the two MacDonald's foundries located in Portsoy (Reproduced by permission of the Trustees of the National Library of Scotland)

which was originally two separate dwellings. The building is currently a two-storey, five-bay house and shop with a rear wing which is now in use as a bakery. Many of the original details survive and the house has been designated as a Category B Listed building. The bakery was originally two dwellings and retains two doorways. It has a granite frontage with alternate shop window-door-window-door-window on the ground floor, the panelled doors with letterbox and fanlights. It has three first floor windows and two later l9th century dormers in its slate roof. It is not known for certain how much of the present building was occupied by the foundry, but it is likely to have been all or most of the complex. To the south there is an area of open ground which probably formed part of the foundry and which has not been developed since 1902. An overgrown structure visible in this yard corresponds to a feature visible on the Ordnance Survey 2nd edition map and may have a possible link to the foundry. This former foundry site is now flanked by the town hall building to the west, itself a former church and by more modern shops to the east.

Illus 25

A 'Princess' reaper made by the MacDonald Brothers Foundry (©Highland Folk Museum. Licensor www.scran.ac.uk)

Site 2 (occupied 1887-1968)

In 1887 the foundry was moved to a shoreline location at Loch Soy, a small loch to the south of Portsoy town centre. The new location was reported as being of 'considerable dimensions' (*Banffshire Reporter* September 10th, 1887). Prior to occupation by the foundry the land had been owned by a local firm of marble workers who had the rights to the Loch Soy water (*Banffshire Journal* July 14th 1970). The Ordnance Survey 1st edition shows the ground here as mainly undeveloped although there is a large boiler in the southern part of the site, perhaps related to the marble works. This new site for the foundry was a more suitable location as it was directly adjacent to the railway yard and would surely have been more convenient for the shipping of materials and manufactured goods. The first map of Portsoy made after the foundry had moved to the new site shows a smithy was also operating in the same yard. This layout was to remain largely unchanged during the operational years of McDonald Bros. In 1968, the same year that the railway closed the foundry also shut its doors for the last time and Alexander Valentine MacDonald passed away shortly afterwards in 1970. The site of the foundry and part of the adjacent railway depot was subsequently cleared and by 1980 was occupied by Charles Gray, a local farmer and potato merchant who has built potato sheds which stand on the footprint of the foundry buildings.

MACDONALD BROTHERS INVENTIONS

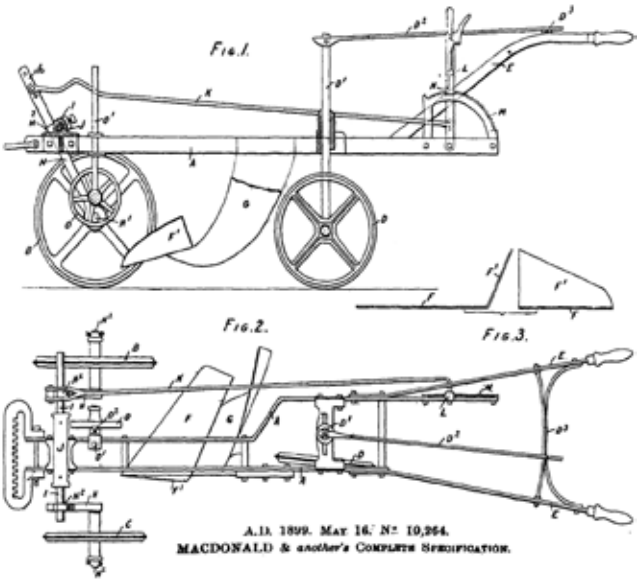
The MacDonald Brothers marketed themselves variously as electrical engineers, motor engineers, and agricultural implement makers. They also produced designs for steam capstans and line-haulers which had a considerable local market. A description of some of their products follows.

Agricultural designs

The MacDonald brothers were responsible for the design of numerous agricultural implements which were said to have been 'put on the market by the thousand' (*Banffshire Reporter* January 26th 1916).

Simplex and Princess reapers

Back delivery reapers, a single seater design with a chain-driven reel and a rake to keep the cutters clear of the cut corn, were popular in the NE of Scotland and MacDonalds designed two reapers, the *'Simplex'* and the *'Princess'* both of which appear to have sold well (Powell 1988, 24). These were used for cutting oats and barley and could be drawn by one or two horses. The driver sat in a seat behind a large 'ground wheel' which was turned as the horses moved forward and which in turn drove an apparatus which swept the crop towards a reciprocating cutter. This was a relatively simple design, well within the financial reach of small farmers, which made the task of reaping much easier. (Illus 25)



Illus 26

The design of MacDonalds 'Roadside Paring Machine' as it appeared in the patent application of 1899

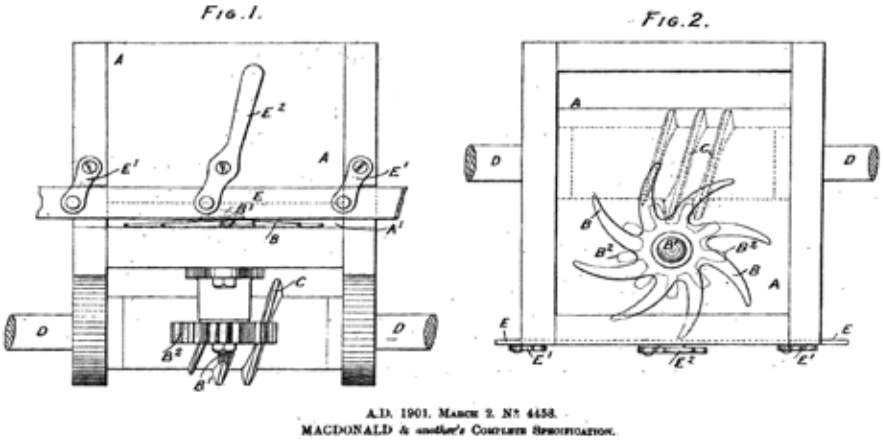
Road Paring machine

A trial of this device was reported in the *Banffshire Reporter* in April of 1900. It was reported that 'The work done by the machine was all that could be desired, and gave the District Committee, under whose auspices the trial was held, complete satisfaction. Two machines were ordered for the Huntly district. The opinion was freely expressed that this machine will be a great boon for dressing the side of public roads, which work at present 'is done by a tedious and expensive process of manual labour' (*Banffshire Reporter* April 25th 1900). (Illus 26)

Ideal Manure Distributor

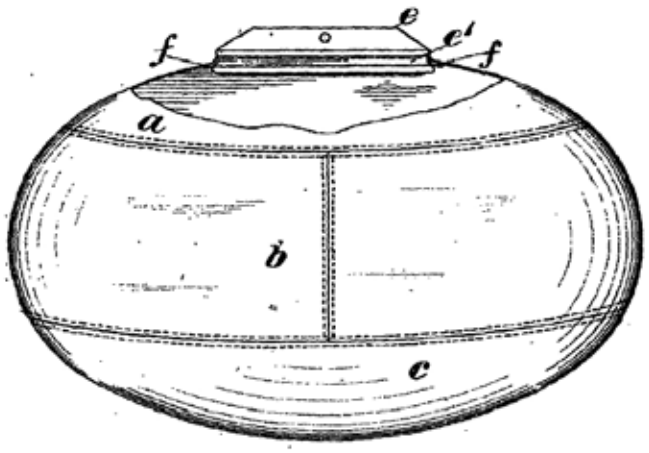
This device was designed to be carried on a cart or other vehicle. It employed a series of discs which were rotated by gears connected to the wheels of the vehicle.

As well as those patented devices listed above, the MacDonalds designed a variety of other agricultural implements including harrows, turnip lifters, turnip and mangel-wurzel cutters and steel hay rakes. However they are best remembered for the designs and inventions they created for use in the fishing industry, including buoys, capstans, line haulers and devices for propelling sailing vessels in light winds. (Illus 27)



Illus 27

The design of MacDonalds 'Ideal Manure Spreader' as it appeared in the patent application of 1901



Illus 28

An illustration of a canvas buoy, from the turn of the twentieth century

Maritime designs

Canvas buoys

The Portsoy Buoy Factory which is now occupied by the Portsoy Marble Workshop produced canvas buoys for use as line and net floats. Known locally as 'boughs', they were coated with Archangel tar (the same tar used at many sites to tar ropes). The factory employed a production line method for manufacturing boughs, using machinery supplied by the MacDonald Brothers and operated until the 1950s when the advent of plastic buoys wiped out the canvas bough industry. (Illus 28)

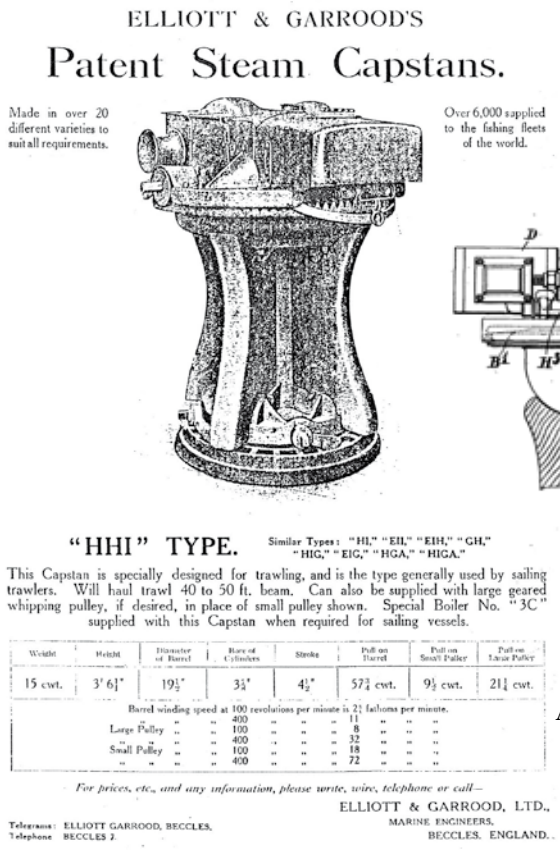
Steam Capstans

Prior to 1880 the only devices on board Scottish luggers to assist with hauling the herring nets or great-lines were man-powered winches and capstans, often dubbed the "Iron man". The first effective steam capstan for use on board fishing vessels was invented in 1884 by Elliott & Garrood, an engineering firm based in Beccles near Yarmouth. Steam from a boiler was fed through the centre of the hollow capstan spindle, leaving the warping drum free to rotate around the spindle (Cushing 1988, 87). The steam capstan could be used not only for hauling the messenger rope of the nets but also for lowering and raising the foremast and for the heavy work of setting and trimming the sails. (Illus 29 and 30)

The design of the McDonald's steam capstan differed from the more widely used Elliott & Garrood in a number of ways. First, it is of a somewhat heavier, more robust construction, less tightly designed than its East Anglian rival. It has a flywheel for each of its two cylinders whereas the Elliott & Garrood has a single flywheel shared by both cylinders. Perhaps its most significant feature is that by drawing a lever, the direction of rotation of the capstan barrel could be instantly reversed. This allowed a speedy and effective response to the occurrence of riding turns (when successive turns of rope foul and overlay those turns already on the capstan barrel). Using the reversing lever one man could deal with riding turns without the need to summon assistance from other crew members. This was said to be particularly useful in heavy weather (Slater 1997, 34). Testimonials from satisfied customers published by McDonalds mention the ease with which the capstan dealt with any task when at 40–50 pounds of pressure, the simplicity of adding handles and using it as a manual capstan and its fuel efficiency (Illus 31). Despite these attributes, the MacDonald Brothers capstan has the appearance of a roughly-assembled engine, constructed from readily available components: this feature is amply demonstrated by the observation that the cover over the capstan's engine could only be fitted following the buffing off of the outside corners of the steam cylinders. (Illus 31)

There is at least one known surviving (and operational) steam capstan made by the MacDonald Brothers. It is fitted to the *Reaper*, a 'Fifie' herring drifter built in 1901 (see Appendix 3). The *Reaper* has been preserved by the Scottish Fisheries Museum and is kept in sailing condition by the Scottish Fisheries Museum Boats Club; she operates as an important part of the museum's outreach to distant communities around the coasts. When not at sea she is usually berthed in Anstruther Harbour. (Illus 32–35)

The invention of the steam capstan, together with machine made cotton nets revolutionised the herring fishing industry. With the addition of the capstan, crews were able to work more and more nets, culminating in fleets of drift nets up to 1.5 miles in length, with a combined area of *c.* 40,000 square yards (Cushing 1988, 114–115). The printed testimonials from skippers which are to be found in MacDonald Brothers' advertising materials also provide interesting accounts of the value of the steam capstan in raising and lowering the foremast when at sea.


ELLIOTT & GARROOD'S

Patent Steam Capstans.

Made in over 20 different varieties to suit all requirements.

Over 6,000 supplied to the fishing fleets of the world.

"HHI" TYPE.

Similar Types: "HI," "EII," "EIH," "GH," "HIG," "EIG," "HGA," "HIGA."

This Capstan is specially designed for trawling, and is the type generally used by sailing trawlers. Will haul trawl 40 to 50 ft. beam. Can also be supplied with large geared whipping pulley, if desired, in place of small pulley shown. Special Boiler No. "3C" supplied with this Capstan when required for sailing vessels.

Weight	Height	Diameter of Barrel	Bore of Cylinders	Stroke	Pull on Barrel	Pull on Small Pulley	Pull on Large Pulley
15 cwt.	3' 6½"	19½"	3½"	4½"	57¾ cwt.	9½ cwt.	21¼ cwt.

Barrel winding speed at 100 revolutions per minute is 21 fathoms per minute.

	400	"	"	"	11	"	"	"
Large Pulley	"	"	100	"	"	8	"	"
" "	"	"	400	"	"	32	"	"
Small Pulley	"	"	100	"	"	18	"	"
" "	"	"	400	"	"	72	"	"

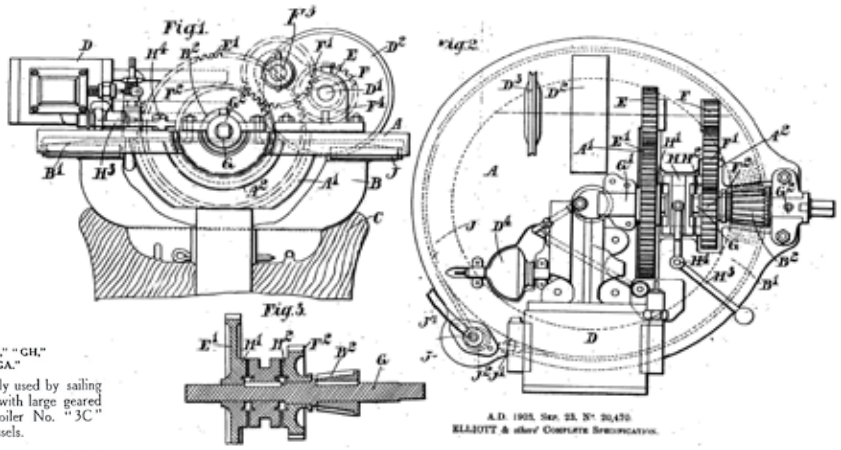
For prices, etc., and any information, please write, wire, telephone or call—

ELLIOTT & GARROOD, LTD.,
MARINE ENGINEERS,
BECCLES, ENGLAND.

Telegrams: ELLIOTT GARROOD, BECCLES.
Telephone BECCLES 2.

Illus 29

Advertisement for the Elliott and Garrood steam capstan

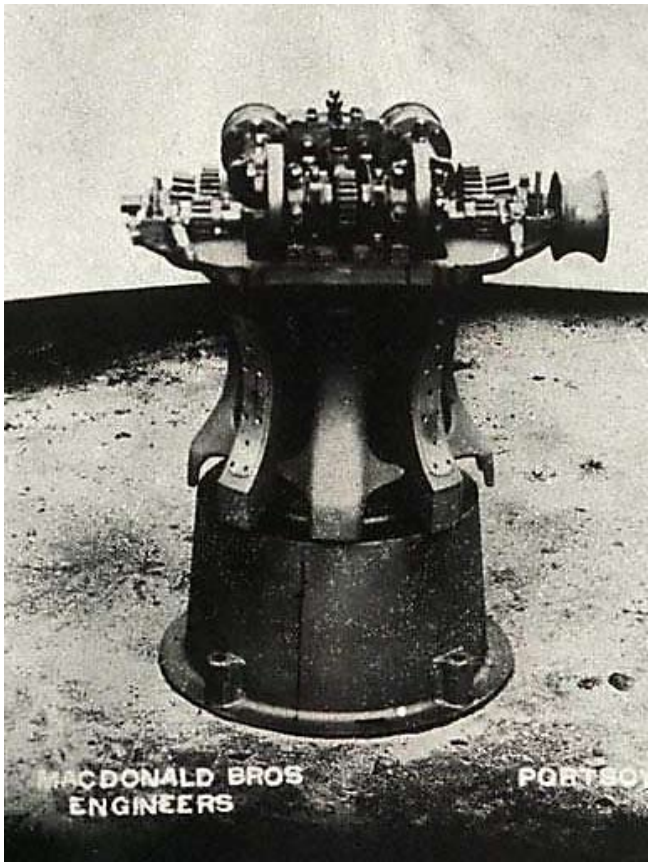


Illus 30

An 1898 patented design for a steam capstan by the firm of Elliott and Garrood

Patent Steam Line Haulers

Line hauling during the 19th century was an enormously difficult and sometimes dangerous task. Fishermen used 'great lines' for cod, ling and halibut and 'sma' lines' for haddock (Slater 1997, 34). Several men had to spend hours hauling great lines which could be up to two and a half miles in length. The lines were usually hauled on board with a manual winch, the "iron man". This device 'consisted of two V-grooved pulleys geared to a large wheel handle' which would be manually cranked. This "iron man" was eventually supplanted by a steam-powered line hauler, examples of which were produced by both Elliott & Garrood and the MacDonald Brothers foundry. The patent application for MacDonald's Steam Line Hauler claims that it 'is light and portable so that two men can easily place it in position for working and detach it and lay it aside when the lines are hauled on board' (patent 4404 Feb 27th 1908). The device consisted of two haulage sheaves on horizontal spindles. The sheaves were driven by a small single cylinder steam engine. The whole apparatus was mounted on a stud spindle in such a way that it could be shipped on the gunwale and swivelled around



Illus 31

Apparently the very first steam capstan designed by MacDonald Bros. (©Moray Council (Elgin Library). Licensor www.scran.ac.uk)

to achieve the best lead for the incoming lines. While in use a single operator would stand behind the machine to haul in the slack line. A MacDonalds Brothers' advertising bill from the 1950s suggests that this device is regarded as their most significant and successful product and also highlights just how long their basic design was in use, although there were variations in its configuration over the years. It is claimed that the line haulers designed by the MacDonald Brothers were used far beyond Scotland.

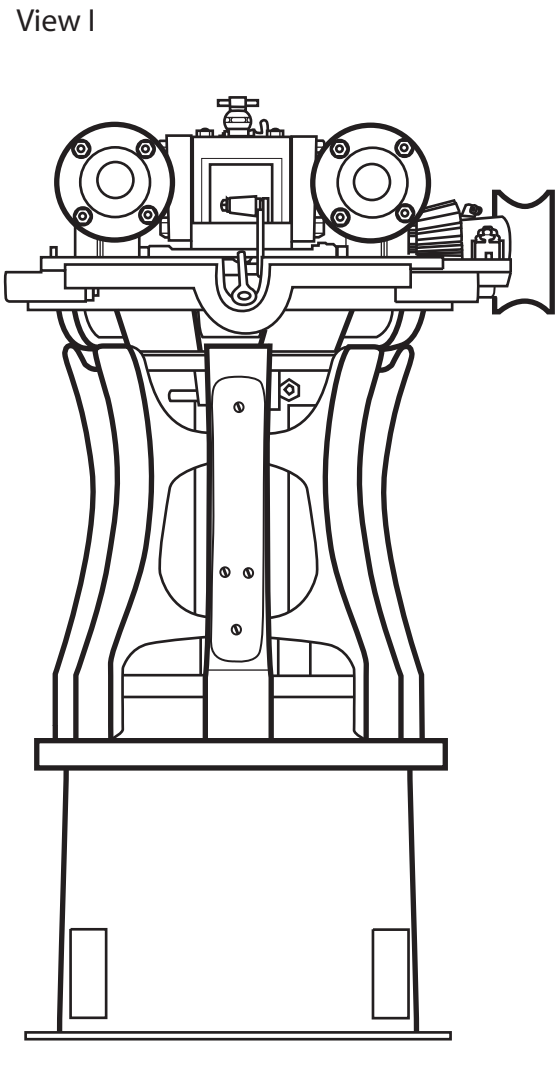
Illus 32

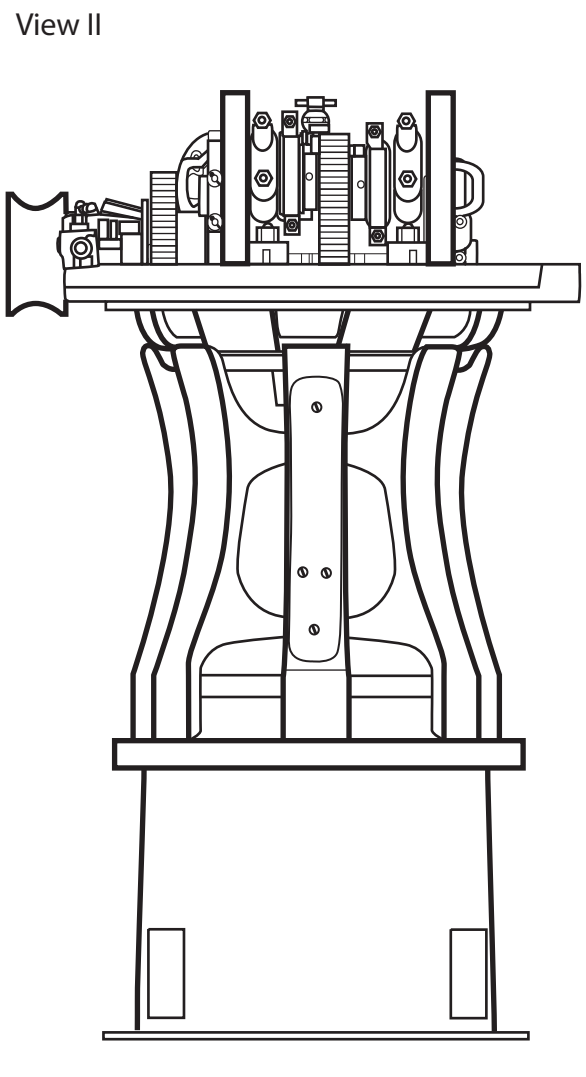
Although cruder in some respects than Elliott and Garrood's model, the MacDonalds' design was superior in other ways, in particular in its ability to reverse direction. This photograph of the top of the Reaper's capstan shows the complexity of their design

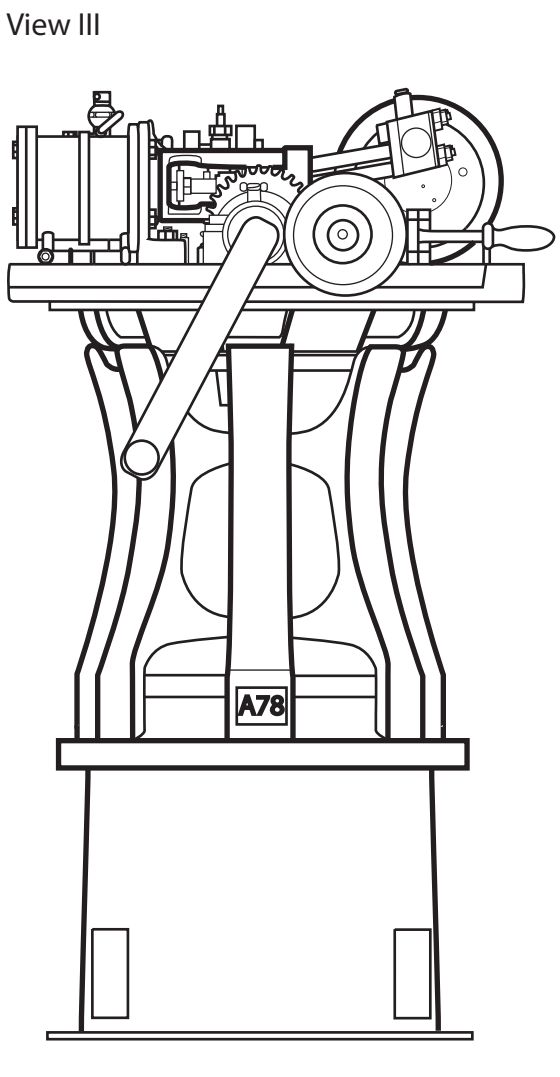
Auxiliary Steam Propulsion units for sailing drifters

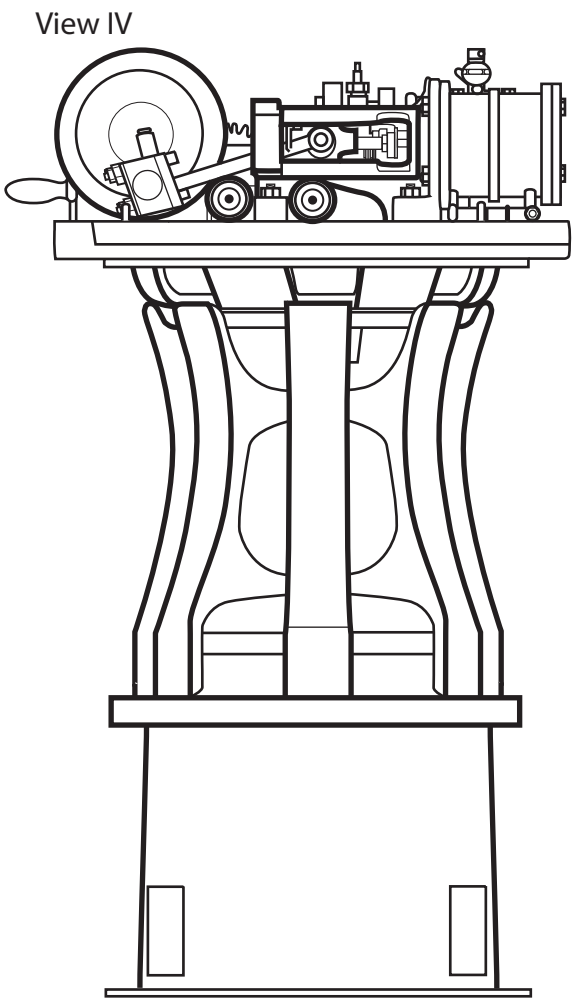
This pioneering invention by the MacDonald Brothers was an inspired response to the predicament of Scottish sailing fishermen faced with adverse wind conditions. The Scottish fishing fleet at the turn of the twentieth century was at a crossroads. The area fished by the fleet was rapidly expanding and the very use of sailing luggers seemed to be under threat as the first steam drifters came on to the scene. The first steam drifter was built in Leith in 1882 but it took until approximately 1897 for them to become popular (Cushing 1988, 87). A steam drifter was able to operate independently of the wind, getting out to sea and returning with a catch much faster than a sailing boat. Although the cost of building a steam drifter at around £3,000 was far greater than that for a sailing lugger which could be built for as little as £600–£800, this was offset by the fact that a much larger annual catch could be landed. Enormous profits were made by the operators of steam drifters in the early years of the 20th century with the Scottish fleet doubling in size between 1901 and 1904, the year of MacDonalds Brothers' steam propeller patent. These early years saw plentiful herring catches but because of the steam drifters' huge capital and operational costs in comparison to the sailing luggers, their operators and owners faced ruin if there was a poor year. This happened in 1908, and the investment in steam drifters left parts of Scotland's fishing fleet in 'an unparalleled state of indebtedness' (Bergius 1953).

The MacDonald Brothers may not have foreseen such a catastrophe when they designed their steam propulsion device but their customers must have been glad that they had opted for modifying their existing boats rather than splashing out on a steam drifter. The foundry designed a steam driven propulsion device which had a lowering propeller shaft emerging through the bottom of the boat when required. The design allowed for single or twin propellers to allow it to cater for larger boats and was capable of delivering a speed of around 3 to 6 knots. Thus it was now possible for a boat fitted with one of these devices to propel itself when there was no favourable wind. This could be of vital importance as a boat with a large haul of herring could get back to market in good time, whereas a boat becalmed or wind-bound risked a poor price at market for a catch which was perishing and perhaps only useful as fertiliser for the fields. When not in use the propellers could be drawn back into the boat to reduce drag. The first boats to be outfitted with the device were the *Nannie Raffan* of Portsoy, the *Cynosure* and the *Agnes Wood,* and it was reported that great interest was paid to the success of these boats by other fishermen who encountered them. It was possible to outfit a wooden vessel with MacDonalds Brothers' propulsion gear for around a third of the cost of a steam drifter although the top reported speed of 5 to 6 knots was a deal slower than the average speed of a steam drifter's 9 knots.









Illus 33
The *Reaper* Steam capstan as recorded during refurbishment in 2009

Ultimately it was the diesel engine which was to triumph over both sail and steam. Diesel engines did not require an engineer and stoker and could be operated by the fishermen themselves. An auxiliary diesel engine was first fitted to a Scottish sailing fishing vessel as early as 1901. By 1914 the number of steam drifters in Scotland had peaked and use of the diesel engine had begun to rise in earnest. There were some initial problems conveying power from a diesel engine to the capstans and other deck gear but this problem had been resolved by 1926. By 1952 motor vessels were catching 78% of Scotland's total herring haul (Bergius 1953).

The focus of work at the foundry changed over the early decades of the twentieth century as diesel powered boats began to displace the steam drifters and sailing boats. With a lessening demand for steam machinery at sea agricultural engineering became the mainstay of the foundry although occasional engine repairs on fishing vessels were still carried out (Slater 1997, 34). MacDonald Brothers finally closed down their premises in 1968, ending a ninety year history of sound, innovative engineering in Portsoy. Copies of the Elliott & Garrood and MacDonald Brothers patents are presented in Appendix 2.

Illus 34

The MacDonald Brothers steam capstan *in situ* on the deck of the *Reaper*

MACDONALD'S

NEW IMPROVED

Patent STEAM CAPSTAN

FOR

Fishing Boats.

WE have great pleasure in calling the attention of those interested in

FISHING BOATS

TO OUR

New Patent Steam Capstan,

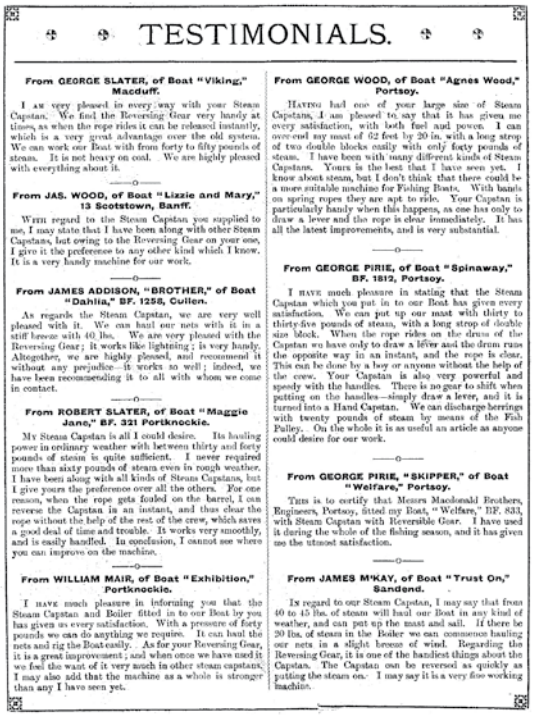
the Special Features of which are:—

1st.—It has Steel Gearing.
2nd.—The Shafts are Steel throughout.
3rd.—The Gear is Machine Cut.
4th.—It can be Reversed in an instant.
5th.—The Winding Drum can be Released from the Engine by shifting a Lever.
6th.—The Boiler is made of Steel Plates Seven-Sixteenths Thick, tested to Two Hundred Pounds Pressure per square inch, and Stamped accordingly.
7th.—The Boiler Mountings are all made of the very best Gun Metal, and are Highly Finished.
8th.—The Capstan can be Worked with Handles by Hand, and in this form it is very powerful.
9th.—No alteration has to be made for turning it into a Hand Capstan except to draw a Lever.
10th.—The Capstan can be used with or without Pauls, at pleasure.
11th.—The Bearings can all be adjusted to take up wear.
12th.—The Fish Pulley can be used independent of Capstan, by shifting a Lever.

PRICE AND PARTICULARS OF PURCHASE ON APPLICATION.

Annexed are a few TESTIMONIALS from Users of our Capstan.

MACDONALD BROTHERS,
Engineers, PORTSOY.



TESTIMONIALS.

From GEORGE SLATER, of Boat "Viking," Macduff.

I am very pleased in every way with your Steam Capstan. We find the Reversing Gear very handy at times, as when the rope rides it can be released instantly, which is a very great advantage over the old system. We can work our Boat with from forty to fifty pounds of steam. It is not heavy on coal. We are highly pleased with everything about it.

From JAS. WOOD, of Boat "Lizzie and Mary," 13 Scotstown, Banff.

With regard to the Steam Capstan you supplied to me, I may state that I have been along with other Steam Capstans, but owing to the Reversing Gear on your one, I give it the preference to any other kind which I know. It is a very handy machine for our work.

From JAMES ADDISON, "BROTHER," of Boat "Dahlia," BF. 1258, Cullen.

As regards the Steam Capstan, we are very well pleased with it. We can haul our nets with it in a stiff breeze with 40 lbs. We are very pleased with the Reversing Gear; it works like lightning; is very handy. Altogether, we are highly pleased, and recommend it without any prejudice—it works so well; indeed, we have been recommending it to all with whom we come in contact.

From ROBERT SLATER, of Boat "Maggie Jane," BF. 321 Portknockie.

My Steam Capstan is all I could desire. Its hauling power in ordinary weather with between thirty and forty pounds of steam is quite sufficient. I never required more than sixty pounds of steam even in rough weather. I have been along with all kinds of Steam Capstans, but I give yours the preference over all the others. For one reason, when the rope gets fouled on the barrel, I can reverse the Capstan in an instant, and thus clear the rope without the help of the rest of the crew, which saves a good deal of time and trouble. It works very smoothly, and is easily handled. In confusion, I cannot see where you can improve on the machine.

From WILLIAM MAIR, of Boat "Exhibition," Portknockie.

I have much pleasure in informing you that the Steam Capstan and Boiler fitted in to our Boat by you has given us every satisfaction. With a pressure of forty pounds we can do anything we require. It can haul the nets and rig the Boat easily. As for your Reversing Gear, it is a great improvement; and when once we have used it we feel the want of it very much in other steam capstans. I may also add that the machine as a whole is stronger than any I have seen yet.

From GEORGE WOOD, of Boat "Agnes Wood," Portsoy.

Having had one of your large size of Steam Capstans, I am pleased to say that it has given me every satisfaction, with both fuel and power. I can over-haul my mast of 52 feet by 20 in. with a long strop of two double blocks easily with only forty pounds of steam. I have been with many different kinds of Steam Capstans. Yours is the best that I have seen yet. I know about steam, but I don't think that there could be a more suitable machine for Fishing Boats. With hands on spring ropes they are apt to ride. Your Capstan is particularly handy when this happens, as one has only to draw a lever and the rope is clear immediately. It has all the latest improvements, and is very substantial.

From GEORGE PIRIE, of Boat "Spinaway," BF. 1812, Portsoy.

I have much pleasure in stating that the Steam Capstan which you put in to our Boat has given every satisfaction. We can put up our mast with thirty to thirty-five pounds of steam, with a long strop of double size block. When the rope rides on the drum of the Capstan we have only to draw a lever and the drum runs the opposite way in an instant, and the rope is clear. This can be done by a boy or anyone without the help of the crew. Your Capstan is also very powerful and speedy with the handles. There is no gear to shift when putting on the handles—simply draw a lever, and it is turned into a Hand Capstan. We can discharge herrings with twenty pounds of steam by means of the Fish Pulley. On the whole it is as useful an article as anyone could desire for our work.

From GEORGE PIRIE, "SKIPPER," of Boat "Welfare," Portsoy.

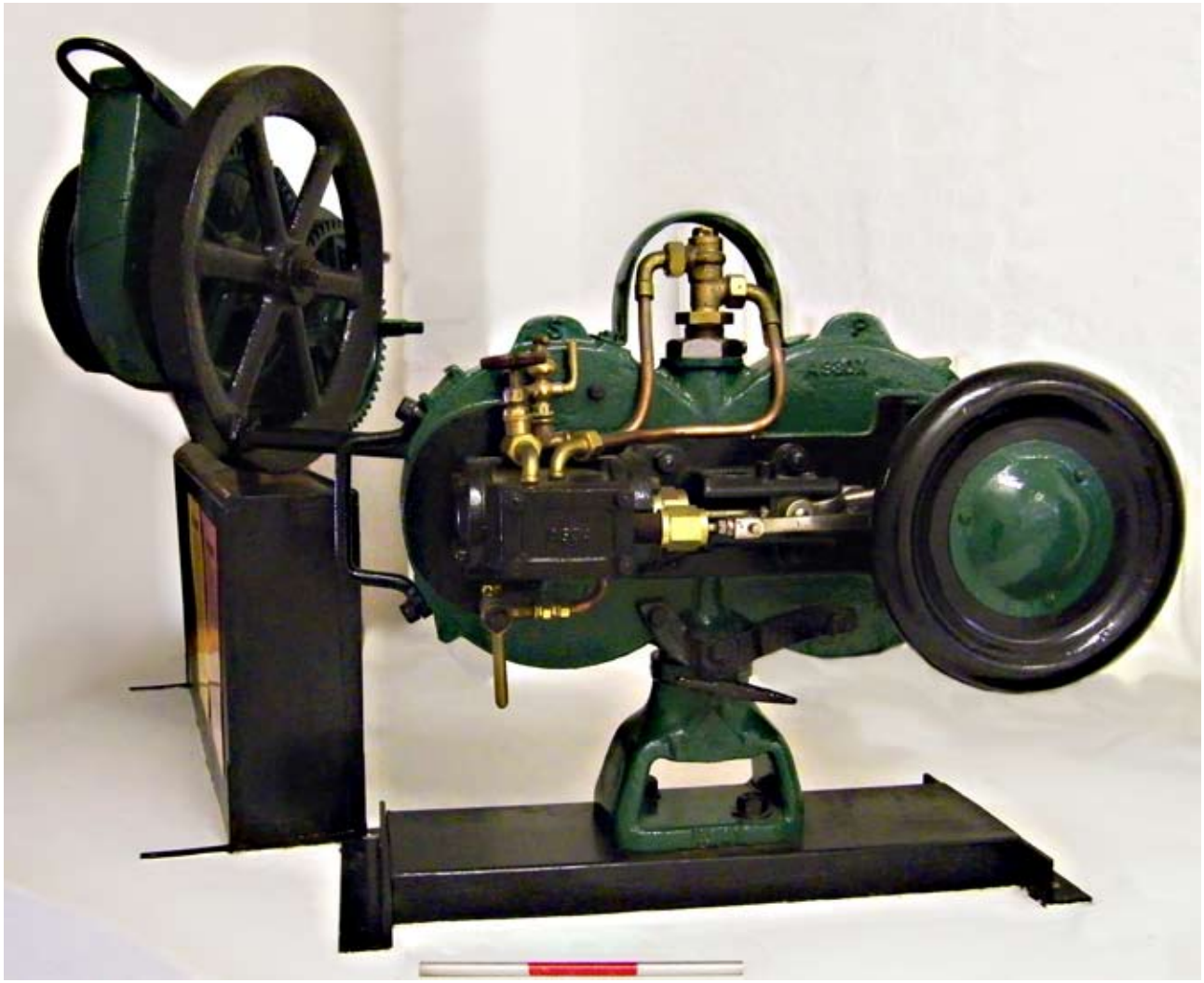
This is to certify that Messrs Macdonald Brothers, Engineers, Portsoy, fitted my Boat, "Welfare," BF. 833, with Steam Capstan with Reversible Gear. I have used it during the whole of the fishing season, and it has given me the utmost satisfaction.

From JAMES M'KAY, of Boat "Trust On," Sandend.

In regard to our Steam Capstan, I may say that from 40 to 45 lbs. of steam will haul our Boat in any kind of weather, and can put up the mast and sail. If there be 20 lbs. of steam in the Boiler we can commence hauling our nets in a slight breeze of wind. Regarding the Reversing Gear, it is one of the handiest things about the Capstan. The Capstan can be reversed as quickly as putting the steam on. I may say it is a very fine working machine.

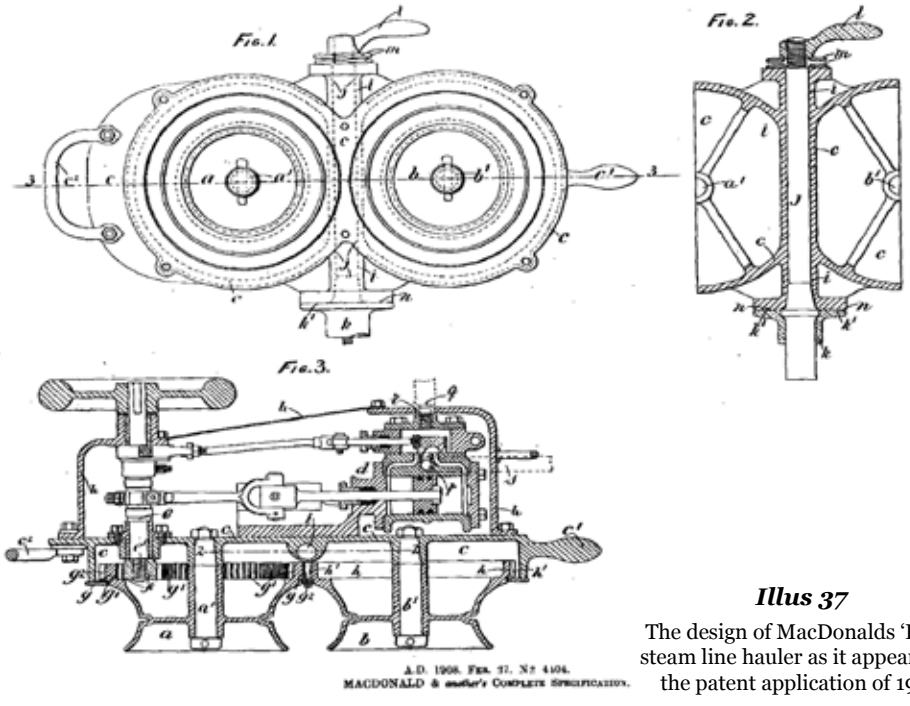
Illus 35

Advertisement and Testimonials relating to the MacDonald Brothers' steam capstan



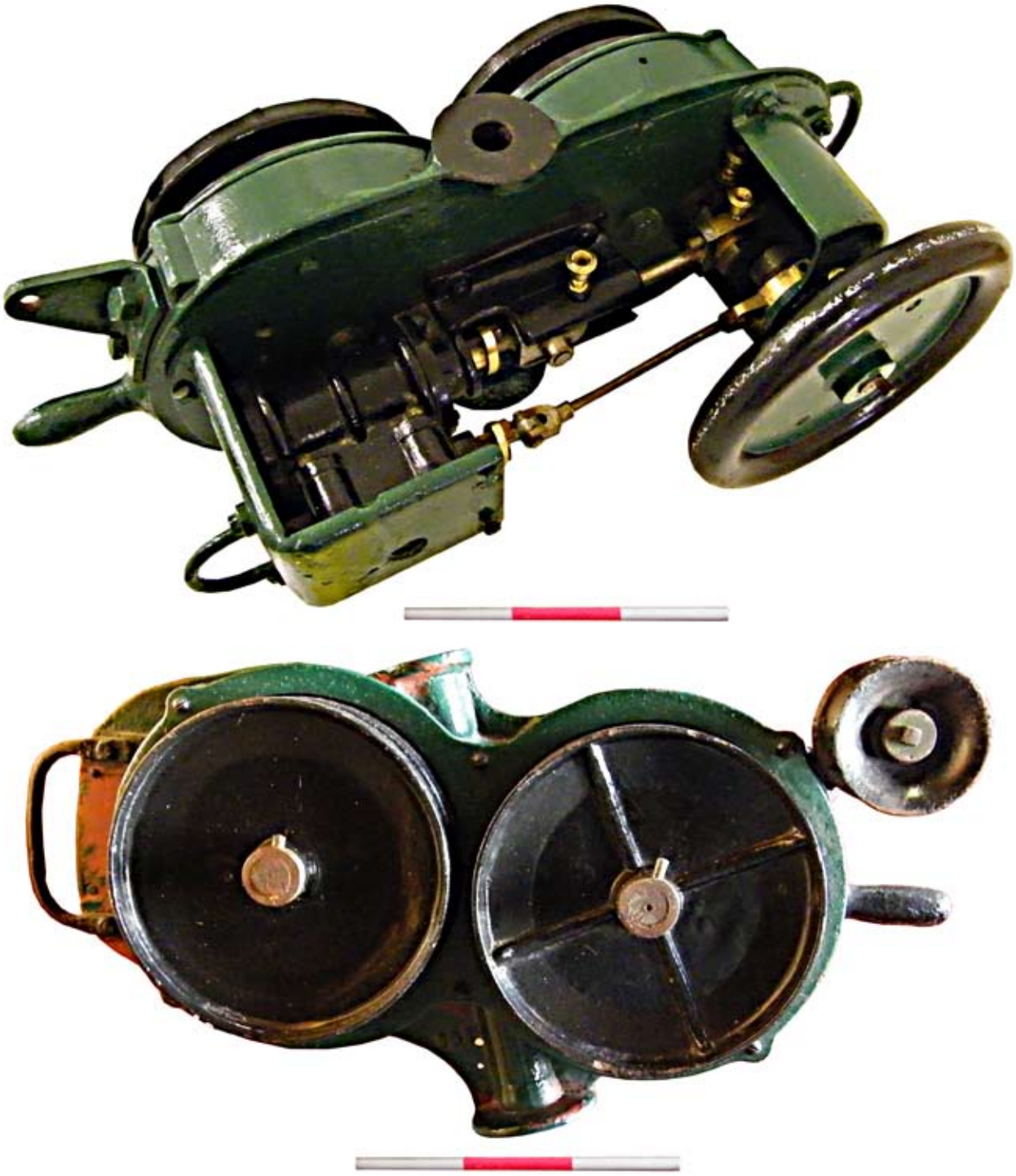
Illus 36

Examples of the hand operated line hauler (on the left) and an Elliott and Garrood steam line hauler housed in the permanent collections at the Scottish Fisheries Museum



Illus 37

The design of MacDonalds 'Ideal' steam line hauler as it appeared in the patent application of 1908



Illus 38

Two examples of the MacDonald's Brother's steam line hauler housed in the permanent collections at the Scottish Fisheries Museum. The top example represents that illustrated in the 1908 patent; the lower version is a slightly later design illustrated in the angled long axis of the mechanism and wheels in relation to the vertical component used to attach the hauler to the deck mounting (just above the scale)

Steam machinery at the Scottish Fisheries Museum

The Scottish Fisheries Museum collections include examples of both steam line-haulers and steam capstans. The dominant form of capstan throughout the United Kingdom was that provided by the East Anglian firm of Elliott & Garrood and the museum has an Elliott & Garrood capstan in the collection, which came to the museum as part of the equipment on board the Zulu herring drifter *Research*, LK62. There is also a second Elliott & Garrood capstan-engine, which was formerly used at Boddam to ease the lifting of wet nets during the process of barking the fishing nets.

Neither of the above engines is in working order but there is a fully operational steam capstan fitted on board the museum's Fifie herring drifter *Reaper* FR958 which is currently operated by means of a compressed air supply delivered from the boat's engine room. This capstan is a rare survivor from the MacDonald Brothers foundry in Portsoy. That this foundry managed to compete successfully against their much larger English rival, supplying capstans (and line haulers) within a local niche market along the shores of the Moray Firth, is a very special Scottish industrial story.

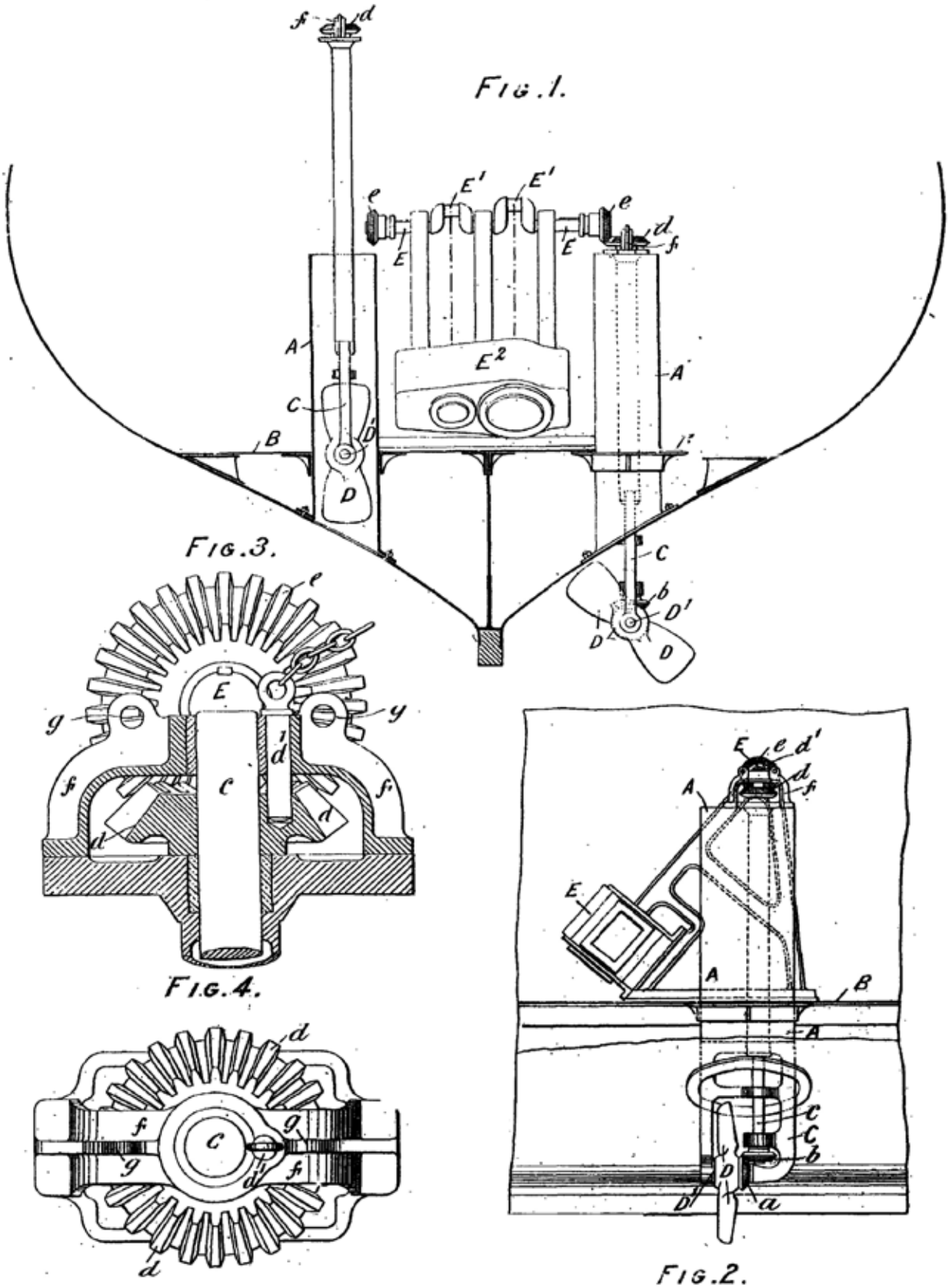
Illus 39
A MacDonald Brothers steam line hauler in operation (Scottish Fisheries Museum)

The SFM collections include four steam line-haulers, one by Elliott & Garrood and three by MacDonald Brothers, the latter comprising two different configurations of the basic machine. There is also a manually operated "Iron man" line-hauler in the collections. A list of these capstans, line-haulers and associated items is presented in Appendix 3.

DISCUSSION

The increased tonnage of the larger Fifies and Zulus meant that more nets could be carried and more fish could be brought to market. In the days of the "iron man" a boat's crew who found themselves with a good catch of herring would have to face hours of back-breaking work just to haul it aboard. The coming of steam power revolutionised this aspect of the fishing. The arrival of the steam capstan and line-hauler made possible the building of even larger vessels. Thus, even before steam power was applied to the propulsion of fishing vessels, the steam capstan improved the design of sailing vessels and extended their working life. Responding to these developments, a modest family-owned foundry located in a small burgh on the coast of Scotland was to achieve a surprising amount of success in designing and marketing steam capstans and line-haulers, against stiff competition from their larger rivals in Beccles, East Anglia. Although the foundry was a small enterprise which lasted for only two generations its significance to both the local community and to the story of Scotland's fishing should not be underestimated. The MacDonald Brothers, through hard work and sheer ingenuity, brought Portsoy to the forefront of their branch of Scottish engineering. It is a very special Scottish industrial story.

Ultimately it was technological advances far beyond Portsoy which were to bring the story to an end. The foundry was unable to compete with the mass production of the mid twentieth century. Only the larger engineering firms in urban locations managed to survive these changes by undergoing expansion, specialisation and automation. The era of the enterprising local engineer who could turn his hand to such a wide variety of engineering work is now a thing of the past.



Illus 40

The design of MacDonalds steam propulsion device as it appeared in the patent application of 1904 which also shows how it was to be mounted on a boat

Recommendations for future work

1. Check that all capstans, line-haulers, and associated parts and tools are properly accessioned and are included in the MODES database.

2. In view of the significance of the MacDonald Brothers design for an auxiliary screw propulsion system, consider commissioning the manufacture of a working model or full sized example, using the drawings from the Patent Application. This might be a project pursued jointly with the staff of the Salmon Bothy Museum in Portsoy, who at present have no original machinery from the foundry in their collection.

In that building, long and low,
With its windows all a-row,
Like the port-holes of a hulk,
Human spiders spin and spin,
Backward down their threads so thin
Dropping, each a hempen bulk.

At the end, an open door;
Squares of sunshine on the floor
Light the long and dusky lane;
And the whirring of a wheel,
Dull and drowsy, makes me feel
All its spokes are in my brain.

As the spinners to the end
Downward go and reascend,
Gleam the long threads in the sun;
While within this brain of mine
Cobwebs brighter and more fine
By the busy wheel are spun.

(Longfellow 1868, 272)

Chapter 4

The development of rope and sail manufacture in 19th century Montrose

The burgh of Montrose had a number of roperies and sail-lofts supporting the local ship-building yards in the 18th and 19th centuries.This part of the research focused on aspects of the evolution of rope-making and sail-making in Scotland, utilising a ropery and sail-loft in the Burgh of Montrose as a case study. The research comprised an initial desk-based assessment and a Level 1 (English Heritage 2006) historic building survey of the extant buildings, structures and archaeological features of the Montrose Rope & Sail Company, as well as the analysis of maps, documents and photographs, and the collection of oral testimony.

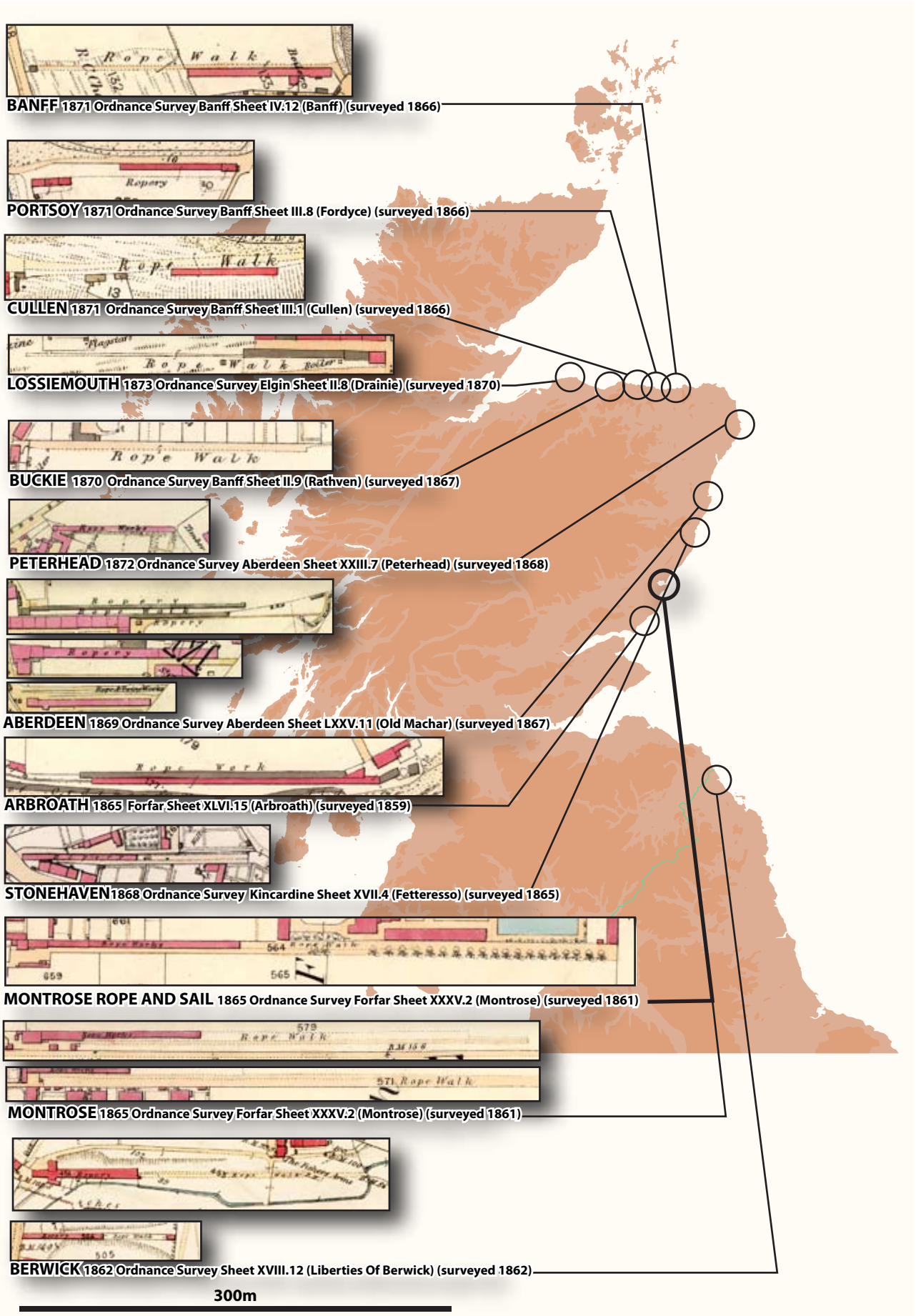
The desk-based assessment concluded that the majority of the surviving remains of the former Montrose Rope & Sail Works have been only slightly modified from their original condition, mostly to accommodate changes in products being produced on site. Historic building recording identified the north wall of the ropewalk as the site of the earliest phase of development on the site. The lower stone rubble section of this wall represents the first phase of construction. This original wall, and the other buildings and features associated with it, can be roughly assigned to four phases from the late 18th through the 20th century.

The research also highlights, using data from sail-makers' journals, the changes in sail-making practices during the 19th century, in particular, the change from flax canvas to cotton canvas and the introduction in the 1880s of wire bolt ropes on the foresails of fishing luggers.

THE MANUFACTURE OF ROPE

Rope is an ancient commodity with evidence of its use throughout recorded history. Perhaps the earliest depiction of its manufacture can be found on a tomb of the Fifth Dynasty at Thebes which shows a man and boy twisting ropes for a boat (Smiley 1951, 265). Historically rope has been manufactured from a variety of materials:

- Flax based cordage has been found on pre- modern human archaeological sites in Georgia and is native to Europe
- Hemp originated in Central Asia and was one of the earliest plants to be cultivated having a variety of uses including rope making
- Abaca is a relative of the banana native to the Philippines. Abaca fibres were known as Manila hemp although they are not the same species as true hemp
- Other natural fibres include sisal (found in the Americas) and jute (from India)

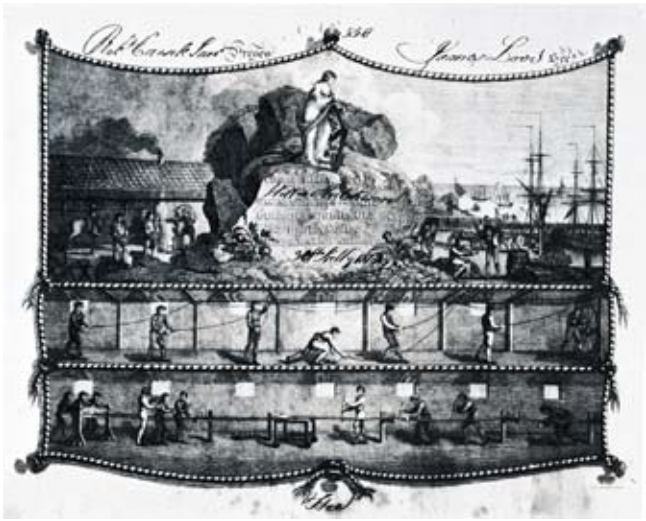


Illus 41

Map showing a selection of ropewalks located along the east coast between Lossiemouth and Berwick upon Tweed

- Man-made fibres such as Nylon first began to be used for rope in the 1930's.

In Europe from the medieval period onwards the manufacture of rope was carried out in 'ropewalks', long parcels of ground where the rope could be laid out straight and its component yarns and strands twisted together. There is little archaeological evidence for medieval ropewalks and it is possible that ropes were often made in open areas without associated structures. The rapidly expanding economy of Great Britain during the late eighteenth century and nineteenth century required a large increase in the number of ships to satisfy the demands of Empire-building, including vessels for the navy and for the merchant and slave trades. This led to a massive increase in demand for rope and this period saw the establishment of many ropeworks around Scotland and the rest of the UK. By this time specialised machinery had been developed along with buildings of a particular design which improved working conditions and sped up the process of rope manufacture considerably.



Illus 42

Membership certificate from 1813 of Gourock, Greenock and Port Glasgow Ropemaker Society. It shows a process of rope manufacture very similar to that which would have been carried on at Montrose Rope and Sail Works

Ropeworks are easily recognisable on historic maps due to their distinctive plans and are often located away from the centre of settlements on level ground near the coast where there would be sufficient room to lay them out and where they could be close to their supply lines and customers. Ropewalks have now fallen out of use, with the exception of that at Chatham Historic Dockyard which still operates commercially and also provides public access to the spinning and laying floors so that visitors may see the rope-makers at work. Although there are no active ropewalks in Scotland there are numerous indications of upstanding buildings, including those at Johnstone (NS46SW 33.07), Gourock in Glasgow (NS37SW 30 and 29) and at the recently (1970s) demolished Kirkcaldy, Forth and Clyde Ropery (NT29SE 47). There were dozens of other sites in Scotland which have long since vanished, with major centres at Aberdeen, Edinburgh and Glasgow among others (Illus 41). These long narrow buildings were essentially housing for the machinery and the work-force employed in rope-making. At its simplest, the built structure need not cover the entire length of the rope-walk, but merely provide protection from the weather for the machinery at the head of the roperie, making it hard to judge from cartographic evidence alone which ropewalks were the largest. Apart from simple shelter from the elements there were other advantages to having a building around a ropewalk. Ropewalk buildings were constructed in a uniform way with evenly spaced windows and had several useful features, such as hooks on ceiling beams over which a rope could be slung, beams projecting from the walls at regular intervals with pegs to keep the strands of rope separate and some ropewalks even had rails built into the floor so that a moveable trolley, known as a breast board or sledge, could move along the rails as it twisted the strands into rope. Illus 42, dating to 1813, shows a typical ropeworks of the 18th to 19th century with examples of many of the surviving features and machinery still visible at the Montrose Rope & Sail Works, including the tar house for tarring hemp rope.

The latter half of the 19th century saw a great deal of technological innovation in the area of rope manufacture. Ropewalks began to fall out of use as mechanised methods for rope manufacture were invented. Most notably, wire began to replace hemp for certain tasks at sea. Wire rope was invented in Germany in 1834 by Wilhelm Albert (Feyrer 2007, 1), initially for use in the mining industry. Its use soon spread to the United Kingdom. An experiment carried out in Liverpool in the mid-nineteenth century found it to be a quarter of the weight and less than half the girth of a hempen rope of similar strength (Sholto 1857, 154-5). By 1876, crucible steel began to be

used and further increased the strength of wire rope. Hempen rope began to fall out of favour, especially for larger ships (Murray 1916, 299). The weight of the hempen ropes required to handle large sails had limited the size of vessels up to this point in time and the improvements in strength, durability and stability of the new wire rope enabled larger ships to be built. Finally, during the twentieth century the introduction of synthetic materials such as nylon and polyester enabled the production of yet stronger lightweight and durable ropes.

CASE STUDY: MONTROSE ROPE AND SAIL WORKS

Montrose before the ropeworks

Montrose was given its Royal charter in the twelfth century. It occupies the southwest corner of a spit of land bounded by Montrose Basin to the west, the River Esk to the south and the North Sea to the east. By 1400 the town had grown into one of the hubs of the Scottish herring and cod fishery. In the mid-sixteenth century traders in Montrose had established links as far as the Baltic Sea. By the mid-seventeenth century, twelve trading ships were based in Montrose and the town's principal exports were salmon, grain and sheepskins. By 1789, the number of trading vessels in Montrose had increased to 53 small trading ships averaging 67 tons each. The cargo tonnage of ships in Montrose was to treble by the 1840s (Smith 2001, 666-7). For a period of more than 500 years fishing and trade had become central to the economy of the burgh and for many their livelihood was either directly or indirectly connected to the sea.

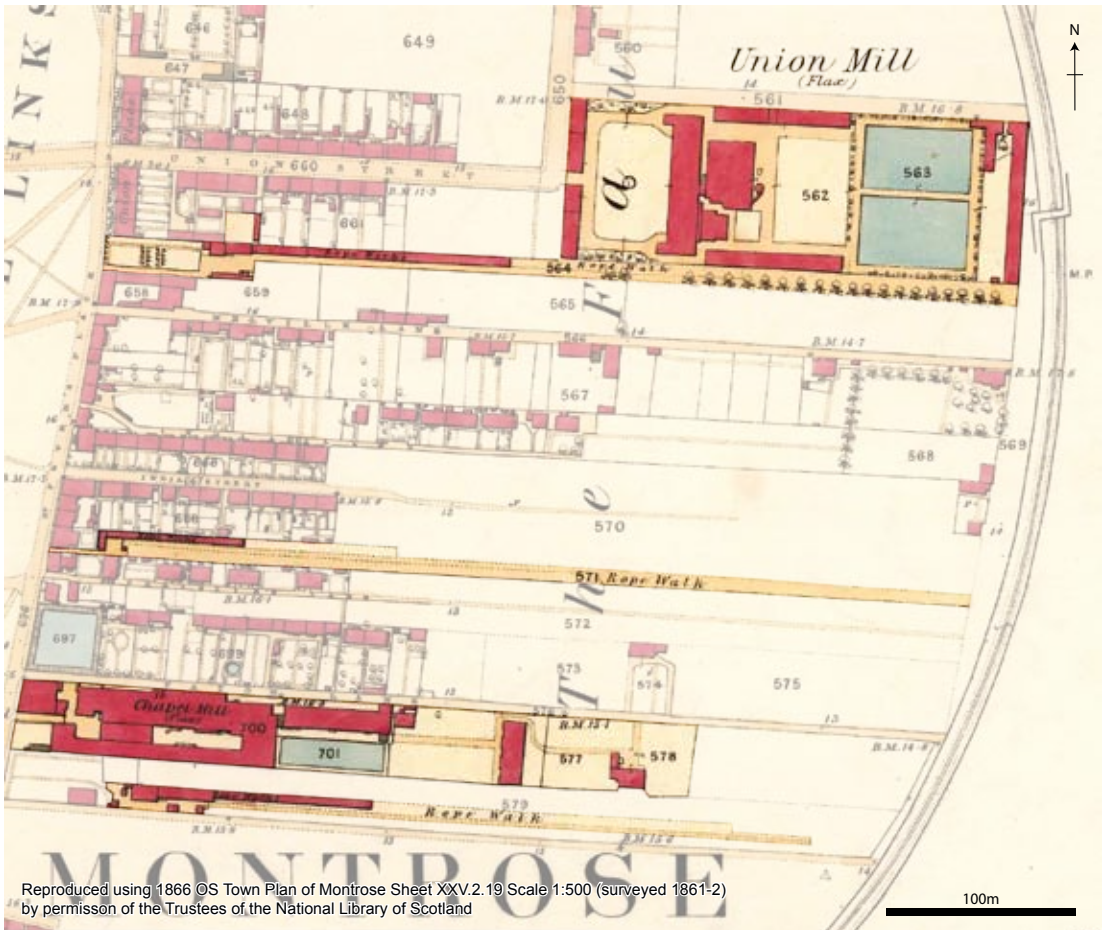
The earliest maps of Montrose show the area now occupied by the rope works in the *Faulds*, an agricultural area outside the historic core of the town located NE of the town centre, with few buildings apart from a chapel. The place name *Faulds* is the Scottish form of 'folds', defined as a place in the outfield of a farm where livestock were penned during the night (Salter 1971, 53).

Ships, linen, sailcloth and rope

A healthy industry of linen manufacture grew up in Montrose beginning around the 1720s and continuing into the eighteenth century with the establishment of a 30-loom factory producing sailcloth and coarse linens in 1754. The Bleaching Grounds visible on the 1794 Ainslie map had been laid out to serve this industry. The end of the American War of Independence five years later was to cut the demand for sailcloth and, although it remained one of the major industries, two companies moved into the manufacture of thread for export to London and Manchester. However, a boom in coastal trading c. 1800 allowed the boat building and repair industry to sustain itself over the following decades. By the end of the eighteenth century the Faulds was becoming the industrial heart of Montrose, with a tannery, a bleaching yard, a 'boiling house' (for the whaling fleet) , a lunatic asylum and the ropeworks itself located there (Ainslie 1794). These uses, particularly tanneries and the whale try works would have been regarded as dirty and unpleasant and were typically located at a distance from residential areas, suggesting that there was little settlement here in the eighteenth century.

In 1805, a flax spinning company was established in Montrose and by 1820 a four storey steam-powered flax mill had been built. By 1854 five such flax spinning mills were in operation in Montrose with around 2500 people employed in linen mills by 1867. Shipbuilding also became an important industry and there were three shipbuilding yards in operation by 1869 (Smith 2001, 667-8).

Between 1783 and 1810 a number of ropewalks are known to have been established in Montrose and in 1834, the total import of hemp to Montrose was over 43 tons (NSA 1834-45, 281). In 1837 three ropewalks are recorded as being in use (Adams 1993, 269). This pattern may reflect a period of consolidation and a decline in demand following the end of the European wars. Those rope-works remaining in operation appear to have been the Montrose Rope & Sail Company, Boyd and Company Ropeworks (established as a combined linen and ropeworks at the southern



Illus 43
Ropeworks and flax mills in the Faulds area of Montrose

end of the Faulds around 1822) and the Chapel Linen and Ropeworks (established at Eastern Road in 1795) (Smith 2001, 667). During a slump in business in 1874, Boyd and Co. Ropeworks was taken over by J. and G. Paton and added to their Chapel Works (Adams 1993, 269). The 1st edition Ordnance Survey Town Plan of Montrose of 1865 shows a total of three ropeworks in the town which appear to correspond to these three ropeworks. Of these, the Montrose Rope & Sail Company site appears to have been the largest. In addition, there are two large Flax Mills in operation which are likely to have supplied the ropeworks.

Illus 43 shows a map of Montrose in 1865 with the Union and Chapel flax works and three ropeworks in the Faulds area. It is thought that the Union Mill supplied materials to Montrose Rope & Sail while the Chapel Mill supplied materials to its own ropeworks and after 1874 to the former Boyd and Co Ropewalk. The original Chapel ropewalk was recorded in the 1970s as being single storey and seventy bays in length (RCAHMS NO75NW 84).

SITE DESCRIPTION

The former Montrose Rope & Sail works is located NE of the centre of Montrose in the centre of the block bounded by Eastern Road to the west, Union Street to the north, Faulds Road to the east and Bent's Road to the south. The site runs E-W, parallel to Union Street and Bent's Road, its present eastern extent stopping just short of the junction of Union Street and Union Row.

The site is flat and is surrounded by residential development fronting on the surrounding streets. It is irregular in shape with a rectangular yard containing several buildings to the west and an adjoining long narrow parcel of land to the east which is the site of the ropewalk. Access to

Illus 44

Detail of 1960s map showing the site as it is now (1966 Ordnance Survey 7157 and 7257 1:25,000 surveyed 1964)

the site is at its west end, from a drive turning off the north side of Bent's Road between two residential properties, leading to an area approximately 23m north to south and 37m west to east. There is a second access, also between residential properties, off Union Street. This access leads to a connected parcel measuring 18m west to east and 23m north to south that backs up against the main block of ropeworks buildings on the 'L' shaped parcel. The entire site, encompassing both of these parcels, is currently occupied by five standing buildings, as well as by a tar house (latterly a barking boiler) and a 'Hatchelling House' and the boiler situated along the south property boundary. The main block of buildings comprises three attached units. The two western units are both two-storey buildings. Attached to their east is the long, single-storey ropewalk. The final building on site is a store in the rear yard to the north of the main block. The main block of buildings is centred on National Grid Reference (NGR) NO 7190 5798 and the ropewalk runs across to NO 7205 5797. (Illus 44)

Development of the Montrose Ropeworks

Documentary and Cartographic

Much of what we know about the history of the rope and sail loft at Montrose comes from an unpublished manuscript written in the 1970s by Mary Chalmers, entitled *A History of Montrose Rope and Sail Company*. As mentioned above, the ropeworks were built at the end of the eighteenth century around the same time as several other industrial ventures in the *Faulds* area of town. A coin discovered within the fabric of the original walls of the ropewalk was found to have a date of 1789, thus providing an approximate date for the earliest phase of development. Ainslie's map of Montrose from 1794 shows a 'threadworks' to the immediate east of the town in the approximate location of the later ropeworks. A title deed dating to 1802 describes a ropewalk with an area of 'two roods, twenty six falls, five ells'. At this point the ropewalk, along with a dwelling house, a warehouse and 'other conveniences for carrying on the business of rope making', was co-owned by three merchants based in Montrose. An early map post-dating the construction of the ropewalk (Wood 1822) shows the ropewalk in a largely open area of subdivided rectangular plots with small dwellings scattered irregularly along their edges and it may be that the layout of the ropeworks was the starting point for the street layout in this area. The ownership of each building on this map is marked, with the ropeworks having belonged to 'Kinnear and Faddie' at this time.

The 1st Edition Ordnance Survey map (surveyed 1861-2 and published 1865) clearly shows the buildings on the ropeworks site in their present layout, labelled 'Rope Works', with the exception of a structure built up against the north wall of the main block of buildings and another along the eastern boundary in the yard to their north side which have since been demolished. An uncovered ropewalk is demarcated on the map. It starts at the east end of the enclosed ropewalk and doubles its length. The ground between the ropewalk complex and St. Peter's

Place (now called Eastern Road), is landscaped, with a drive along its south side leading to the buildings. Residential development is starting to spread eastward along the plots to the north of the ropeworks along Union Street and a large flax milling complex is sited at the east end of Union Street on the parcel adjacent to the open section of ropewalk.

By the time the survey was revised for the 2nd Edition Ordnance Survey map in 1901-2 (published in 1903), the St. Peter's Place parcel and a smaller one to its east had been split from the rest of the ropeworks site and the access moved to its present position off Melville Lane (now called Bent's Road). The map shows four additional buildings, not included in the 1861-2 survey, on the site: a building sited north to south along the east side of the access off Melville Lane; a building built up against the north wall of the westernmost section of rope walk/sail loft, in a different location than that shown on the 1st edition map; a ropewalk built parallel to the existing one along its southern wall and a small rectangular building accessed from the eastern end of the site. The 2nd edition map does not show an uncovered extension to the northern ropewalk, although it does indicate that the easternmost section of the southern ropewalk may have been open on its north side. The map also shows a building to the rear of the two St. Peter's Place parcels that is built up against the west wall of the main block of buildings. The uses and buildings on the plots immediately north of the ropeworks appear not to have changed from those shown on the 1st Edition map.

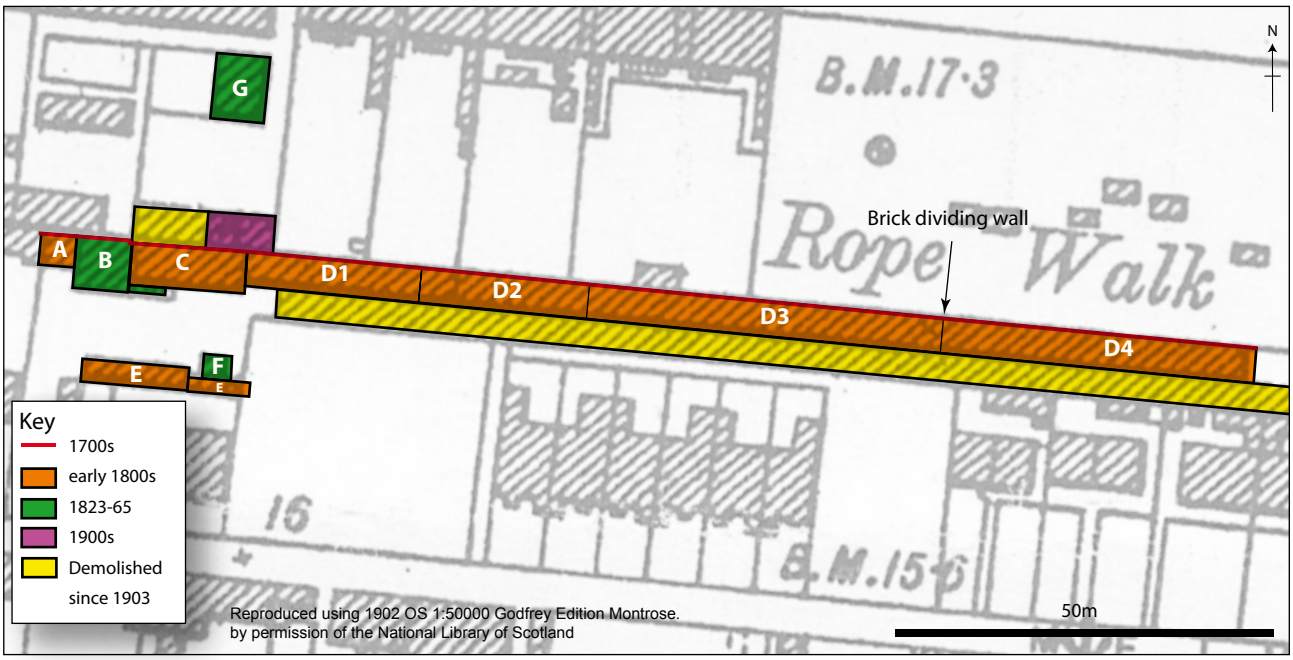
Further documentary evidence shows that the ropewalk changed hands several times during the 19th century and was eventually bought by James Paton in partnership with three other men (Chalmers 1970, 1). It has remained in the ownership of the Paton family up to the present day. The Paton name had long been associated with industry in Montrose, with members of the family having operated linen mills and threadworks in the town around the 1820s (Adams 1993, 269). In 1906 part of the land was sold to John Ford, who built a terrace of houses and a hotel (now known as Marine House) adjacent to the ropewalk (Chalmers 1970, 1). Although they didn't manufacture sail cloth, the Montrose Rope & Sail Works purchased it from Richards and Company, a large flax spinning firm operating in Montrose that had another branch in Aberdeen, and processed it into finished sails (Chalmers 1970, 5).

The ropewalk presently occupies a long narrow stretch of ground running east to west. Most maps show the northern ropewalk as roofed for approximately half its length (i.e. the western half). The Ordnance Survey map from 1903 shows two ropewalks and appears to show that the entire length of both the northern and southern walks were roofed; however by publication of the 1924 Ordnance Survey, the southern walk is once again unroofed. Also in 1924, the eastern end of the ropewalk property appears to have been redeveloped with the Betts Hotel (later Marine Hotel). This corresponds with the area of the property sold to Ford in 1906. A major fire broke out at the ropeworks on August 16th 1936 which caused £2,000 worth of damage to the plant and stock and £1,000 damage to the buildings (The Scotsman August 17th 1936).

During the 1970s the Montrose Rope and Sail Company was still flourishing and manufactured rope, nets and sails as well as repairing nets, sails and agricultural harvesting equipment (Illsley 1977, 483-4). The company is still in operation in a recently constructed, purpose-built facility on the industrial estate adjacent to the old airfield at the north end of the Burgh.

Buildings and other features

The dwelling house, warehouse and associated structures described in the 1802 title deed have been largely or completely removed although parts of them may have been incorporated into the fabric of the buildings presently on the site. The only surviving part of the original set of buildings is the spinning shed or ropewalk, which measures around 150 metres with a north wall of Scurdyness rock and red sandstone and a south wall of brick (Chalmers 1970, 3, and Historic Building Register entry 38182). Much of this has been covered externally with cement dry-dash. The different fabric of the north and south walls together with the irregular spacing of the windows and presence of blocked openings suggests that this building has undergone extensive alterations over the years. The pitched, timber frame roof is currently covered with Scots slates



Illus 45

A phase plan of the upstanding buildings at Montrose Rope and Sail Works with labels for each of the upstanding buildings. Some buildings visible on the 1902 background map have since been demolished including a second area of roofing along the ropewalk itself

over the western part and corrugated iron sheeting on its eastern extent; however, according to Chalmers, it was originally covered by red tiles (Chalmers 1970, 3). The floor of the ropewalk is made of tar barrel staves laid directly onto bare earth and survives very poorly towards the eastern limit of the structure.

Brief descriptions and thumbnail photographs of each building and feature are included in a Gazetteer in Appendix 4. This section comprises a Site Index and an interpretive summary, based on the evidence in the Gazetteer. In both the Gazetteer and this Site Index, the buildings are labelled alphabetically. As the main block of buildings are all joined to form a continuous run, each section has been labelled A-E from west to east to aid the reader in identifying the sections of the building under discussion below. Site features are labelled numerically 1–40. Site artefacts are labelled alphanumerically (A1–A3). A labelled site plan is included as Illus 45.

A (westernmost block)

A piend-roofed two-storey building currently attached to the rope shed to its east (building B). The façade is set back from the façade of the adjacent rope shed and has a window and timber door at the ground floor and a window at the first floor. There is a window at the first floor in the west wall of the building. Any openings at the ground floor on this side were obscured from view by the site boundary wall. The windows are all timber-framed in two parts with four panes each. The south and west walls of the building are finished in dry-dash. The north wall of the building is constructed of brick. The roof is finished in slate.

The ground floor of this building was most recently used as a store (this part of the building was not accessible during the site visit). The first floor of the building served as an office and has a moulded cornice running around the perimeter of the ceiling.

B (Rope shed/store-house)

This building comprises a gable-roofed two-storey rectangular building with stone skews and a capped chimney at its west end. Three bays at ground floor level with central timber double door

Illus 46
South elevation of building B and the adjoining building C and exterior access steps

Illus 47
South elevation of building B, C and D (from left to right)

and flanking timber windows were also noted. Two paired sets of windows were recorded on the first floor. The roof is finished in slate. An entrance to the first floor is in the return of the east wall and is accessed by a stair built against the front of the adjacent building (building C). (Illus 46)

The west, south and east walls are finished in dry-dash. The north wall of the building is brick at the first floor and masonry at the ground floor. There are no openings in this wall, although there is at least one obvious straight joint in the brickwork. There is a row of bricks laid on end with a row of holes for joists just above the masonry section of the wall, possibly related to structures shown built up against this wall on the 1st and 2nd Edition Ordnance Survey maps.

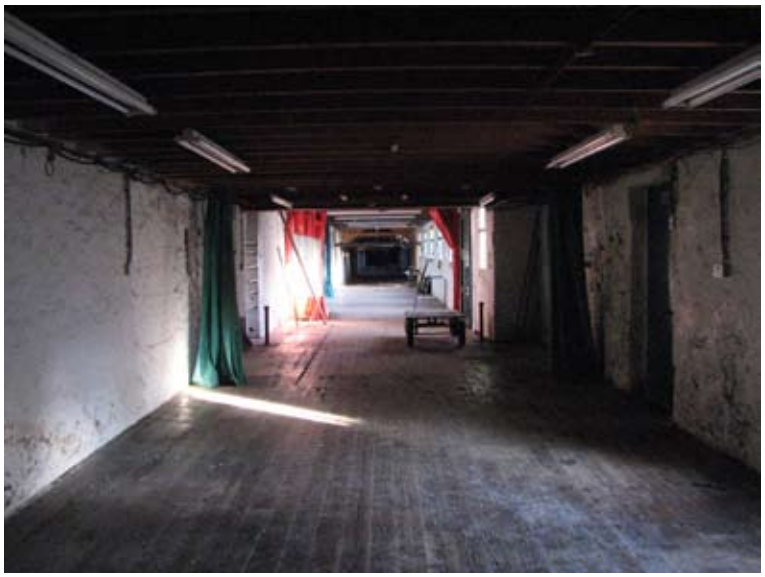
The ground floor of the rope shed was most recently in use as storage and a reception area. The first floor is open work space, with a work bench built against the north wall. It is connected to the office in building A by a door. The office floor in building A is a step down from the first floor level in building B.

C (Ropewalk/Sail loft)

This two-storey section of the building is gable-roofed and rectangular. There are two windows and a door at the ground floor (one of the windows is square and the other rectangular) and six bays at the first floor clearly defined by larger, rectangular windows. The front wall is masonry built and finished in dry-dash. (Illus 47)

The exterior of the north wall is also finished in dry-dash. The north wall has five openings at the first floor and the western 5 bays are of masonry construction. The easternmost, sixth bay is built of brick, as is the east end wall. The east end wall is supported by a steel girder at ceiling level at the ground floor. At one point, there was

Illus 48
The first floor 'sail loft' in building C



Illus 49
The ground floor of building C (original western extent of the ropewalk)

a partition wall under this steel beam. To access the ropewalk under cover, workers had to go through the door opening in the north wall west of this dividing wall into a lean-to and from the lean-to back into the ropewalk through another door opening just east of the beam (now a press).

The flat-roofed lean-to is built up against the north wall of building C for most of the ground floor. It extends over the exterior wall of the adjacent building D (the ropewalk) to the east. The side walls are in brick and the rear (north) wall is built of concrete block. A timber double-door in the north wall provides access to the yard behind the main block of buildings. The lean-to houses storage space, as well as a kitchenette and staff toilets.

Although the exterior appearance of the ground floor is obscured somewhat by this lean-to addition, it is clear from the interior of the building that the ropewalk initially extended to the west wall of C. Exterior evidence at the north wall of B suggests that the ropewalk may have extended as far as its western wall.

The ground floor in building C has a built-up wood plank floor that is level with that in the ground floor of B. The two structures are connected by a door opening through the east wall of B/west wall of C. The first floor of building C is also an open work space with a wood plank floor level with that in the first floor of building B. This space was most recently used for canvas sewing and is referred to by a local informant as the 'sail loft'. (Illus 48–49)

D (Ropewalk)

The section of ropewalk east of that incorporated into the ground floors of buildings B and C, here referred to as building D, is a single-storey gable-roofed structure, approximately 150 metres in length, with a rubble masonry north wall and a brick south wall. Both walls have regularly spaced window openings, although they don't align exactly from north to south across the interior space. The easternmost section of building D (D4), approximately 84 metres long, is blocked off by a brick wall running north to south on the interior of the structure.

Pennies with a 1789 date imprint were found pressed into the mortar in the north wall of the ropewalk. There are two changes in the roof structure of the ropewalk that are more readily visible on the interior of the structure, one approximately 46 metres to the west of this interior brick dividing wall and another approximately 70 metres to the west of it. The roof over these areas is finished in Scots slate laid over wood sarking boards from building C to just west of a blocked opening in the north wall (D1) and in Scots slate laid over corrugated sheeting from that point to the east (D2). The next section of roof is finished in Welsh slate laid over corrugated sheeting (D3). The blocked off eastern length of the ropewalk is roofed in corrugated sheeting, but not finished in slate, at least in areas where the roofing material is not hidden by vegetative growth (D4).

The wood plank flooring at the ground floor of building C extends into the western part of the rope walk and terminates at the first change in the roof (D1). There is a straight joint in the south wall of the rope walk approximately one metre east of this change in the roof where its construction changes from machine-made brick to hand-made brick. There is a straight joint in the north wall of the building approximately 18.25 metres west of the interior brick dividing wall.

Illus 50
View of the ropewalk (D) looking east. Note the re-used barrel stave floor and upright posts

The wall construction of the lower sections of wall on either side of the joint appears similar and may suggest enclosure of a formerly open section of ropewalk.

The floor level at the west end of the ropewalk (even within the section of south wall built of machine-made brick) used to be earth, indeed it seems that the building originally had an earth floor throughout its length. The floor level in buildings C and the western part of building D (D1) was raised and floored at some point (1960-70s) when this area was used for wire rope work, including wire-splicing. There were vices and press machines for wire splices located in this area. The floor of the most easterly part of building D has been consolidated by the regular deposition of re-used tar barrel staves. At regular intervals along the north wall of the ropewalk, a series of eight sections of whale jaw-bones are set into the wall to provide stands, to keep the yarns and strands off the floor, where they might pick up grit and dust, during the spinning and laying up of ropes (see Gazetteer feature 35 *et seq.*). Hooks in the roof joists were also used to lay the rope strands to avoid entanglement – also noted during the site visit. Also of particular note was the presence of timber posts set into the ropewalk floor which appear to be re-used sections of deck beam ends from a ship. (Illus 50–54)

E (Hatchelling House)

The building known as the Hatchelling House (James Paton, pers. comm.) is a single storey gable-roofed structure oriented west to east along the south property line, built up against the boundary wall. It has a taking-in door in the gable end of the west wall. There in an entry into the ground floor at the north side of the building. It is finished in dry-dash matching that on buildings A-D and has a slate roof. It first appears on the 1865 Ordnance Survey map.

Illus 51 (left)

Example of a whalebone upright set into the north wall of the ropewalk (D). Note the socket for inserting the wooden bar

Illus 52 (right)

A whalebone upright built into the north wall of D. A horizontal wooden bar projects from a slot in the upper part with vertical wooden pegs along the top

The building takes its name from the first stage in the rope-making process, the carding or hatchelling of the hemp fibres to straighten them, which most likely took place in this building. Fibres would have been hand-combed by hatchellers until the introduction of mechanised spinning machinery in the 1860s. It is unclear whether hatchelling was ever done either by hand or by machine in this building, though the name of the building seems to imply that it was. Based on its date, it could have been purpose-built to house spinning machinery. If the Hatchelling House ever did provide an enclosed space for this process to be carried out, it moved to another location on site at some point prior to the early 20th century as James Paton recalls the building being used to store bails of raw hemp (pers comm.).

F (Tar House)

The boiler sits atop timber supports and is sited just east of the Hatchelling House. It is a cylindrical structure constructed of timber with a peaked roof, basically a large lidded cauldron for heating tar. Alternative names for it are a Tar House or Barking House although it seems that the barking of lines was done in another boiler just outside the south wall of the section of ropewalk just east of C (J.P. pers comm.). The tar used at the former Montrose Sail and Ropeworks came from Archangel in Russia. Until the 1970s this structure was connected to the ropery to the north by an overhead gantry, allowing tarred hemp to be delivered direct to the laying floor (R G W Prescott, pers.com). There is evidence on the south wall of building C of the opening whereby the tarred hemp entered the ropery.

Illus 53
Iron hooks located in the roof joists of D used to lay the separate rope strands in order to stop them from tangling

G (Storage shed)

The building now utilised as a storage shed at the north side of the yard behind the main building is a masonry built single storey, gable-roofed structure oriented north to south with stone skews at both ends and a capped stack topping the south wall. It has four bays on its east elevation, two windows a door and a window. The south wall shows extensive evidence of rebuilding on the exterior. There is a timber garage door and a blocked window at the ground floor and a blocked window opening in the gable end, suggesting that the space under the roof contained a use that required some light. The interior of the building is finished in whitewash. There is a blocked fireplace in the chimney breast in the south wall of the building. From the building's layout, it was most likely originally built as a dwelling unit.

Function and fittings of the ropewalk and the rope making process

The rope-making process (for hemp rope) has a number of stages. It begins with carding of the hemp to make hemp fibre, known as hatchelling. The fibre is then spun into yarn (Illus 55). The yarn is then warped (stretched) by tying one end off to a hook, drawing it out to the proper distance and winding it on winches. The yarn is then tarred. The yarn is then grouped in 3 (Hawser laid) or 4 (Shroud laid) strands. The strands are then twisted into rope in the ropewalk. Three hawser laid ropes twisted together make a cable.

The ropewalk had a wheel at one end and a wheel at the other end. The layout and specifications used would depend largely on the type of rope being produced but a typical setup would involve a stationary wheel at one end which spun each strand individually, known as the tackle board, and another wheel at the opposite end which spun all the threads together, known as a breast-board or sledge (Illus 56). Two men would walk the length of the walk first laying out each of the required number of strands (3 or 4). A man would then walk back and forth between the wheels at either end of the walk laying up the strands into rope using a rope-top, a piece of wood with three or more grooves cut into it which brought the strands together smoothly and

Illus 54
Upright post used to support rope strands. This component appears to be the end of a re-used deck beam from a vessel

ensured an even tension along the length of the rope. (Illus 57)

According to James Paton (a relative of the present proprietor), who has known the ropery since the 1930s, rope-making, barking of nets and lines, and canvas sewing were all occurring on the Montrose site in the first half of the 20th century. Hemp rope was still produced up until the 1950s. There were six to twelve people regularly involved in all these processes with up to 15 people employed on site during very busy periods.

Illus 55

Spinning wheel noted in the artefact collection at the ropeworks

PHASING

Fabric evidence, rather than map evidence, is of most help in outlining rough phases of development for this site. There is evidence of both horizontal and vertical extension of the ropeworks complex, which roughly follows the phasing laid out below. Please refer to the Site Index and Gazetteer, in addition to the illustrations inserted here, to clarify the parts of the site under discussion.

1. The ropewalk commences life as a single wall, the north wall, which serves as a site boundary and a wind break built of masonry.

2. Windows are added and the height of the ropewalk (north wall) is increased slightly in areas B-D in larger, more regular cut blocks of sandstone. A south wall in hand-made brick is built and a roof added.

Illus 56

A wheeled sledge used during the rope making process

Illus 57

Examples of a 3 strand and 4 strand rope-top

3. Building A of the main complex is built. Building C, incorporating part of the ropewalk in its ground floor, is built. It is a two-storey masonry building with window openings front and rear.

4. Section B is raised to two-storeys. The gap in the south wall between the ropewalk and section C is filled in with machine-made brick.

It is possible that the north wall of the ropewalk was built in more than two phases, as the masonry on Sections B and D appears to be of a different character. It is also possible that the sections of the former ropeworks built of machine-made brick represent more than one phase. The following text describes the likely phasing of development on the site, based on the documentary evidence summarised above and inspection during our site visit.

Illus 58

Whalebone uprights still upstanding to the south of the roofed part of the ropewalk and outside the current property boundary. One whalebone is in the centre of the image with another visible at the far right. The brick building in the background is the southern wall of the upstanding ropewalk building

Phase 1 – late 1700s

The ropewalk was initially open-air. The structure that now covers it began as just one wall, the masonry north wall running from B through to the east end of D, which served as a wind break. The north wall of the ropewalk was visibly built in two stages. The earliest part of the wall is the lower part, which is identifiable as it is a medium to dark grey rubble stone, the Scurdyness Rock identified by Chalmers. A later phase, extending the wall upwards, in more regularly cut blocks of sandstone, sits atop the earlier section and is easily identified as a horizontal joint sits between it and the lower, grey rubble built wall. These sections of wall are visible at the rear (north) elevations of B and D. There is also a straight joint in the north wall approximately 18.25 metres west of the interior dividing wall. Given that the sections on either side of the straight joint appear to be constructed of the same material, it maybe that the section of north wall east of this represents an early extension to the ropewalk.

This north boundary wall for the open ropewalk predates the buildings on the site. It has eight regularly spaced whale jaw-bones built into it along its length. Each whale-bone has a mortice toward its upper end to hold a piece of wood projecting into the walk. In turn, each wooden piece holds one or more pegs. The pegs were likely used to assist the men in the ropewalk in keeping the strands of hemp apart while they were set out prior to being laid up into a single rope (see Illus 51 & 52). The presence of the whale bones in this wall is intriguing, as there are also free-standing whale bones in a line parallel with the ropewalk just outside the fence that runs along the present south property boundary (Illus 58). These tie in with map evidence of a second ropewalk, no longer extant, which sat parallel to the existing walk on the Montrose Rope & Sail Works site (see map in Illus 45).

Phase II – early 1800s

It is likely that the first building constructed on the site were buildings A (dwelling house) and C (warehouse). Both the 1822 map by Wood and the 1832 map by Gardner show two buildings on the site. Wood's indicates a building on a square plan roughly in the location of A and a second building in two sections in the approximate locations of C and D. Fabric evidence suggests building C was constructed as a two-storey structure. Both the front and rear walls appear to be of masonry for their full height.

Wood's map suggests that the western section of the ropewalk (D1) was enclosed by 1822. Prior to this date the north wall of the ropewalk was raised and regularly-spaced window openings were inserted along its length in the C and D sections. A south wall in hand-made brick was also added from the change in roof height in the western section of the ropewalk to its eastern extent and the ropewalk was roofed. Fabric evidence suggests that the Hatchelling House (E), although first shown on the 1865 OS map, also in handmade brick, dates from this phase of construction.

Phase III – c. 1823-65

Although of masonry, and possibly contemporary with Section C, it appears that Section B was built up against the west wall of Section C at this time. From the fabric evidence, it appears very likely that B was not originally a two-storey structure. The south wall of B, and part of the east wall at the ground floor, are visibly thicker and appear to be masonry built. The north wall is a section of the ropewalk at the ground floor. The south, east, north and west walls above the ground floor are brick built.

Although there was a fire in 1936 that did damage this building, it is unlikely that the masonry walls at the first floor would have been the only loss as a result of the fire. It would also have been very possible, had the masonry walls at the first floor collapsed, that the rubble would have been used to reconstruct the building. The use of brick to build the walls at the first floor strongly suggests that the original building was only one storey in height.

This suggests that B is of two phases in the 1800s, an earlier one-storey phase c. 1823-65 (it first appears on the 1865 OS map) and a later extension to two storeys in brick. The entire complex of buildings is shown on the 1865 OS Town Plan in its present configuration, accessed off Peter's Lane (Eastern Road).

Phase IV – 1900s

The section of south wall between building C and the change in the roof at the east end of D1 is in machine-made brick and has a raised roof height when compared to the section of ropewalk to the east. This section of the south wall and roof most likely date from a later phase of construction or were rebuilt to accommodate a different use of the portion of the ropewalk just east of C.

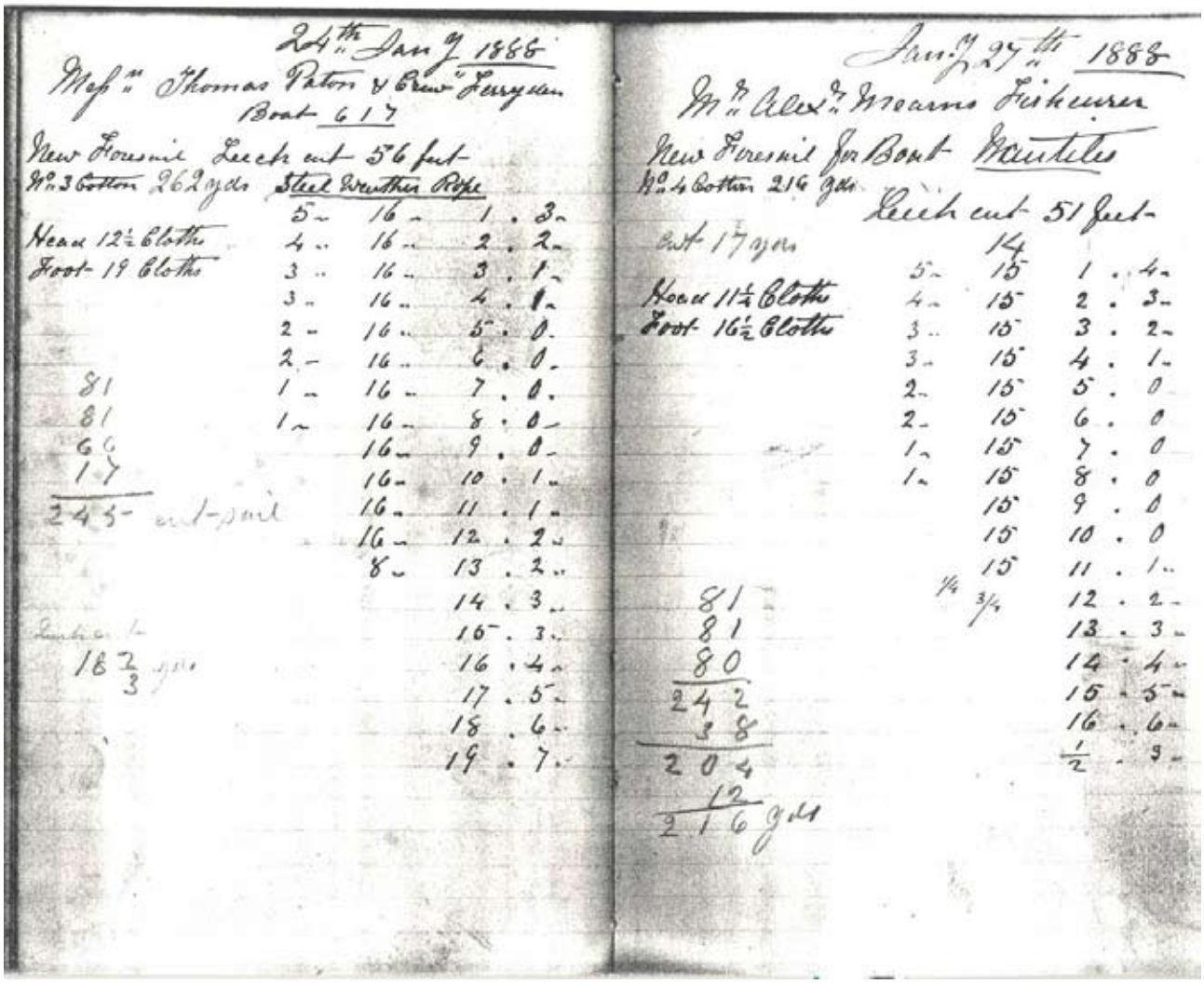
There is some evidence that parts of A, B, and C were rebuilt after the fire at the ropeworks in 1936. The site information published by RCAHMS suggests that these buildings were extended to two storeys at this time; however, this doesn't seem to be supported by the exterior walls and decorative features in these areas of the building (*i.e.* fireplace surround and cornice in A-F01). The only features clearly datable to the 1930s are the windows in the south, first floor wall of B, which are metal-framed. There is also the possibility that the change in floor height between A and B-C dates from the post-fire repairs.

There is a later lean-to addition at the rear of the ropewalk, bridging the junction between D and C. Some of the material at this junction, a steel I-beam supporting the first floor east wall of C, above, and concrete block and corrugated asbestos roofing used in the lean-to appears to be quite recent (c.1960s).

SAIL-MAKING AT THE MONTROSE ROPE & SAIL WORKS: THE INTRODUCTION OF STEEL WIRE BOLT ROPES

Sail-making continued at the works throughout the 19th century; rope-making survived well into the 20th century. The scope of the sail-making work can be judged by an inspection of a remarkable series of sail-makers' journals in which commissions carried out by the master sail-makers were recorded, with details of the ship for which the sails were intended plus the dimensions and tables of gores for the sails. The journals provide a detailed record of some 50 years, starting in 1857. The Sail Loft was making new suits of sails for locally built vessels in the coasting and short seas trades as well as sails for the large fishing fleets of nearby Ferryden and other coastal villages. The full analysis of this rich source of material will provide a wonderful insight into the operations of this craft workshop over the second half of the 19th century. In the present exercise we are only able to draw attention to one or two important aspects of the work of the sail loft, namely, the switch from flax canvas to cotton canvas and the introduction of wire rope for use as bolt-ropes in the foresails of herring luggers.

Locally produced flax canvas was the mainstay of work in the early part of the record but this material was slowly supplanted by the importing of cotton canvas from North America, a process that accelerated after the close of the American Civil War. The switch to cotton canvas, thought to be much superior by sailing fishermen, had implications for the survival of the local flax industry.



Illus 59

An extract from a Montrose Rope and Sail Works order book highlighting the reference to the use of 'wire rope' for the bolt rope

Throughout most of the 19th century, the margins of lug sails were reinforced by sewing vegetable fibre bolt-ropes to them. This long-standing practice is not mentioned in the journal entries, presumably because it had been a common standard for centuries. However, at a later period, in the 1880s some tables of gores have an additional note added to them, indicating the use of a "steel weather rope" (i.e. a wire bolt rope on the luff of a lug-sail).

This feature is mentioned only in connection with sails for the larger boats and the practice of mentioning it lapses after some months, presumably as this new practice became established as standard. Table I shows the relationship between the size of sails (represented by two key dimensions and the number of yards of canvas they contain) and the presence or not of a note about a "wire weather rope".

The Table presents figures for two matched groups of sails, one with wire rope and one without, both groups drawn from the same time period. There is a significant relationship between size and the mention of a wire luff rope.

		No. yds canvas	*Leech (ft)*	*Head (ft)*
Wire rope (n = 7)	***Median***	240	52	24
	IQ range	226-247	51-53	24-25
Hemp rope (n=7)	***Median***	139	39	19
	IQ range	113-206	36-49	16-22

Table 1

Relationship between the size of sails (represented by two key dimensions and the number of yards of canvas) and the presence or absence of a note about a "wire weather rope"

The introduction of wire luff ropes cannot have been undertaken lightly, for it was necessary to sew as many as ten reef cringles into the wire rope - a fearsome task to be carried out by hand. It must therefore have been undertaken for a good reason. The likely explanation is that, with the introduction of steam capstans to the largest class of sailing luggers there was the risk of setting the luff so tight that the power of the steam capstan could break a vegetable fibre luff rope. The additional advantage of the use of wire rope was that the stretching experienced with hemp bolt ropes, which resulted in the luff of the sail sagging away to leeward, was obviated, with the result that the new type of foresail was more aerodynamically efficient and gave a better windward performance. The down side however, was that the sail was more difficult to furl as can be seen by a comparison of the two vessels illustrated, one with a soft hemp luff rope and the other with a wire rope.

Illus 60

The left hand vessel shows a furled lug sail with neatly stowed hemp bolt rope; The right hand vessel shows a furled lug sail with a more awkwardly stowed wire bolt rope

DISCUSSION

Montrose Rope & Sail Works was a central part of the growth and development of industrial Montrose from the late 18th century onwards. It was among the first buildings to occupy the Faulds area and its presence seems likely to have influenced the street layout in that part of the growing town. From this humble beginning the subsequent growth and expansion of industrial activity was extensive and culminated with the construction of two large flax mills. Montrose Rope & Sail Works is particularly significant as it is perhaps the only ropeworks in Scotland to remain in constant use since the late eighteenth century and though its ropewalk is now silent, much of the machinery, the knowledge and the history of a once thriving industry is preserved within its long narrow confines. The ropery is a small-scale industrial site of great significance on a national scale, without parallels elsewhere in Scotland today.

Illus 61
The Paton family with their float at the local Gala *c.*1930

The suite of whale jaw-bones used as stands in the ropewalk is a tangible reminder that Montrose Whalers were a constant presence in the Scottish whaling fleet from the 1750s until the end of commercial whaling in Greenland and Baffin waters (Scoresby, 1820; Jackson, 1993). Similarly, the large number of staves from barrels of Archangel Tar which were used to floor the ropewalk reminds us of the scale of trade with the Baltic in Montrose.

The long history of the Montrose Rope & Sail Company, and the lengthy involvement of the Paton family in its affairs, has continued through the 20th century to the present day. Two ledgers we were shown covering the period 1962-64 revealed a wide range of sales, including rope and canvas products supplied to the fishing industry, as did photographs of the firm's floats at Montrose Gala Day processions in the 1930s (kindly provided by Mr James Paton, who witnessed the Galas as a young boy). (Illus 60 and 61)

Today, the firm occupies new premises whose well-lit factory floor contains a computer-controlled cutting table, installed in 2001, and rows of sewing benches where staff machine products including vehicle covers, tents and canvas bags for the military, alongside their more traditional sales of items such as ropes and twine for small-line manufacture in the fishing industry.

Though the sail-making activities of the yard are known only from documentary sources they have considerable significance. They chart in detail the impact of new technology on the very traditional activities of the Montrose sailing fishing fleet and show how new technology does not necessarily supplant former ways. By contrast, it may well help sustain traditional features by improving performance, and thus prolong their survival in the face of competition from new forms. The superb aerofoil performance of the huge fore-lug on the largest fifies and Zulus, dependent as it was on the properties of the wire bolt-rope, produced the fastest and most

powerful fishing vessels of the late 19th and early 20th century, under favourable conditions faster even than the steam drifters and motor vessels that ultimately replaced them.

Our research at Montrose has been productive and points to the desirability of further work in a number of areas:

- to produce a detailed survey of the Tar House (a unique industrial survivor in Scotland), supplemented with limited excavation of the space between it and the main building in the hope of locating the capstan or horse-gin which was apparently used to haul tarred rope yarn into the ropery

- to carry out a detailed survey of the hatchelling house, with some excavation of the interior, to clarify the usage history of this building

- to dig an exploratory trench across the line of the southern rope walk in the vicinity of the few surviving whale-jaw upstands, to clarify the history of this space and its relationship to the extant covered ropewalk to the north

- to search for more documents relating to the history of rope- and sail-making in Montrose and to carry out further analysis of those documents already known, thus contributing to an authoritative industrial history of this important seaport community.

Afterword

Each of the four projects has opened new insights into the changes that were under way in the fishing industry in the 19th century. We tend to over-simplify the effects of new technology: there is a myth that new ways are introduced and compete with and wipe out the modus operandi of previous generations in a linear, stochastic fashion. However, the results here show how in many cases new technology serves to strengthen traditional practices, and may help to prolong their useful life, even as competitors with 'new solutions'. Thus, the advent of steam power and the use of steel wire bolt ropes served to enable the enlargement of sailing luggers and to make them more efficient and capable of staving off competition from new types of vessel for a number of years. New vessel designs may therefore co-exist with earlier designs for many years before the demise of the latter. The last operational steam-drifter outlived the last sailing zulu by no more than ten years. In the final analysis this demise may be due to other factors than simply "Industrial inferiority".

A further finding common to a number of strands in this research is the ingenuity and adaptability of small-scale industrial enterprises in Scotland. Sometimes this is manifested in the subtle exploitation of a niche market, perhaps geographically remote from the seat of power of their nearest rival (as in the case of the MacDonald Brothers foundry in Portsoy). Sometimes it is the adaptation and elevation of a simple hand-craft to a proto-industrial scale with low energy costs (as in the case of the hand-looms in the Cardy Net factory). A further point of interest is the strong family tradition underlying some of the industries investigated, (as in the case of the MacDonald family which ran the Portsoy Foundry for over 75 years, and the Montrose Rope & Sail company, which still operates today after more than 150 years of control by the Paton family). Finally, can it be coincidental that the all the main patriarchal enterprises described above co-existed along the east coast for over 50 years at a time of such dynamic innovation in industry?

Productive though this research has been it has nevertheless raised many new questions about the enterprises under review. We have therefore listed, where appropriate, suitable subjects for further research at intervals throughout this report.

Appendices

Appendix 1

HOLDINGS OF THE SCOTTISH FISHERIES MUSEUM RELATING TO CARDY NET WORKS

Record No	*Object name*	*Description*	*Image*	*Location*
ANSFM: 1969/13	note	Hand written in ink on headed note paper. It includes background information to David Gillies's working life - with references to the commercial scene at that time. Very useful for setting up an exhibition.	–	Miller Room & Section D & Ball: 154 : 2005
ANSFM: 1969/195	canvas	Sail canvas	–	Room 2 & Shelf 54 & Boll: 85 : 15.1.1997
ANSFM: 1969/196	sail	White canvas. Brass eyeholes. White fringe. Fine rope. Thick heavy rope with two metal rings.	–	Room 1 & Shelf 21 & Boll: 232 : 9.6.2008
ANSFM: 1969/196/2	ousels	Unused, for use on Drift Nets, corded with frayed ends.	–	Room 2 & Shelf 58 & Ball: 84 : 15.1.1997
ANSFM: 1969/197	net	Brown	–	Room 1 & Shelf 13b & Ball: 54 : 15.1.1997
ANSFM: 1969/198/1	card	White cardboard. Black printed lettering on one side. Pictorial representation of Cardy Works on the other side.	–	Miller Room & Section D & Bole 154 : 2005
ANSFM: 1969/198/2	account	White paper. Blue lined columns No 187. A blank "Terms of Payment".	–	Miller Room & Section D & Box 154: 2005
ANSFM: 1990/17/1	poster	17/1 -Colourful, pictorial poster, showing the factory and Cardy House.	–	Old Painting Store & large buff folder: 15.11.1996
ANSFM: 1994/574	poster	Allegedly in very good condition (but no photo of it in Book E), advertisement for David Gilles, net manufacturer, Largo, Fife.	–	unstated: 6.11.1997
ANSFM: 1995.160.1-19	record	Leather bound with stout cardboard covers, titlement in red with gold lettering. Numbered 1-19. 3 and 16 are letters only.	–	Room 2 & Shelf 43 & Ball: 107 : 29.4.1996

Record No	Object name	Description	Image	Location
ANSFM: 1995/160/20/31	record	Leather bound with stout cardboard covers. titlement in Red Facing with gold lettering. 1 Customer Book -1 Petty Cash ledger -2 Office Cash Books -1 Quotations Book (Cotton and Testing) -1 Cotton Testing Book.	–	Room 2 & Shelf 43 & Box 107 : 12.4.1996
ANSFM: 1995/160/32/40	records	Cotton bound with stout cardboard covers, gold lettering and some without. 2 Books Yards and rows -1 Book freights - 1 Book delivery - 1 Book order - 1 Book cotton received - 1 Book cotton order - 1 Book pricelist issue - I Book customers reference.	–	Room 2 & Shelf 43 & Box 108 . 14.4.1996
ANSFM: 1995/160/41/49	records	An assortment of bindings. One only with red facing and gold lettering. Very thin leather bindings, some cardboard covers only. 1 Scroll Day Book - 1 Net Order Book - 1 ledger - 1 Order Note Book - 1 Lower Largo Fuers A/C - 1 Ledger - 1 Day Book - 2 Wages Books.	–	Room 2 & Shelf 43 & Box 10E1 : 14.4.1996
ANSFM: 1995/160/50/59	record	There are two enclosed in black leather with flaps. Three leather bound with gold lines and lettering. Remaining - an assortment. 160/50 - 1 Orders Recieved 160/51 - 1 Outstanding Accounts 160/52 - 1 Shipping Note Book 160/53-4 - 2 Building Note Books - 160/55-56 - 2 Cash Books -160/57-58 - 2 Ledgers - 160/59 - 1 Bills payable.	–	Room 2 & Shelf 43 & Boll: 108 : 14.4.1996
ANSFM: 1995/160/60-75	record	60-64 - 5 Note books, covered orange rayon -65-68 4 Exercise books, James Gillies - 69-70 2 Memorandum - 71-73 3 labels - 74 - Visiting Card - 75 -Account Forms (2 Sundry Cash Payments, 1 Addresses, Cash at odd times, Sailings and Arrivals, The Spark terminal (pencil written?), Wireless and Schools, Technology, Holiday Observances, Grey cardboard/cotton net, A swatch of labels/ per rail, David Gillies, Largo)	–	Room 2 & Shelf 43 & Box 108 : 17.4_1996
ANSFM: 1995/160/76-79	books	100/76 Ledger, leather bound with red facing and gold lettering. - 160/77 Home Preacher, black leather binding, gold lettering. Edited by Rev Norman MacLeod, Dean Of the Chapel Royal. Produced by William Mackenzie, Howard Street, South Bridge, Edinburgh. - 160/78 Gazzetter. hard cardboard covers, gold lettering. Longman's Gazetteer Of the World. Edited by George G. Chisholm MA BSc, Produced by Longman. Green & Company, London. - 160/79 Album, Grey hardboard covers, empty belonged to Daisy Gillies. Cardy House, Lower Largo, 1910.	–	Room 2 & Shelf 62 & Box 109: 19.4.1996

Record No	Object name	Description	Image	Location
ANSFM: 1995/160/80/90	records	160/80 - Certificate, The Shipwrecked Fishermen and Mariners RBS. - 80/1 - Map African, Political Divisions 1896 - 80/2 -Photograph, HRH The Prince of Wales K.G. - 80/3 - Photograph, coloured, of Ivy Jardine - 80/4 - Photograph, coloured, of Gillies Family - 80/5 - Photograph, coloured, of Cardy House interior 80/6-8 Three photographs, three sepia photos, identical mountings, children - 80/89 - Photograph, Sepia, Steamship - 80/90 - Photograph, Sepia, two joiners.	–	Room 2 & Shelf 62 & Box 109: 14.4.1996
ANSFM: 1995/160/91/99	records	Evening, Largo Mill, Sepia, Mounted - Shore and Cottages, sepia, mounted - Largo Salmon Fishermen, black and white, mounted - cottages at Largo. black and white, mounted - The docks at Aden 1881. black and white, mounted - Cottages and Shore Largo, black and white. mounted - Engineers and Fishermen "S.S. Largo Bay", black and white, mounted -Catholic Priest aman and adram, black and white mounted - Shore and Sea and Laid up boats, sepia.	–	Room 2 & Shelf 62 & Box 109: 14.4.1996

Appendix 2

LIST OF PATENTS TAKEN OUT BY MACDONALD BROTHERS AND ELLIOTT & GARROOD

Copies of Patents taken out by the MacDonald Brothers (not including the steam capstan) and also an example of a Patent taken out by Elliott & Garrood relating to capstans.

N° 5217 A.D. 1897

Date of Application, 26th Feb., 1897
Complete Specification Left, 26th Nov., 1897—Accepted, 15th Jan., 1898

PROVISIONAL SPECIFICATION.

Improvements in or relating to Capstan Gear.

We, WILLIAM ELLIOTT, and WILLIAM GARROOD, both of Ingate Iron Works, Beccles, in the County of Suffolk, Engineers, do hereby declare the nature of this invention to be as follows:—

This invention relates to capstan gear of the kind in which the engine is carried upon a bed plate at the top of the capstan, the engine itself being suitably boxed in to protect it and the whole apparatus, being particularly suitable for use on fishing craft.

In carrying out the invention we secure the engine upon the top of the capstan as above described and over it we place a preferably steel casing which may be hinged and adapted to be closed tight and secured by a padlock or other device if necessary, the gearing also as mush as possible being similarly boxed in.

For use on fishing vessels it is often desirable to use the power of the engine for discharging the cargo and for similar light purposes for which the heavy capstan, which is primarily used for hauling in the fishing nets, is unsuitable. For this purpose we apply a winding drum to one or more of the shafts of the engine, say for example the engine crank shaft itself. This drum may be connected in various ways, but the preferable arrangement is to form a flattened surface upon part of the shaft near the end so that its circular form is destroyed and to form a passage-way through the projecting portion of the shaft thus left at the end, so as to give access to the flattened portion. In the drum or in the boss of the drum is carried a roller in a suitable opening or recess, preferably so that it will not drop out, and the drum can be applied to the shaft by passing the roller through the passage-way at the end of the shaft until the roller lies upon the flattened portion first above described. When the engine is started and the pressure placed upon the drum the shaft endeavours to rotate without the drum, and the roller then becomes jammed upon the flattened portion where the curve approaches the full circle, and the drum is perforce carried round with the shaft. It will be appreciated that this locking mechanism will apply no matter which way the shaft be rotated, though as a rule the whipping drums are only required to rotate in one direction. By this means we provide a cheap and handy attachment which is also readily detachable.

The previously described arrangement is exceedingly handy and useful for raising light weights, as for example, the baskets by which the fish are frequently discharged in small quantities, but where heavier loads are required to be lifted, as in the case of the fish being packed in barrels and then landed, the following arrangement, which gives greater power, is preferred.

The whipping drum is carried upon a shaft carried in two cheeks or brackets adapted to be easily attached to or detached from the bed plate at the top of the capstan; on this drum shaft is a spur wheel which, when the mechanism is in place, engages with a pinion upon the engine shaft and is thus driven rotating the whipping drum with it. As the pinion on the engine shaft is smaller than the wheel upon the drum shaft the drum rotates at a slower speed and with greater power

[*Price 8d.*]

N° 12,821 A.D. 1898

Date of Application, 8th June, 1898

Complete Specification Left, 8th Mar., 1899—Accepted, 29th Apr., 1899

PROVISIONAL SPECIFICATION.

Improvements in or relating to Power Driven Capstans.

We, WILLIAM ELLIOTT, Engineer, and ELLIOTT & GARROOD LIMITED, Engineers, of Ingate Iron Works, Beccles, in the County of Suffolk, do hereby declare the nature of this invention to be as follows:—

This invention relates to power driven capstans. The object of the invention is to economise space and weight as much as possible, and also to facilitate the fixing of the apparatus to the deck of the vessel or other place where it is to be used. The apparatus is constructed substantially as follows:—

To the deck of the vessel is secured the pan or foundation which is made circular and of the same diameter as the bottom of the barrel or capstan proper, so that if the rope falls off the capstan the coils will merely slide on to the foundation instead of becoming jammed underneath the rotating portion of the capstan. A central vertical pillar extends upwards from the foundation, and is practically a portion of the same casting or forging, and upon it the barrel is carried and rotates. Near its lower end the barrel has openings through which the foundation bolts and pawls can be passed so that the capstan can be placed in position and the foundation bolts applied and secured without dismounting the capstan or any of its gear.

The pillar is provided with a central opening preferably of an oval or elongated form in cross section, so that it may accommodate say two pipes, the steam and the exhaust without weakening the column so much as would be the case if a circular bore were employed.

Also in the lower end of the capstan are mounted any desired number of pawls, say for example two, which engage with a suitable annular rack formed in or upon the foundation. Recesses are made in the barrel to receive the gudgeons of the pawls; the openings into these recesses are smaller than the recesses themselves, and the gudgeons are flattened so as to pass through the reduced openings, the flats on each pawl being substantially parallel with a longitudinal line drawn through the centre of the pawl so that the latter can only be applied and withdrawn when in a vertical position, its normal working position being approximately horizontal, in which position it cannot be removed from its seat. The pawl is made flat ended and both edges alike, so that it can be turned over to work in either direction. The centre of the end may be recessed.

The top of the barrel has a toothed ring lying nearly in a horizontal plane, with which gears a bevel pinion upon a shaft driven by the engine. Above this toothed ring lies the engine bed-plate, which is suitably shaped to protect the ring and has a depending flange for this purpose, is dished to accommodate pipes or mechanism and provided with suitable brackets, bosses, or beds to receive respectively the lower guide bars of the engines to which the cylinders are secured the plummer blocks for the engine shafts and for the lay shaft or shaft driven by the

[*Price 8d.*]

N° 10,264 A.D. 1899

Date of Application, 16th May, 1899
Complete Specification Left, 16th Feb., 1900—Accepted, 7th Apr., 1900

PROVISIONAL SPECIFICATION.

Improvements in and relating to Roadside Paring Machines.

We, ALEXANDER MACDONALD and JAMES MACDONALD, of the Firm of Macdonald Brothers, of Portsoy, in the County of Banff, Engineers, do hereby declare the nature of our invention to be as follows:—

This invention has reference to and comprises improvements in and relating to road side paring machines and consists of a new or improved construction or arrangement and combination of the parts of machines for paring the sides of roads, or footpaths of roads, which has hitherto been usually done by hand labour, and which improvements will enable such work to be done with accuracy and economy.

In carrying into practice the improvements of this invention the frame or main body of the machine is mounted on three wheels two in front and one in rear, the latter being mounted on a vertical rod to swivel in the frame as the guiding wheel, a hand lever being secured to the upper part of the vertical rod. A horizontal shovel shaped plate is attached to the machine frame and is formed with a tusk, or vertically projecting part to act as a vertically cutting edge. This shovel plate is carried at such a distance below the frame as to cut off the turf to the desired depth and leave a perfectly level surface on the road side. A steel board is fitted above the shovel plate similar to a plough board to throw the cut turf to one side as the machine proceeds.

The two front wheels are not mounted on an axle but are independently and interchangably carried on studs at the lower end of levers, which are carried by eyes on a square bar to which they are adjustably secured by pinching screws. This square bar is carried in a hollow sleeve hinged or jointed to the front of machine frame. The upper part of one of the wheel levers is pierced with holes for adjustably connecting one end of a connecting rod, the other end of which is jointed to a lever at rear of machine frame fitted with a quadrant and spring catch or pawl. By this means the upper end of the wheel lever can be shifted from an angled to a vertical position and so adjust the height of machine frame and cutting shovel plate.

A small guide wheel is adjustably suspended from the machine frame between the two front wheels. The whole is designed to be drawn by horse power.

Dated the 15th May 1899.

W. R. M. THOMSON & Co.,
96, Buchanan Street, Glasgow, Agents.

COMPLETE SPECIFICATION.

Improvements in and relating to Roadside Paring Machines.

We, ALEXANDER MACDONALD and JAMES MACDONALD, of the Firm of Macdonald Brothers, of Portsoy, in the County of Banff, Engineers, do hereby declare the

[*Price 8d.*]

N° 4458 A.D. 1901

Date of Application, 2nd Mar., 1901

Complete Specification Left, 30th Nov., 1901—Accepted, 9th Jan., 1902

PROVISIONAL SPECIFICATION.

"Improvements in and relating to Machines for Distributing Manure, Seed, Sand, and the like".

We, ALEXANDER MACDONALD, and JAMES MACDONALD, of the Firm of Macdonald Brothers, of Portsoy, in the County of Banff, Agricultural Engineers, do hereby declare the nature of our invention to be as follows:—

This invention has reference to improvements in and relating to machines for distributing artificial manures, and seed on land, and sand on streets, and for such like purposes.

According to our improvements, the manure or granular material is placed in a box or trough shaped vessel placed on a cart or like tram drawn vehicle.

On the inside lower part of box are arranged a series of discs, preferably in the form of star toothed wheels, each mounted on a parallel spindle carried in suitable bearings in frame of box. These spindles are fitted with toothed wheels at their opposite end, and these wheels are turned by a series of worms formed on a spindle carried in bearings at right angles to the direction of the spindles carrying the star wheels; and this worm spindle would be driven by chain or other gear from the shaft of vehicle travelling wheels.

A slot or opening is formed in the bottom of box, and a sliding or oscillatory bar is fitted over this slot. This bar is connected to oscillatory or moveable links at its ends and operated by a hand lever so as to adjustably regulate any desired width of opening of slot for the manure or granular material to pass through.

By this means the star wheels which are grouped in line adjacent to each other agitate and force the material in an effective manner through the regulated opening in bottom of box.

Dated the 1st March, 1901.

W. R. M. THOMSON & Co.
96 Buchanan Street, Glasgow. Agents.

COMPLETE SPECIFICATION.

"Improvements in and relating to Machines for Distributing Manure, Seed, Sand, and the like".

We, ALEXANDER MACDONALD, and JAMES MACDONALD, of the Firm of Macdonald Brothers, of Portsoy, in the County of Banff, Agricultural Engineers, do hereby declare the nature of our invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement in writing, reference being made to the accompanying drawings:—

This invention has reference to improvements in and relating to machines for distributing artificial manures, and seed on land, and sand on streets, and for such like purposes.

And in order that our said invention and the manner of carrying same into practice may be properly understood we have hereunto appended a sheet of

[*Price 8d.*]

N° 20,470 A.D. 1903

Date of Application, 23rd Sept., 1903

Complete Specification Left, 7th July, 1904—Accepted, 25th Aug., 1904

PROVISIONAL SPECIFICATION.

"Improvements in or relating to Steam Capstans".

We, ALEXANDER ELLIOTT, Engineer, of Beccles, in the County of Suffolk, and ELLIOTT AND GARROOD LIMITED, Engineers, *etc.* of Beccles, in the County of Suffolk, do hereby declare the nature of this invention to be as follows—

This invention relates to steam capstans of the type manufactured by us for many years past, in which a horizontal engine is placed on top of the capstan upon a fixed bed-plate forming a table or cover at the top of the capstan which latter is revolved by a bevel pinion and toothed ring. Hitherto we have made these capstans to run in one direction only and without means for reversing the direction of rotation of the capstan unless the engine was reversed or disconnected; it is not our present intention to reverse the engine itself but to introduce toothed mechanism by which the direction of rotation of the capstan can be reversed.

In carrying out the present invention we maintain the general arrangement of the engine and simple gearing much as before, but we add in the following manner the reversing mechanism. Hitherto the engine shaft carried a pinion engaging with a train of wheels to turn the capstan; in our present invention we provide the engine shaft with two pinions engaging respectively with two trains of wheels one consisting of two wheels and the other of three, so that the motion obtained will be in opposite directions. A lay shaft carries the bevel pinion engaging with the capstan ring and feathered upon this lay shaft is a clutch adapted to engage with clutch teeth upon one member of each train of wheels or to assume an intermediate position free from either; the clutch is moved by a clutch lever pivotted upon the bed-plate and having at its free end a ball by way of handle and a conical point engaging successively with three countersunk holes so as to fix the clutch in any of its three positions. The lay shaft lying as it does underneath portions of the engine cannot be lifted out to remove it and is therefore made to slide out longitudinally; for this purpose the portion of it which carries the last wheel of the reversing train and the hole in this wheel are made of larger diameter than the other portion of the shaft so that the feathers upon which the clutch slides can be drawn out through this wheel. The inner bearing may be formed in a sliding block and the other bearing, which is preferably made in one piece, with the lower half sunk into the bed-plate, can be removed with the shaft when the bolts by which it is attached are withdrawn and the recess in which it is sunk in the bed-plate allows the bevel pinion on the shaft to come away with the latter without fouling the bed-plate.

To prevent the capstan running away when the clutch is in the middle position and the capstan loaded a band-brake is carried by the bed-plate and surrounds the outer periphery of the toothed ring referred to above. Any convenient device may be provided for contracting the band, such as two eccen-

[*Price* 8*d.*]

N° 13,994 A.D. 1894

Date of Application, 20th July, 1894
Complete Specification Left, 20th May, 1895—Accepted, 22nd June, 1895

PROVISIONAL SPECIFICATION.

Improvements in or relating to Capstans or Winches.

We, WILLIAM ELLIOTT, of Ingate Iron Works, Beccles, Suffolk, and WILLIAM GARROOD of Lowestoft, Suffolk, Engineers, do hereby declare the nature of this invention to be as follows:—

This invention relates to capstans or winches which may be driven either by steam or hand power and are applicable for various purposes but particularly for use on fishing boats, the apparatus being so arranged that while admitting of its hauling in ropes, nets and the like over the tops of the rails or bulwarks of fishing vessels which are commonly two or three feet above the deck level to which the capstan is secured, it may be sufficiently strong, and at the same time simple to enable it to be easily manipulated and to withstand all the strains which, particularly in trawling, are often very considerable.

In carrying out the invention we employ any convenient arrangement of engines and gearing adapted to drive one or more vertical or horizontal shafts which carry the capstans or winch heads or ends; the engines may or may not be provided with reversing gear, and where they are not so provided the reversing of the capstan heads may be effected by clutch gearing in any well known manner. The whole apparatus may be encased in a suitably-shaped casing preferably of steel plate upon the top of which may be placed the capstan head. Where a single capstan head is employed the casing may conveniently be conical with the capstan-head on the top: where more than one head is employed the casing may be suitably-shaped say for example in the form of two or three cones side by side and joined together: where horizontal shafts carry the heads, these latter may be at the side of the casing which may be of any suitable shape to accommodate the mechanism. The conical form is exceedingly strong and useful, protecting the machinery in its lower portion and carrying the head on top. With this arrangement a horizontal hand shaft may pass into the casing near the top, preferably squared on the outside to receive a winch handle, the vertical shaft which carries the capstan head having upon it a bevel wheel adapted to engage with a pinion upon the hand-shaft, the bevel wheel being movable along the vertical shaft either by hand direct or by a clutch lever or the like and secured either in or out of engagement with the hand wheel by any suitable means; for example, a turn-button upon the shaft will suffice to hold the bevel wheel in its position in engagement with the pinion of the hand shaft, while, when the button is so turned as to allow the bevel wheel to fall, it will be out of engagement and its own weight will keep it clear of the pinion. With an engine running in one direction only, a convenient arrangement is to drive by gearing from the engine shaft a horizontal shaft running underneath the vertical shaft which may be carried in suitable bearings, the horizontal shaft carrying two bevel pinions adapted to engage with the bevel wheel upon the vertical shaft the two bevel pinions being clutch pinions and moved in or out of gear by a suitable clutch lever or other suitable mechanism so that when one is in gear the other is out of gear. Preferably these pinions would

[*Price 8d.*]

N° 14,776 A.D. 1904

Date of Application, 1st July, 1904—Accepted, 4th Aug., 1904

COMPLETE SPECIFICATION.

"Improvements in and relating to the Propulsion of Fishing Boats and other Vessels".

We, ALEXANDER MACDONALD and JAMES MACDONALD, both of Portsoy, Banffshire, Engineers, do hereby declare the nature of our invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement in writing, reference being made to the accompanying drawings:—

This invention has reference to improvements in and relating to the propulsion of fishing boats and other vessels, and has primarily for its object to act as an auxiliary to propel the boats or vessels in calm weather so that they may leave port and proceed to and from the fishing grounds when boats or vessels dependent on wind are becalmed; or be used in combination with sails, and which in such cases will be specially serviceable for materially assisting the boat or vessel in leaving or coming to ports during the prevalence of head or adverse winds. While in good sailing weather the propeller or propellers can be expediously raised out of the water and housed, and the sailing properties of the boat or vessel will consequently not be interfered with.

And in order that our said invention and the manner of carrying same into practice may be properly understood we have hereunto appended a sheet of explanatory drawings in which Figure 1 is a sectional elevation of the rear end of a fishing boat or vessel as fitted with two propellers in accordance with our improvements, one of the end quarters being shown with the propeller in the water and the other with the propeller in its raised and housed position. Figure 2 is an elevation at right angles to and corresponding to Figure 1 showing one of the propellers in the water. Figures 3 and 4 are an elevation and plan view respectively to an enlarged scale of the upper gearing connected to the crank shaft of engine.

Referring to these drawings:—

By our improvements we fit one or more but preferably two cast iron or other metal vertical tubes or trunks A which may be cast in one with or form part of the engine bed plate B, so that no alteration of the structural arrangements of the boat or vessel is necessary. These hollow casings A would preferably be fitted at the rear quarters of the boat or vessel, but may be fitted further forward if so desired. The propeller D is loosely mounted by its boss on the lower horizontal shaft D^1 of the frame C which slides in V shaped guides in casing A and a bevel wheel *a* on propeller boss is driven by a corresponding wheel *b* on the vertical shaft *c*. A bevel wheel *d* at the upper part of the vertical shaft *c* gears with a corresponding wheel *e* on the crank shaft E, and the shaft *c* is supported at the upper part of hollow casing A by a bridge piece *f*.

The crank shaft E is driven by cranks E^1 from the connecting rods and pistons of any ordinary steam or other fluid pressure engine or motor such as E^2 resting on the bed plate B.

When the propellers are desired to be raised out of the water into the housing casings A, the bevel wheels *e* are made to slide by their collars along feathers on the shaft E by means of ordinary hand clutch levers, so as to leave a clear way for raising the vertical shaft *c* as shown on the left quarter of Figure 1.

[*Price* 8*d*.]

N° 4404 A.D. 1908

Date of Application, 27th Feb., 1908
Complete Specification Left, 26th Aug., 1908—Accepted, 4th Feb., 1909

PROVISIONAL SPECIFICATION.

"Improvements in and relating to Motive Power Driven Machines or Appliances for Hauling Lines and Nets on Board Fishing Vessels".

We, ALEXANDER MACDONALD and JAMES MACDONALD, of the Firm of Macdonald Brothers, of Portsoy, in the County of Banff, Engineers, do hereby declare the nature of our invention to be as follows:—

This invention has reference to improvements in and relating to machines or appliances for hauling lines and nets on board what is known as "steam drifters" and fishing boats; and comprises a new arrangement and combination of appliances whereby the hauling work will be performed by motive power driven devices instead of by manual labour as heretofore.

The work which the improved machine is intended to perform has heretofore been accomplished by a hand driven machine, but as a drift of lines extends generally from two to two and a half miles in length sunk at times in from eighty to one hundred fathoms of water the application of motive power to perform the hauling operations is a desideratum. The improved hauling machine is light and portable so that two men can easily place it in position for working and detach and lay it aside when the lines are hauled on board.

According to our improvements we mount two haulage pulleys on horizontal spindles in a suitable portable frame, so that the line to be hauled comes over the one pulley and under the other where a man is placed to haul in the slack line much in the same manner as in hand driven machines. By our improvements we provide a strong intermediate frame and on the opposite side to that on which the haulage pulleys are fitted, we mount a small horizontal steam engine of ordinary construction, and on an extension of the crank shaft of engine we mount a spur pinion. This pinion meshes with the internal teeth of a double toothed rim wheel mounted on the spindle of one of the haulage pulleys, and the external teeth on this wheel gears with the teeth of a toothed wheel mounted on the spindle of the other haulage pulley, so that the two haulage pulleys are driven in unison. A hollow vertical socket is formed between the line of the two haulage pulleys near the centre of frame of machine so as to mount the latter over a vertical stud spindle carried in a bracket which fixes the machine to gunwale of boat or vessel, and enables the machine to be swivelled to and secured in any position to suit the fairlead of the lines. A hand lever would be fitted at top of stud spindle and have a spring washer mounted on spindle below it, so as to adjustably turn spindle and put on the required tension whilst yet permitting the machine to be swivelled on spindle to suit the lead of lines or nets. The bottom flange of machine and adjacent top flange of gunwale bracket are both turned to a true surface so as to work easily while yet permitting no vibration on the frame. A leg extension of the gunwale bracket is hinged to or mounted in a slotted bracket bolted to the side of boat, so that the machine can be lifted up on this hinge to gunwale and thus be secured both to gunwale and side of boat. Steam is supplied to the engine by means of a flexible pipe coupled to a nozzle in the steam chest, and the exhaust steam is conveyed away by a similar flexible pipe coupled to the nozzle of exhaust outlet

[*Price 8d.*]

N° 29,210 A.D. 1912

Date of Application, 19th Dec., 1912

Complete Specification Left, 19th June, 1913—Accepted, 19th Dec., 1913

PROVISIONAL SPECIFICATION.

Improvements in and relating to Rakes.

I, JAMES MACDONALD, of the Firm of Macdonald Brothers, of Portsoy, in the County of Banff, Engineer, do hereby declare the nature of my invention to be as follows:—

This invention has reference to and comprises improvements in and relating to rakes, more particularly such as are employed for hay, straw and like materials, and consists in substituting metal teeth for the wooden teeth usually employed, which will render such rakes more durable and freer and quicker in working than as heretofore constructed.

In carrying this invention into effect or practice the teeth of the rake are formed of steel, iron, or other suitable metal of the necessary length. The lengths are of curved or approximately semi-circular shape in section and are driven into a wooden bar at spaced distances apart. Otherwise the teeth may be rivetted to or secured to a metal bar.

The teeth so secured, are arranged with their convex side towards the handle or facing the pull of the rake. The handle is preferably secured to the bar by a bracket bolted or rivetted to same and formed with a recess or pocket to receive the end of the handle which is secured to the outer end of the bracket by a screw nail or other fastening, but other methods of attaching the handle may be employed.

Dated the 18th day of December, 1912.

W. R. M. THOMSON & Co.,
96, Buchanan Street, Glasgow,
Agents.

COMPLETE SPECIFICATION.

Improvements in and relating to Rakes.

I, ALEXANDER MACDONALD, legal representative of the late JAMES MACDONALD, of the Firm of Macdonald Brothers, of Portsoy, in the County of Banff, Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being made to the accompanying drawings:—

This invention has reference to and comprises improvements in and relating to rakes, more particularly such as are employed for hay, straw and like materials, and consists in substituting metal teeth of a curved shape in cross section for the wooden teeth usually employed, which will render such rakes more durable and freer and quicker in working than as heretofore constructed.

Heretofore it has been known to form the teeth of rakes of a curved cross

[*Price* 8*d*.]

Appendix 3

SCOTTISH FISHERIES MUSEUMS COLLECTIONS RELATING TO STEAM POWERED FISHING GEAR

A list of steam capstans, line-haulers and related items in the Scottish Fisheries Museum collections at Anstruther.

1. "Iron man" manually operated line-hauler

2. Steam capstan by Elliott & Garrood, formerly fitted on zulu drifter *Research*, LK62

3. Engine from steam capstan (Elliott & Garrood), formerly used at Boddam in connection with the barking of nets

4. Miscellaneous cast iron and wooden whelps from the barrel of a steam capstan (Elliott & Garrood), found on a beach, Mainland Shetland

5. Steam capstan by MacDonald Brothers. Currently fitted on fifie drifter *Reaper*, FR958

6. Steam line-hauler by Elliott & Garrood

7. Steam line-hauler by MacDonald Brothers (x3, with two variations in design)

8. Standard wooden despatch crate (x2) with iron carrying handles and metal hasp, for transporting line-hauler (dimensions: 55 x 96 x 50cm deep); MacDonald Brothers, Portsoy

Note: None of the above items on this list appear in the MODES database at the SFM and it would be desirable to correct this omission.

9. Steam capstan spanner (x2); iron, painr=ted black; carrying maker's name and origin (MacDonald Brothers, Portsoy); both spanners have been broken off at one end. Record no: ANSFM: 1994/336/1-2

Appendix 4

GAZETTEER: MONTROSE ROPE 'N SAIL COMPANY

Brief descriptions of each feature are included in the gazetteer below. The location of each feature is described, utilising the alphabetical label for the relevant building. Each feature is then labelled numerically. Site artefacts are labelled alphanumerically (A1-A3).

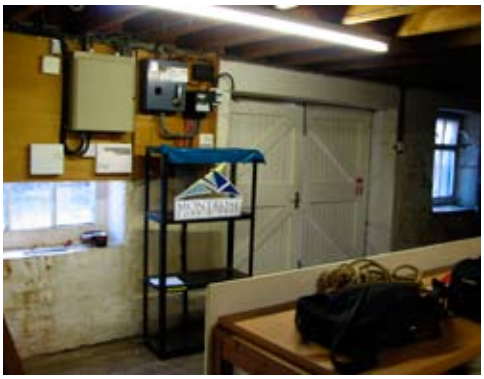
Location Label	A-D
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	Main block of buildings
Description	These four letters indicate the four attached sections of the main block of the ropeworks complex and will be described in further detail below.

Location Label	A
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	store/office
Description	Piend-roofed two-storey section of the building built up against the end wall of that adjoining to the east (B). The façade is set back and attaches at a right angle in the approx. centre of the adjoining wall to the east. The facade has a window and timber door at the ground floor and a window at the first floor. There is another window in the west wall at the first floor. The windows are all timber-framed in two parts with four panes each. Openings at the ground floor on the west side were obscured from view by the site boundary wall. The south wall and visible part of the west wall of the building are finished in dry-dash. The north wall of the building is constructed of brick. The roof is finished in slate.

Location Label	A
Floor/Room	ground floor
Elevation	–
Feature Label	–
Feature Name	store
Description	not accessible at time of visit

Location Label	A
Floor/Room	first floor
Elevation	–
Feature Label	–
Feature Name	office
Description	Basically square room with simple cornice running around. Window in south wall, window and press in west wall, door and fireplace on east wall.

Location Label	B
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	rope shed
Description	Gable-roofed two-storey rectangular section of building with stone skews and a capped chimney at its west end. Three bays at ground floor with central timber double door and flanking timber windows. Two paired sets of windows at the first floor. Roof finished in slate. An entrance to the first floor is in the return of the east wall and is accessed by a stair built against the front of the adjacent building (C).



Location Label	B
Floor/Room	ground floor
Elevation	–
Feature Label	–
Feature Name	–
Description	Rectangular room split into storage and reception areas by partition wall running north-south. West end of space is storage area, with access to building A concealed behind tarpaulin nailed to wall. North wall is finished in plasterboard. East wall has door into building C's ground floor (ropewalk). South wall has two window openings flanking a central double-door.

Location Label	B
Floor/Room	first floor
Elevation	–
Feature Label	–
Feature Name	–
Description	Rectangular space with timber flooring raised above the floor level in A. Door into the first floor of A in west wall. Two windows in south wall. Open to first floor of building C at north side of east wall and exterior door in south side of east wall. Built in cabinets against north wall.

Location Label	C
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	rope walk (ground floor) / sail loft (first floor)
Description	This two-storey section of the building is gable-roofed and rectangular. There are two windows and a door at the ground floor (one of the windows is square and the other rectangular) and six bays at the first floor, which are clearly defined by larger rectangular windows. The front wall is masonry built and finished in dry-dash. The exterior of the north wall is also finished in dry-dash. The north wall has five openings at the first floor and is masonry for the western 5 bays. It changes to brick for the last bay before the east end wall, which is also built in brick and is supported by a steel girder at ceiling level at the ground floor.

Location Label	C
Floor/Room	ground floor
Elevation	–
Feature Label	–
Feature Name	rope walk
Description	Section of ropewalk later incorporated into building C. Rectangular area with door into B on west wall, door and window openings on south wall and blocked openings, and access to an attached lean-to, on its north wall. The eastern extent of C is defined by a steel beam (visible at ceiling level) that supports the east wall of the first floor. The floor in C is level with that in B.

Location Label	–
Floor/Room	–
Elevation	north wall
Feature Label	37
Feature Name	blocked window
Description	Bricked up window opening flush with masonry rubble wall surface

Location Label	–
Floor/Room	–
Elevation	north wall
Feature Label	41
Feature Name	blocked window
Description	Bricked up window opening flush with masonry rubble wall surface

Location Label	
Floor/Room	
Elevation	north wall
Feature Label	42
Feature Name	blocked window
Description	Bricked up window opening flush with masonry rubble wall surface

Location Label	–
Floor/Room	–
Elevation	south wall
Feature Label	44
Feature Name	window
Description	Square four-light window in masonry wall.

Location Label	–
Floor/Room	–
Elevation	south wall
Feature Label	45
Feature Name	window
Description	Rectangular window in masonry wall

Location Label	–
Floor/Room	–
Elevation	south wall
Feature Label	46
Feature Name	door
Description	Exterior door in masonry wall.

Location Label	–
Floor/Room	–
Elevation	south wall
Feature Label	47
Feature Name	blocked opening (window)
Description	Blocked up rectangular window opening in masonry wall

Location Label	C
Floor/Room	first floor
Elevation	–
Feature Label	–
Feature Name	sail loft
Description	A rectangular room oriented west-east, accessed through B and with a timber floor level with that in B, with window openings along the north and south masonry walls. The east wall of B is constructed of brick and the easternmost bay in the north wall is also constructed of brick.

Location Label	D
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	rope walk
Description	The rope walk is a single-storey gable-roofed structure, approximately 150 metres in length, with a rubble masonry north wall and a brick south wall. Both walls have regularly spaced window openings, although they don't align exactly from north to south across the interior space. There are two changes in the roof structure of the ropewalk and at least one straight joint (feature 7) visible in the north wall. The south wall changes from machine-made brick in the area of C to hand-made brick further to the east (feature 55). A limewash coats the interior surfaces of both walls.

Location Label	D1
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	west of change in roof 1
Description	One of the changes in the roof structure is visible to the west side of the photo, to the right of feature 55 (straight joint in wall).

Location Label	–
Floor/Room	–
Elevation	north wall
Feature Label	33
Feature Name	blocked window
Description	bricked up window opening flush with masonry rubble wall surface

Location Label	–
Floor/Room	–
Elevation	north wall
Feature Label	36
Feature Name	blocked window
Description	Bricked up window opening flush with masonry rubble wall surface

Location Label	–
Floor/Room	–
Elevation	north wall
Feature Label	34
Feature Name	whale bone
Description	Whale bone oriented vertically and built into masonry walling. There is a small square slot (approx. 2cm square) about halfway up the bone and a larger, rectangular slot (approx. 10cm wide x 20cm high) just above it, that likely held a wooden beam similar to that visible in feature 6.

Location Label	–
Floor/Room	–
Elevation	north wall
Feature Label	35
Feature Name	whale bone
Description	Whale bone oriented vertically and built into masonry walling. The top of the bone has been squared off and there is a round slot (approx. 8cm in diameter) about halfway up the bone and a larger, rectangular slot (approx. 10cm wide x 20cm high) just above it, that likely held a wooden beam similar to that visible in feature 6.

Location Label	D1
Floor/Room	–
Elevation	–
Feature Label	40
Feature Name	belt drive
Description	Belt drive oriented west-east that has been bolted to metal brackets which are attached to the base of roof trusses. There is a metal strap with a pair of spikes projecting downward in its centre (a belt guide?) mounted to the trusses just north of the belt drive. The belts for the drive are not in place and presumably would have attached to machinery mounted nearby.

Location Label	D1
Floor/Room	–
Elevation	south wall
Feature Label	48
Feature Name	window
Description	Rectangular window opening - timber frame in thin machine-made brick wall

Location Label	D1
Floor/Room	–
Elevation	south wall
Feature Label	49
Feature Name	sliding door
Description	Panelled timber sliding door on overhead cast iron track mounted to machine-made brick wall

Location Label	D1
Floor/Room	–
Elevation	south wall
Feature Label	50
Feature Name	paired window
Description	Rectangular window opening - timber frame in thin machine-made brick wall (features 51-54 are of same construction)

Location Label	D1/D2
Floor/Room	–
Elevation	south wall
Feature Label	55
Feature Name	straight joint
Description	Change in wall composition from machine-made brick (west of the joint) to hand-made brick (east of the joint)

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	24
Feature Name	blocked window
Description	Window opening bricked up flush with exterior wall face; timber lintel and slot (for shutter pivot?) at right side of opening.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	25
Feature Name	blocked window
Description	Window opening bricked up flush with exterior wall face; timber lintel.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	27
Feature Name	blocked window
Description	Window opening bricked up flush with interior masonry rubble wall surface; no evidence of lintel.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	29
Feature Name	blocked window
Description	Window opening bricked up flush with interior masonry rubble wall surface; timber lintel.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	30
Feature Name	blocked window
Description	Window opening blocked up with masonry flush with exterior rubble wall surface; timber lintel.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	32
Feature Name	blocked window
Description	Window opening bricked up flush with interior masonry rubble wall surface; no evidence of lintel.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	23
Feature Name	whale bone
Description	Whale bone with squared off top approx. 1.5m in height oriented vertically and built into masonry walling west of feature 25. There is a rectangular slot (approx. 10cm wide x 15cm high) cut into the bone that likely held a wooden beam similar to that visible in feature 6.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	26
Feature Name	whale bone
Description	Whale bone with squared off top approx. 1m and 15cm in height oriented vertically and built into masonry walling. There is a rectangular slot (approx. 10cm wide x 15cm high) cut into the bone that likely held a wooden beam similar to that visible in feature 6.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	31
Feature Name	whale bone
Description	Whale bone with squared off top approx. 1.5m in height oriented vertically and built into masonry walling west of feature 32. There is a rectangular slot (approx. 10cm wide x 15cm high) cut into the bone that likely held a wooden beam similar to that visible in feature 6.

Location Label	D2
Floor/Room	–
Elevation	–
Feature Label	28
Feature Name	rail
Description	A wooden rail with 7 iron hooks (5 of one type - blacksmith made? - and 2 that appear machine-made).

Location Label	D2
Floor/Room	–
Elevation	nr. south wall
Feature Label	63
Feature Name	pit
Description	A shallow pit of approximately 1m in diameter dug into the earth floor just off the south wall. Pers. comm., the pit is fairly recent. A copper pot sat in it, which was used to dip netting twine and turn it green (the green stain visible on the wall behind the pit is Cupranol). A corrugated plank sat on top of the copper. This was where the twine was laid out to drain back into the vat.

Location Label	D2
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	flooring-tar barrel staves (continues into D3)
Description	The tar barrel staves have been laid on the packed earth floor.

Location Label	D3
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	east of change in roof 1
Description	

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	1
Feature Name	blocked window
Description	Sloping masonry cill, wooden lintel; evidence of rebuilding around this window - brick to both sides.

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	2
Feature Name	blocked window
Description	Sloping masonry cill, wooden lintel; evidence of rebuilding around this window - brick to both sides.

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	3
Feature Name	blocked window
Description	Damaged sloping masonry cill, wooden lintel; masonry to west side with lower brick repair; bit of masonry with brick above to east side of opening with one missing brick.

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	4
Feature Name	blocked window
Description	Sloping masonry cill, wooden lintel; evidence of rebuilding around this window - brick to both sides; one missing brick to right side.

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	5
Feature Name	blocked window
Description	Sloping masonry cill, wooden lintel; brick repair to left and right of opening in V shape; missing one brick to right side.

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	8
Feature Name	blocked window
Description	Sloping masonry cill, wooden lintel with dowel hole in front; brick repair to left and right of opening in V shape; missing one brick to right side.

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	11
Feature Name	blocked window
Description	Flat cill, lintel is possibly a ship's timber (3 dowel holes at bottom side); brick repair in V shape.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	12
Feature Name	blocked window
Description	Flat brick cill, 2 wooden lintels - one to south and one to north (possibly re-used ship's timbers); south lintel has dowel holes to bottom side, north lintel has dowel holes front to back.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	17
Feature Name	blocked window
Description	Flat cill, rough timber lintel with dowel holes (re-used ship's timber); brick repair to right side.

Location Label	D1
Floor/Room	–
Elevation	north wall
Feature Label	19
Feature Name	blocked window
Description	Sloping cill, regular timber lintel; brick repair to west and east of opening.

Location Label	D1
Floor/Room	–
Elevation	north wall
Feature Label	21
Feature Name	blocked window
Description	Sloping masonry cill, more substantial sized timber lintel (re-used ship's timber); brick repair to left and right.

Location Label	D1
Floor/Room	–
Elevation	north wall
Feature Label	22
Feature Name	blocked window
Description	Flat cill, timber lintel (re-used ship's timber with dowel holes back to front); brick repair to west and east of window opening.

Location Label	D3
Floor/Room	–
Elevation	north wall
Feature Label	6
Feature Name	whale bone
Description	To west of feature 5; timber support with upright peg near south end inserted into a slot near the top of the whale bone (possibly used to support rope).

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	13
Feature Name	whale bone
Description	To west of feature 11; slot near the top of the whale bone similar to that holding timber support in feature 6.

Location Label	D2
Floor/Room	–
Elevation	north wall
Feature Label	18
Feature Name	whale bone
Description	

Location Label	–
Floor/Room	–
Elevation	nr. north wall
Feature Label	–
Feature Name	30 fathom mark
Description	painted on floor just east of feature 18

Location Label	D3
Floor/Room	–
Elevation	–
Feature Label	7
Feature Name	straight joint in wall
Description	Straight joint with similar squared sandstone masonry blocks to either side; upper part of wall to east (right) of joint is brick-built.

Location Label	D3
Floor/Room	–
Elevation	nr. north wall
Feature Label	–
Feature Name	40 fathom mark
Description	Painted on floor just west of features 5 and 6.

Location Label	D3
Floor/Room	–
Elevation	–
Feature Label	10
Feature Name	Spindle bobbin
Description	Wooden spindle bobbin oriented north-south 'hanging' between two vertical mounts attached to truss running south from feature 8.

Location Label	D3
Floor/Room	–
Elevation	–
Feature Label	9
Feature Name	rail
Description	Wooden rail with cast iron hooks laid across wall heads just east of feature 8.

Location Label	d1
Floor/Room	–
Elevation	–
Feature Label	20
Feature Name	rail with hooks
Description	Laid across wall heads just west of feature 18.

Location Label	D3
Floor/Room	–
Elevation	–
Feature Label	14
Feature Name	post
Description	Timber post in centre of floor/easternmost of 3.

Location Label	D2
Floor/Room	–
Elevation	–
Feature Label	15
Feature Name	post
Description	Timber post in centre of floor/central of 3.

Location Label	D2
Floor/Room	–
Elevation	–
Feature Label	16
Feature Name	post
Description	Timber post in centre of floor/westernmost of 3.

Location Label	D3
Floor/Room	–
Elevation	–
Feature Label	56
Feature Name	window opening
Description	Height reduced at some point (lower part of opening bricked up); window in top of opening covered by corrugated sheet; wooden lintel.

Location Label	D3
Floor/Room	–
Elevation	–
Feature Label	57
Feature Name	window opening
Description	Height reduced at some point (lower part of opening bricked up); window in top of opening covered by corrugated sheet; wooden lintel; brick missing in right margin (slot to accommodate pivot for shutter?).

Location Label	D3
Floor/Room	–
Elevation	south wall
Feature Label	58
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins.

Location Label	D3
Floor/Room	–
Elevation	south wall
Feature Label	60
Feature Name	window opening
Description	Window opening with wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window; brick missing from right margin (slot to accommodate pivot for shutter?).

Location Label	D3
Floor/Room	–
Elevation	south wall
Feature Label	61
Feature Name	window opening
Description	Window opening with timber lintel; covered by corrugated sheet.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	64
Feature Name	window opening
Description	Window opening with timber lintel; covered by corrugated sheet held against inside of window by a board set into slots at either side of the margins.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	65
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins.

Location Label	D3
Floor/Room	–
Elevation	south wall
Feature Label	66
Feature Name	window opening
Description	Window opening with timber lintel; covered by corrugated sheet held against inside of window by a board set into slots at either side of the margins.

Location Label	D3
Floor/Room	–
Elevation	south wall
Feature Label	67
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins; brick missing in right margin.

Location Label	D3
Floor/Room	–
Elevation	south wall
Feature Label	69
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins; brick missing in right margin.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	70
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins; brick missing in right margin; right side of opening covered by thick wooden planks that run partway down the wall below.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	72
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins; brick missing in right margin that appears to serve as pivot for the wooden cover.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	73
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	74
Feature Name	blocked door opening
Description	Bricked up door opening with wooden lintel.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	75
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins; brick missing in right margin.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	76
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	77
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins; brick missing at left side of margin.

Location Label	D2
Floor/Room	–
Elevation	south wall
Feature Label	78
Feature Name	window opening
Description	Wooden lintel; cover is made of wooden planks held together by cross-pieces and held against inside of window by a board set into slots at either side of the margins; brick missing at left side of margin.

Location Label	D2/D3
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	flooring-tar barrel staves (continues from D2)
Description	Flooring in D3 continues from D2; again, barrel staves laid on packed earth.

Location Label	D4
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	not accesible
Description	Not accessible - The eastern length of the ropewalk (approximately 84 metres) is blocked off by a brick wall running north to south on the interior of the structure roughly 94 metres from the east wall of C. From the exterior, this section of the ropewalk has a masonry north wall of the same construction of D1-D3, a hand-made brick south wall with a low brick-built buttress centred between each window opening and is roofed in corrugated sheeting with regularly-spaced skylights, where visible.

Location Label	E
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	hatchelling house
Description	Single storey gable-roofed structure oriented west to east along the south property line, built up against the boundary wall. It has a taking-in door in the gable end of the west wall. There in an entry into the ground floor at the north side of the building. It is finished in dry-dash matching that on buildings A-D and has a slate roof.

Location Label	F
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	boiler
Description	Cylindrical timber boiler atop timber supports with a peaked, ivy-covered roof; also referred to as a barking house.

Location Label	G
Floor/Room	–
Elevation	–
Feature Label	–
Feature Name	storage shed
Description	Masonry-built single storey gable roofed structure oriented north-south with stone skews at both ends and a capped chimney at the south wall. Four bay east elevation with two windows a door and a window. South wall shows extensive evidence of rebuilding and has a timber garage door and a blocked window at the ground floor and a blocked window opening in the gable end. There is a blocked fireplace in the chimney breast on the interior of the south wall of the building.

Location Label	–
Floor/Room	–
Elevation	–
Feature Label	79
Feature Name	whale bone
Description	Westernmost whale bone sited to south of enclosed rope walk (D); likely incorporated in north wall of second rope walk, which is no longer extant.

Location Label	–
Floor/Room	–
Elevation	–
Feature Label	80
Feature Name	whale bone
Description	Easternmost whale bone sited to south of enclosed rope walk (D); likely incorporated in north wall of second rope walk, which is no longer extant.

Artefact Gazzetter

Artefact No.	A1
Feature Name	Ropemaker's tops: 1 x 4 strand; 1 x 3 strand

Artefact No.	A2
Feature Name	Serving mallet

Artefact No.	–
Feature Name	Wooden object 'tensioner'? (on right of image)

Artefact No.	A4
Feature Name	2 x rigger's screws

Artefact No.	A5
Feature Name	3 x marlin spikes. No image.

Artefact No.	A6
Feature Name	Yarn coil winder (wood) and vertical wooden post and second winder

Artefact No.	A7
Feature Name	Belt driven yarn spinner

Artefact No.	A8
Feature Name	Rope Jacks (7 in number; 1 belt driven; 6 hand cranked) Some with 3 hooks, some with 4 hooks, one with 6 hooks. Image shows a 4 hooked example

Artefact No.	A9
Feature Name	Sledges (3 in total) one without base and wheels (Note: to adjust for laying up ropes of different gauges, the appropriate pinion wheel is fastened to the sledge by means of a spun yarn strop tensioned by a Spanish windlass. Image shows one example.

Artefact No.	A10
Feature Name	Spinning wheel (yarn spinner)

Artefact No.	A11
Feature Name	2 x large diameter iron wheels

Artefact No.	A12
Feature Name	"Handy Pick" chain and wire rope cutter

Artefact No.	A13
Feature Name	Setting fid - iron

Artefact No.	A14
Feature Name	Setting fid - wood (found in the Tar House)

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AERIAL PHOTOGRAPHS

The vertical aerial photographs held by the NMRS and examined in the course of the assessment are summarised below.

Sortie	***Frames***	***Date***
B_0010	3013,3015	1946
B_0146	5121	1947
OS73-353	40	1973
ASS/518/88	125,126	1988
106G/UK/0750	5051,5052	1945
OS_66_036	054, 55	1966
ASS/607/88	035,036	1988
ASS/643/88	223	1988

OTHER ROPEWORKS IN THE NMRS DATABASE

- Blackford (NN80NE 17)
- Marine Terrace in Cromarty (NH76NE 51)
- Glasgow
    1. 52 Bellfield Street (NS66SW 829)
    2. 19 Stobcross Street (NS56NE 2138)
    3. 272 Helen Street (NS56SW 159)

OTHER SOURCES

See Appendix 1.

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