THE MIDLAND WIND AND WATER MILLS GROUP

This Journal is published by the Midland Wind and Water Mills Group, which is concerned with the study of the history and technology of mills and with their preservation and restoration. Its area is the region loosely defined as the Midlands, especially the central counties of Staffordshire, Shropshire, Worcestershire and Warwickshire.

The group holds monthly meetings, with talks and discussions, during the winter, and arranges mill tours and open days during the spring and summer. Members periodically receive a Newsletter and the Journal.

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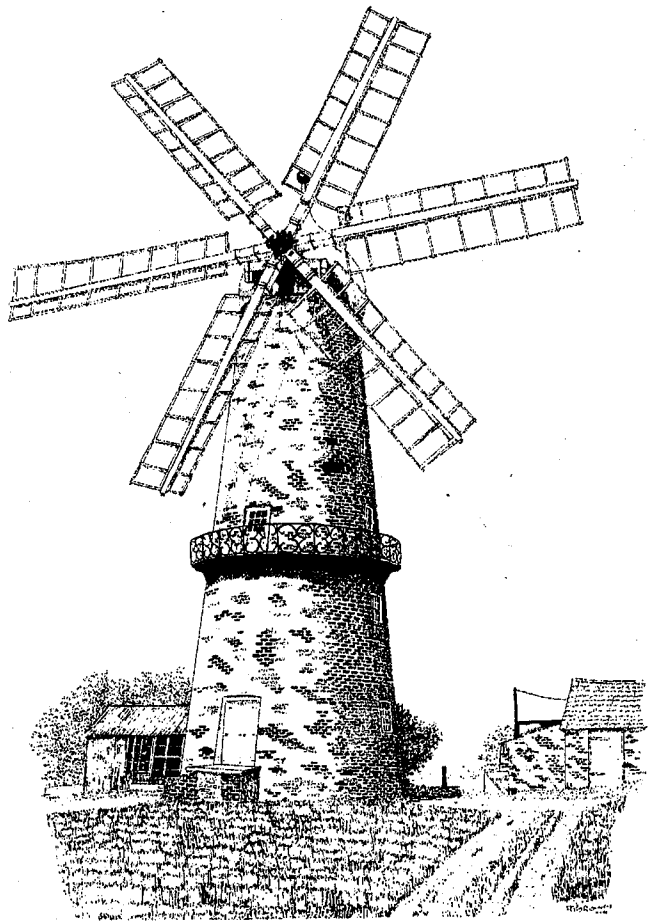
Wind and Water Mills

Number 25



The Midland Wind and Water Mills Group

Wind and Water Mills is the Journal of the Midland Wind and Water Mills Group and is therefore naturally concerned with the mills of the Midlands, but it is not intended to be narrowly parochial. Interesting and important articles relating to mill matters in other parts of Britain and the world will be included whenever available. In general, articles by members will have priority for publication, but submissions by non-members will be willingly included.

Cover illustration: Trader Mill at Sibsey in Lincolnshire. A fully workable six-sailed windmill. See pages 34 - 61.
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Wind and Water Mills

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Number 25

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THE MILLS ON LEA BROOK, DERBYSHIRE

by George Wigglesworth

The Lea Brook (known as Lede, at the time of Domesday[1] and Leyh in 1519) is a tributary of the River Derwent, on its eastern side, about 3 or 4 miles south of Matlock in Derbyshire. It is a short watercourse (SK 3458 to 3156) but because of its reliability and noticeable fall it has seen up to possibly fourteen sites dependent on its stream for power. In its most significant length of 3 km it falls 100m. Its immediate source is its own nearby watershed, as a result of which it rises quickly. It is also situated at the south-east end of East Moor, an aquifer which feeds many springs, and these, together with the peaty ground, create a sustained supply. It reveals a number of locations where little or nothing is known and also many sites which may be known by a variety of names, as well as sites which have disappeared. Many people have authoritatively tried to bring some order to the problems identified but many of these problems still remain.

Lead smelting took place in this valley although there were no lead ore-bearing strata, even though such were to be found in neighbouring parishes as near as a mile away. For smelting a reliable, sustained, surface flow of water was needed which was not to be found in many of the adjoining limestone areas and also large quantities of wood for fuel were needed. Lead mining and extraction was an industry of cyclical profits, as responding to new techniques made less rich ores commercially viable. The upgrading of facilities caused by the introduction of these new techniques makes the interpretation of some of the sites difficult. The censuses in the 19th century reveal that twice as many people in the three Lea Valley villages of Dethick, Lea and Holloway, worked at the lead smelters as opposed to in mining.[2] It is a valley where the landowners took an interest in their employees and tenants, perhaps now judged by some as paternalistic. Evidence of this is to be found in the inoculation of village children paid for by Peter Nightingale,[3] the workers' welfare, health and religious concerns of John Smedley[4] and the local Sunday School movement.[5]

The developments in the 18th and 19th centuries revolved to a large extent round the Nightingale family who generated a large holding in property and the lead industry. Three generations of this family predominate, Thomas Nightingale (1665/6 - 1735), and a father (1705 - 1763) and son (1737 - 1803) both called Peter Nightingale. The latter had no legitimate family and left his estate to his great nephew, William Edward Shore, who then adopted the surname Nightingale

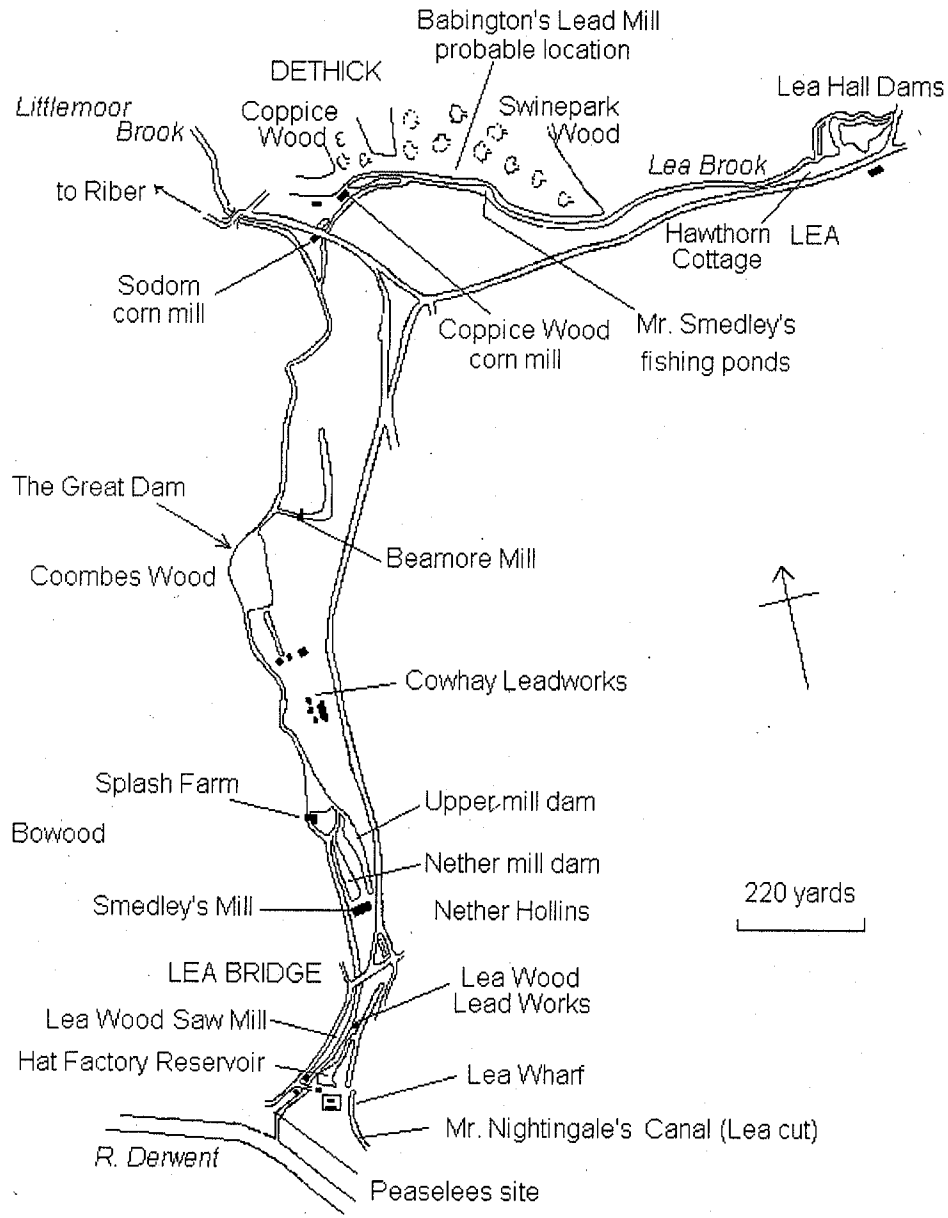


Figure 1. Map of the Lea Brook showing the sites where waterpower has been used.[6]

and was the father of Florence Nightingale. Because of the extensive involvement of the Nightingale family there was often no necessity to record water rights, storage and usage. This is particularly a problem in the lower half of the valley. Dam walls can be identified and flat areas where some of the millponds were situated, but it is sometimes difficult to attribute a date when some were built or improved. Also their use seemed to bear on mills anywhere below them in the valley.

At the present time Lea Brook is a clear, fast flowing stream, 2 to 3 metres wide, which supports grey wagtail, dipper and kingfisher families. However, in the middle of the twentieth century it was polluted, being an open sewer in the lower reaches or carrying farm waste such as skimmed milk dumped near its source.

1 & 2. Upper and Lower Lea Mills

The documents transcribed by Avrom Saltman[7] such as one in 1360, refer to two mills in Lea, and one in Dethick which was a separate lordship. Unfortunately, the passage of time has greatly obscured the solution of the issues connected to these two sites. Firstly, an attempt has to be made to identify these two mills when, perhaps, more than one name was used for the same mill, and then to locate the building in times past and discover if it coincides with any present building.

A contemporary account of paths describes one from Upper Holloway to Dethick as being "beneath the mill" which draws attention to the Hawthorn Cottage site (SK 332575). The elevation of two ponds nearby, across the road from Lea Hall,[8] and the rapid fall of the stream make it possible that this was the location of Upper Lea Mill.[9] Hawthorn Cottage is the only substantial building on that side of the road thereabouts and has a height of about 17 feet from its foundations on the stream bank to road level where the present house is contained in the two upper storeys. The lower storey has substantial walls, an earthen floor and two windows. It has the feeling of a high, industrial space. At the present time there are no indications of a mill wheel to be discerned. In the 14th century Upper Lea Mill was said to be only milling oats and hardly worth 10/- per annum (about £200 per annum by contemporary comparison).

The Lower Lea Mill is impossible to locate without a considerable element of doubt. There was a mill at Coppice Wood (see below) shown on a map of 1718 but this is in the Dethick lordship not that of Lea.[8] If one of the Lea mills was just below Coppice Wood, at the confluence of Littlemoor Brook and Lea Brook, as was the second one shown on the map, then Lower Lea Mill could be the "mill at Sodom" (see below). If Lower Lea Mill was elsewhere in the manor of Lea, such as at Lea Bridge, then subsequent changes make any deductions regarding its location impossible.

The millers of the two Lea mills in the 14th century included "Adam" and "Robert". By 1367 the mills were, to an extent, decrepit, but before 1370 William of Wakebridge rebuilt the lower mill. The name "Nether Mill" was in use in 1633 when Wendesley Blackwall occupied it. It was sold by Elizabeth, the co-heiress of the Earl of Shrewsbury, and her husband the Earl of Kent.[10] Reference to the Upper and Nether corn mills at Dethick in 1760 stresses the problem caused by the names used because there does not appear to be any other reference to there being two mills in the parish of Dethick.

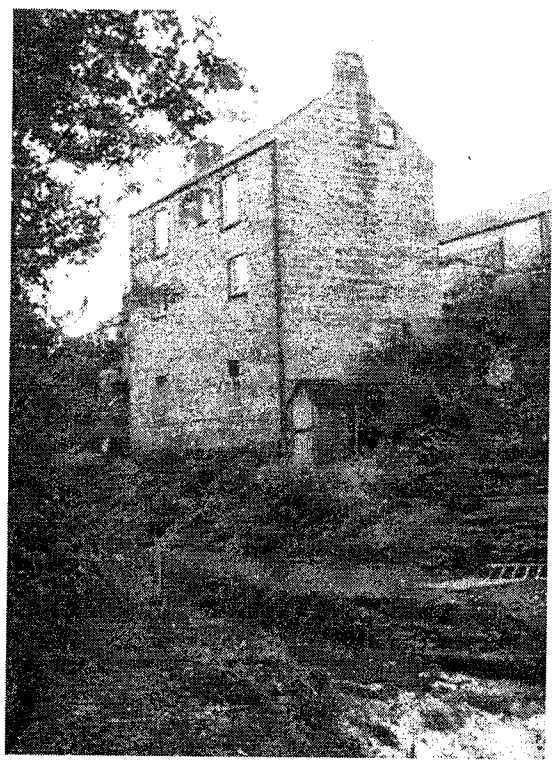


Figure 2. Hawthorn cottage.

3. Swine Park Wood/Coppice Wood Lead Mill (SK 323578)

The names given to the significant woods have changed over time. Swine Park Wood is now divided, creating a separate section, called Coppice Wood, which is nearer to the remains of some mill dams.

The Babington family of Dethick had an important position as lead merchants and in lead smelting (with boles at Riber, Ashover, Barrel Edge for example).[10]

When Anthony Babington was hung, drawn and quartered in 1586 for treason in the aftermath of a conspiracy to rescue Mary, Queen of Scots, from nearby Wingfield Manor, the family muniments were seized and an inventory refers to an ore hearth smelting mill being in use, with bellows, located in a wood.

Evidence of the exact location on Lea Brook of this lead smelting is sparse. However, lead slag has been found south of the building remains, upstream of the existing Dethick Corn Mill (see below), and lead has been found at 500 p.p.m. in an analysis of stream sediments there.[11] Also two bowl-shaped lead ingots have been found thereabouts. The bodies of water named as "fish ponds" a little upstream were reportedly excavated on instructions from J. B. Marsden Smedley in the first half of the 20th century but whether he exploited existing works is unclear.

4.Coppice Wood, Dethick, or Lea Corn Mill (SK 323578)

This mill is on the Dethick side of the manor boundary, but while it was known as "Dethick Mill" in the 1851 census,[12] later, in the 19th and 20th century, it was called "Lea Mill". It became disused before the census in 1881. Traces of mill buildings can still be found. The pictogram on a map of 1718 shows that it had an undershot waterwheel.[8] There are the remains of a weir and a small dam with an external stone revetment on the north side of the valley, upstream from the house, which is now a fashionable private dwelling. The water was

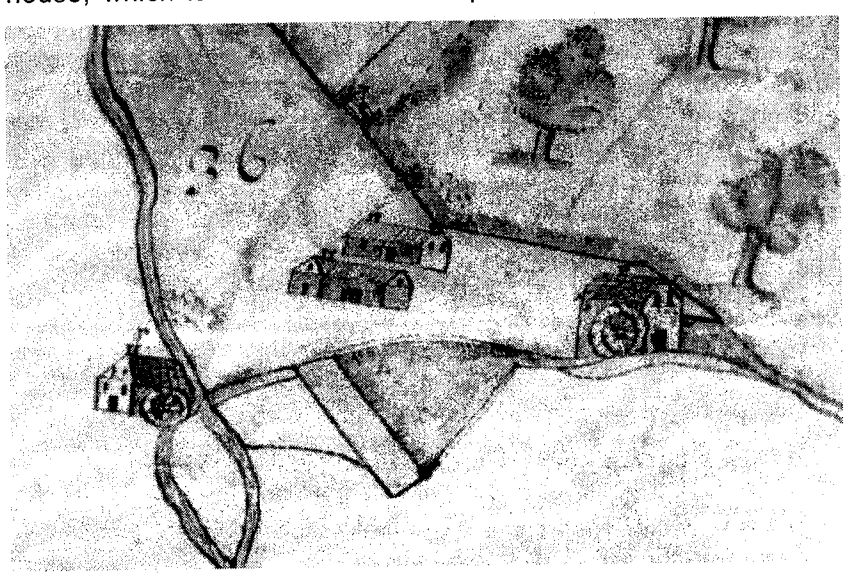


Figure 3. Map of 1718 showing the mills at the confluence of the Lea and Littlemore Brooks.[8] (Reproduced by permission of the Derbyshire Record Office.)

taken to a wheelpit (now choked) by a cast iron pipe of rectangular cross-section through the western end of the dam.[13] The tailrace fed a pond, now having ornamental ducks, but presumably this provided the water supply for the next mill downstream.

In the censuses and trade directories Charles Else, senior, was the miller in 1829,[14] followed by Charles Else, junior, from 1841 to 1871.[12,15,16] Corn being transported to corn mills was exempt from paying tolls on the Cromford-Langley Mill turnpike. The corn mill at Coppice Wood (as well as the one at Pear Tree Farm (see below)) seems to have become disused in the 1880s.[17] This was a time when flour began to be imported in bulk from North America and milling grain by steel rollers was being introduced. Isaac Spencer and Samuel Coupe are named as millers between 1821 and 1860 but it is not clear where they worked or if they were employees rather than proprietors.

5. Mill at Sodom (SK 322577)

As previously mentioned there was a mill shown at the confluence of the Littlemore Brook with the Lea Brook which features as a drawing on the map of 1718.[8] There it is shown with an undershot wheel fed from the dam, which can be seen on the opposite side of the road to the position of the mill. Its tailrace and the course of Littlemoor Brook are not clear, but the latter is less reliable than Lea Brook as a sustained source of power in times of little rain. Although a building is shown on the 1st edition of the 25 inch OS map, all that remains is a point where the water supply ran through the wall. However, this mill's identity is nowhere revealed and so it is given the name above, using the 19th century name for the area, but it is perhaps the best location for "Lower Lea Milne" (see above).

6. Pear Tree Farm/ Beamore Corn Mill (SK 320572)

Pear Tree Farm was previously known as Beamore Farm. Steven Turner wrote that Peter Nightingale (1736-1803) had Beamore Corn Mill built in about 1794, on the end of the farm where his family had lived for many years.[18] It could well have been erected by Joseph Wass, senior, a millwright who had recently arrived in the area from Mansfield. It was seen as a replacement for the corn mill at Lea Bridge (see below).[19] Supposing, as seems likely, that this is the one mentioned in an advertisement for a "newly erected mill" in 1797,[20] then it had four pairs of stones, a carriage road under the mill for loading, and an "overfall wheel" thirty-four feet in diameter producing "power to spare". The miller in 1841 was Robert White and the mill was then called "Lea Mill".[14] The census, by reference to "Lea Old Corn Mill" in 1861, suggests that it ceased to be a corn mill before that date.[15] It was remembered by Turner as a sawmill/ joiner's shop.

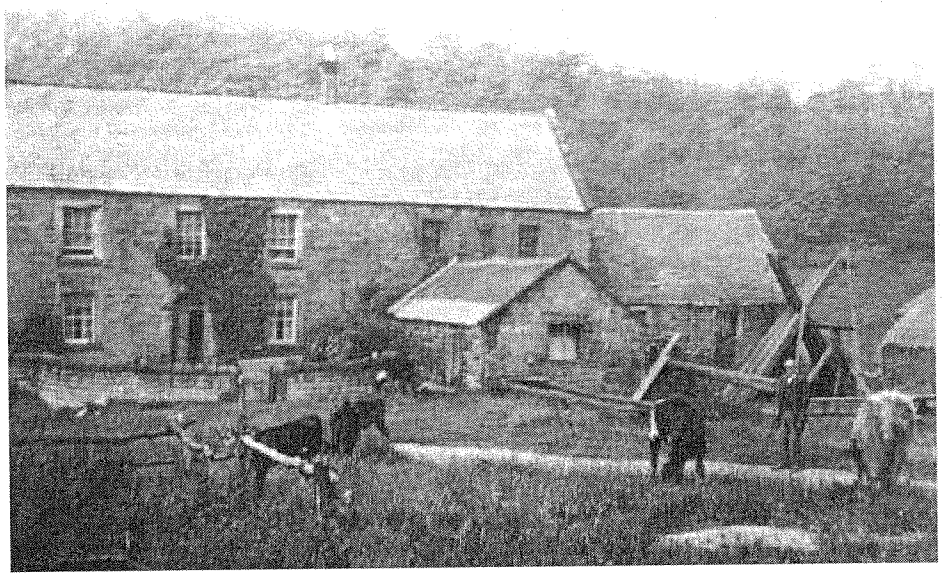


Figure 4. Pear Tree Farm.

Figure 5. Pear Tree Farm showing the extensive buildings at the rear.

There is a dam nearer the road and there has been a description of a headrace. The wheelpit has been filled in but the alignment of a tail-race has been discerned running from the farmyard towards the stream.[13]

7. Cowhay Lead Smelter (SK 319568)

Lead smelting is the process whereby lead ore, usually galena (lead sulphide), is reduced to metallic lead by the application of sufficient heat. In early times boles were sited on hilltops, using wood as the fuel and wind for the draught.[21] This is known to have been the method used in Roman times and probably even earlier. An alternative method, known to be used by the ancient Greeks, was to use a forced draught created by bellows (powered by foot or by animal). Later the fuel used for smelting slag was "white coal" (dried chips of wood), or charcoal, and later still, coal.[22] Open hearths were enclosed and the improvement of designs, such as, eventually, the cupola, made the heat retention and a forced draught from a tall chimney often sufficient.[23] The term hearth can be used as a general term when waterpower was used in a smelting mill.

The early history of the Cowhay smelter runs parallel with that of the Hollins which was eventually to become a textile mill (see below). In 1630 the Spateman family seem to have been involved with both the Hollins and with a site which can be identified with Cowhay. In 1682 the younger John Spateman bought them from John Wigley. In the first third of the eighteenth century the Nightingale family became increasingly involved. Their involvement was to continue until the last three or four years prior to the closure of the lead smelter in 1934. In about 1710 Thomas Nightingale was involved (with Thomas Allen) as leaseholder.[24] By 1732 he owned half the mill and two years after his death his son Peter, having inherited his father's half share, bought the other half from Samuel Clarke, who was related to the Spatemans by marriage.[25] Peter Nightingale, junior, was a central figure involved with the smelter and in the villages of Dethick, Lea and Holloway, but on his death executors and trustees managed the site. These included John Alsop whose family was connected to the Wass family by marriage. Leases, partnerships and trusteeships frequently involved the Wasses and the Alsops.

Ore was brought to the site by pack animals, horse-drawn wagons, steam wagons and eventually by 3 ton to 9 ton motor vehicles. Coal was brought by canal (e.g. 2000 tons in 1854). Ingots were transported, at least in part, by boat from the nearby wharf (4000 tons in 1899). An initial exemption from the usual toll for using the turnpike for carrying lead (presumably including lead ore) was removed and replaced by a third of the normal toll. In a document, the leaseholders of Cowhay Smelting mill were specifically given authority to use the roadway which passes within the textile mill (see below), both sites being owned by Peter Nightingale, and they were required to keep up the roadways

from the wharf to the lead works.[26] However, this route must have been part of the earlier one used by pack animals coming down the hollow way from Wirksworth through Birch Wood, crossing the Derwent at Lea Ford and continuing up past Lea Hall beyond which paving stones have been found hidden in the grass verge on the route to Wessington.

In 1739/40 there is a reference to the Upper and Nether Mills. It is not clear whether these were two separate mills, or alternatively were both within the Cowhay complex, or included the Hollins smelter. It is probable that the latter was in fact the case. There were two smelting mills, one of the new "cupola" (reverberatory) furnaces, a slag mill and an ore mill, which would all require waterpower. In 1763 there was also a rolling mill to make lead sheet using waterpower and in 1776 a further cupola was added.[25] The stream was further controlled by two dams built in 1784 and 1785.[27]

A continuing problem of the smelting process arose from the waste, both slag and volatile gases, which both contained poisonous lead. The former, sometimes called "black stuff", was re-smelted in special hearths which needed a forced (waterpowered) draught. This occurred either on site or elsewhere, even as far afield as Belgium. The waterwheels powered large wood and leather bellows and, at a later date, air pumps, or blowing engines as they were known. The flue gases polluted the area[28] and caused "bellanding", the lead poisoning of cattle. This may be why a downwind area in the Lea Brook valley is called "Sodom". Disturbed soil can still lead to the death of cattle and other stock. In the early days of smelting the gases given off could be condensed using flues leading up a neighbouring hillside, but later specially designed buildings were

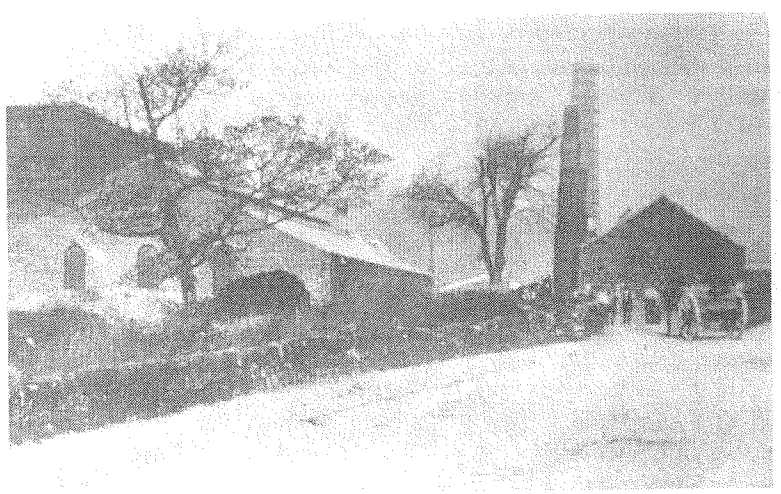


Figure 6. Entrance to the Cowhay Lead Works, 20th century.

used from which flue dust could be collected to be re-smelted.[29] Such work was obviously dangerous and worried employers (such as a Mr. Snowball here)[30] gave workers fat bacon sandwiches and milk to lessen the poisonous effects. In the 20th century the gases were scrubbed and the resulting calcium sulphate dried into a pile.

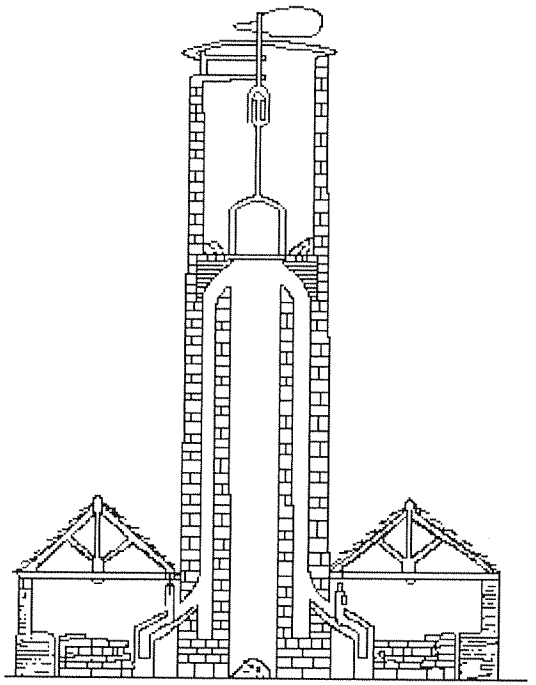


Figure 7. Joseph Wass's patent condensing tower.

Joseph Wass, junior, was responsible for many innovations, such as building his 1822 "patent condensing tower" Patent Number 4682,[31] which was succeeded by the "haystack", both being an attempt to reclaim lead from the fumes and prevent contamination. A description of 1836 shows that the reclaimed dust was housed in barrels for transportation.[32] From 1835 Joseph Wass, senior, and from 1838 Joseph Wass, junior, were involved extensively, having leases for this mill. Joseph was followed by his wife Anne, who was succeeded by their son Edward Miller Wass. In 1839 Cowhay was producing 1400 tons of lead and by 1862 the output was over 2000 tons. The leases of 1848 and 1856 suggest that the red lead mill, rolling mill and slag mill each had a water wheel. However, in 1843, reference was made to a "powerful steam engine".[33] After the deaths of the Wasses, trustees tried to sell their lease but failing in that, managers were employed.

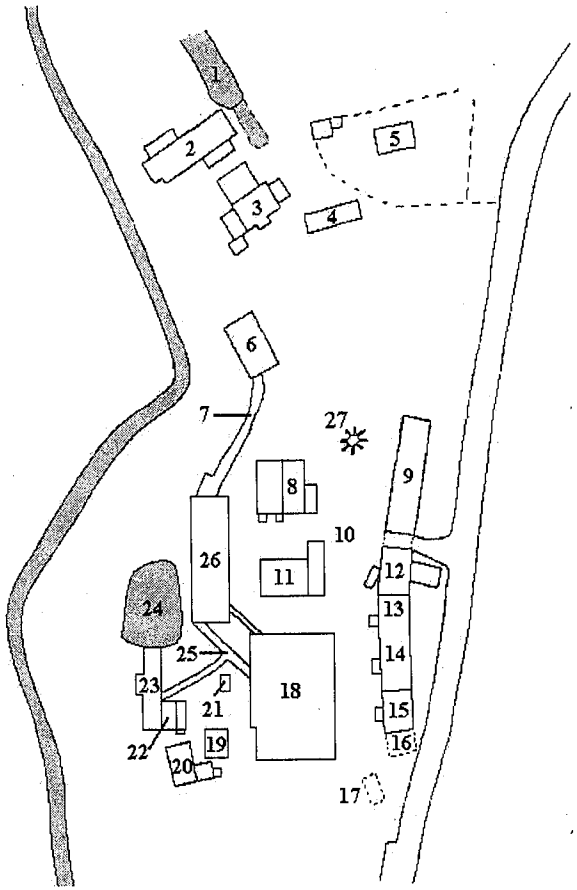


Figure 8. Plan of the Lea Lead Works at Cowhay.[35,36] (See table opposite.)[6]

In 1903 there were three reverberatory furnaces, four Scotch hearths, a slag furnace and a "haystack flue" producing 90 tons of lead per week,[34] however, the "haystack" collapsed in about 1929. After the smelting mill's closure in 1934, it was acquired by Millclose Mines Ltd of Darley Dale, which was owned by the Wass family. Then it was briefly an iron foundry before this was moved to Whatstandwell in 1948 and the site was dismantled.[6] The modern site has been described technically by Baker[29] and, from the point of view of one working there, by Bert Yeomans.[6] The last obvious remains of Cowhay Lead Works are being levelled only now at the start of the 21st century. Above the site some dams can be traced but on the actual site little remains, except some stone troughs and the foundations of the office. Slag can be found and the poisonous

The dates given are for the first and last dates when a structure was shown.

	First	Last
1. Water supply from great dam	1810	1912
2. Rolling mill	1802	1899
3. Red lead mill	1856	
later washhouse and store	1922	
4. Smoke condenser	1879	1922
5. Foreman's house, Lead works cottage		
or Snowball Cottage	1810	present
6. Smoke condenser	1899	1922
7. Brick flues	1912	1922
8. Stable	1856	
Blacksmiths shop and store	1865	1880
9. Ore shed	1856	
10. Offices	1912	
11. Nether cupola	1856	
reverberatory furnace (disused)		1912
12. Slag mill (chimney)	1856	
reverberatory furnace (disused)		1912
13-15. Reverberatory furnaces	1856	1912
16. Blacksmiths shop	1856	1879
17. Weighbridge	1912	
18. Four Scotch hearths	1899	1912
19. Messroom and baths	1899	1912
20. Boilerhouse and shop	1879	1922
21. Blast engine house	1912	1922
22. Electric light plant	1912	1922
23. Slag mill	1802	
Slaghouse disused	1912	
24. Slag mill dam	1835	1879
25. Brick flues	1912	1922
26. Smoke condenser ('haystack')	1899	1912
27. Limekiln	1856	1879

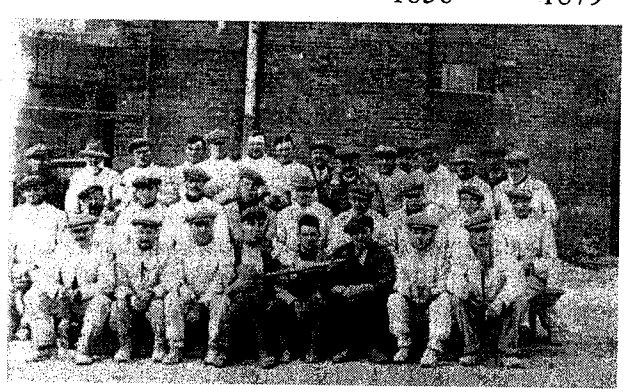


Figure 9. Workers at Cowhay Lead Works, 20th century.

effects of lead remain, stunting or preventing vegetation. The growth of bee orchids are the only obvious benefit. The plan of the site (see Figure 8) indicates the later developments.

8. Splash Farm (SK 318566)

This was probably a corn mill but it does not feature in the contemporary documents in an identifiable way and no dates for it can be given. It is, in fact, located in Amber Valley District, the stream forming the boundary having been diverted and thus obscuring the issue. It is therefore necessary to look for evidence among records dealing with Matlock and with the Derbyshire Dales District. The tailrace was west of the cottage as was the original line of the brook. A drained pond lies west of Lea Brook, to the north of the cottage, which was named "the old corn mill dam" on an 1835 map.[37] The wheel ran in a wheelpit remembered by a former resident as discharging into a culverted tailrace. A building exists which might have housed a wheel of about 13 feet diameter with a breast of up to approximately 10 feet wide. The tithe map and census returns make no mention of a "miller" at Splash Farm. The best assumption is that this was one of the "two adjacent corn mills destroyed to make cotton mills" when the Pear Tree Mill was built in 1794 (see below).[20] An eroded date stone suggests a connection with Peter Nightingale in 1760, possibly when the building was erected or enlarged.

9 & 10. Lea Bridge (SK 318564)

This site seems to have been the location for the Hollins Smelting Mill, two corn mills and, over the last two centuries, the present long-lasting textile mill.

Hollins Smelting Mill

The early history of the Hollins since 1630 is mixed with that of the smelter at Cowhay when the Spateman family were involved with it, specifically when the ownership of the property passed from the Peshalls to Gilbert Clarke.[25] In 1694 Wigley sold the Hollin Mill to Samuel Wood. In 1758 Anthony Wood sold it to the two Peter Nightingales. The mention at this time of an "old" cupola is confusing in that cupolas had only been introduced into this area in the 1740s, at Ashover. Maybe it was simply a reference to an old smelting mill.[13]

There is a plan naming Nether Hollins Dam and Upper Hollins Dam which places the smelting mill roughly where the Hollins stream joins Lea Brook.[37]

The Corn Mill(s).

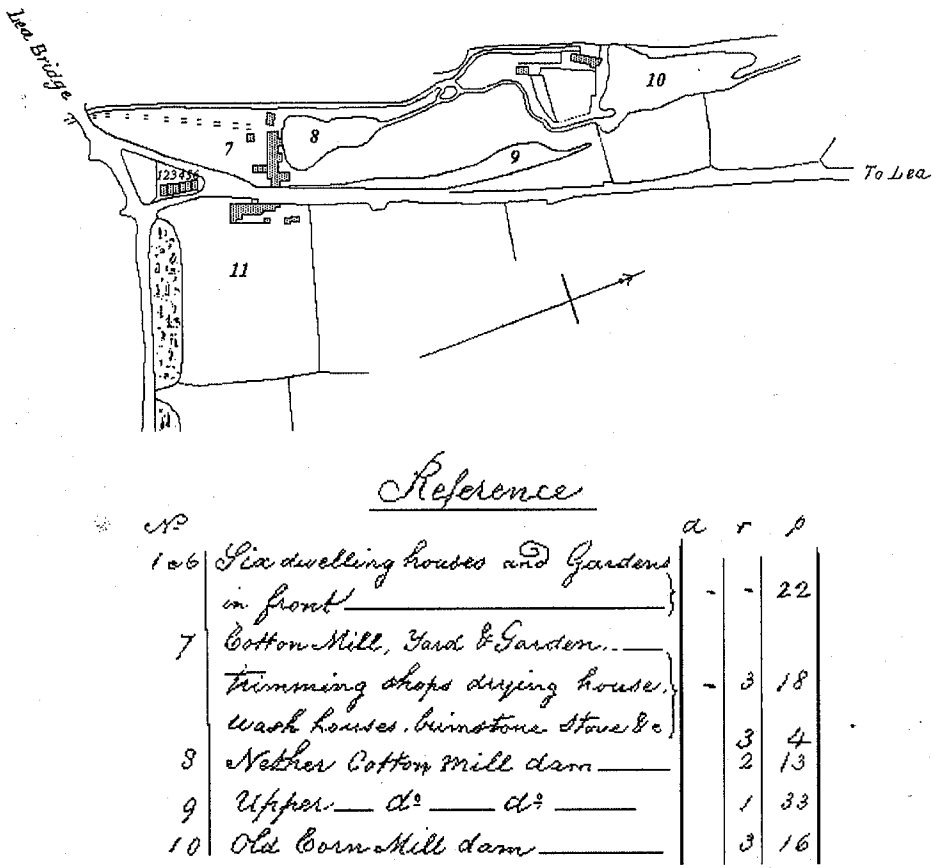
There is reference to one, if not two, corn mills in the Lea Bridge/Hollins area. Firstly, an advertisement in 1797[20] refers to two corn mills "recently demolished to erect cotton mills thereon"[39] (one of which, it is suggested above,

might be Splash Farm). But in 1795 there is also reference to "an ancient mill useless because the water has gone to the mill". Secondly, the mill at Pear Tree Farm was specifically built in place of one at Lea Bridge and is named as "the new mill" on a map dated 1810. There were two dams mentioned above. The only remotely possible identifiable remains are a keystone engraved PN 17** safely built into the much more recent gas-house.

John Smedley's Textile Mill

In 1785 a reference stated "whereas a cotton mill has been erected at Nether Hollins".[40] The mill was built by 1783 at a cost of £800, the machinery and stock being insured for £1,000 and it was operated in 1784 by Peter Nightingale, junior, with the help of Benjamin Pearson, junior, as a spinning mill also weaving a little muslin.[41] The Nether Cotton Mill Dam (of 1 acre) was probably the first to be built (north-west of the mill alongside an existing dam). In 1784 it was agreed to build a dam of 5 acres (2 hectares) above the rolling mill at Cowhay. This, the Great Dam, was finished in 1785 but in the same year it was breached, causing up to œ400 damage, although work at the mill could still continue.[38] The main building was four storeys high with, possibly, 14 bays, being about 55 metres long by 8 metres wide. The mill had two waterwheels, two picking rooms, a smithy, stables, and two warehouses for raw and picked cotton. A bleach croft is named overlooking the river.[42]

In 1818 John Smedley (the elder) took a lease on the mill. The mill's financial security was clearly in doubt until his son, also called John Smedley, started in the 1820s, with great effort, to revitalise the business based on spinning but which diversified into knitting as well. In 1828 it was already clear that Merino goods were to be the salvation of the business. In 1872, 500 workers were employed on the site, 1000 in total in the business.[4] John Thomas Marsden-Smedley was killed in a fall from a horse in 1877 after just one year of stewardship. Then John Bertram Marsden-Smedley assumed control on his coming of age in 1889 and the firm became a limited company (if with predominantly family shareholders) in 1893. In the early days thread had been delivered, for instance, to Manchester by road. Later the canal was an important means by which coal (1300 tons in 1854) and raw materials were brought in and products taken out. This was so much so that J. B. Marsden-Smedley was able to assert that his transport costs by rail would be half as much again when he gave evidence to a Parliamentary Committee considering the closure of the Cromford/Langley Mill canal when the Butterley Tunnel collapsed in 1900.[44] J. B. Marsden-Smedley's time in the early stages was overshadowed by an onerous strike in 1911[41] but he eventually developed a paternalistic business loved by many in the village. The company bought the site in 1946, probably when the Nightingale Estate was sold. J. B. Marsden-Smedley continued until his death in 1959 and the recent



Reference

№		a	r	p
1 to 6	Six dwelling houses and Gardens in front	-	-	22
7	Cotton Mill, Yard & Garden.. trimming shops drying house, wash houses. Limestone Stove &c	-	3	18
			3	4
8	Nether Cotton Mill dam		2	13
9	Upper do do		1	33
10	Old Corn Mill dam		3	16

Figure 10. map of Lea Bridge from a sale document of 1859 showing the textile mill.[43] (Reproduced by permission of the Derbyshire Record Office.)

directors include family members. John Smedley, the man, was content to sell his knitwear through the great hosiery houses, many of which were local, but now "John Smedley" is a worldwide brand. It can still be claimed that the softness of the spring water[45] used for washing contributes significantly to the "handle" of the yarn.[46] The spinning department survived until 2005, while knitwear is still being produced, making the mill one of the longest lasting in continual production.

The pit of a waterwheel remains in the bowels of the mill which is known to have been fed by a pipe from the Upper Mill Dam. The water from the dam is now conducted onwards to the fire precaution system. The location of the other wheel is not known but presumably was associated with the Nether Mill Dam.

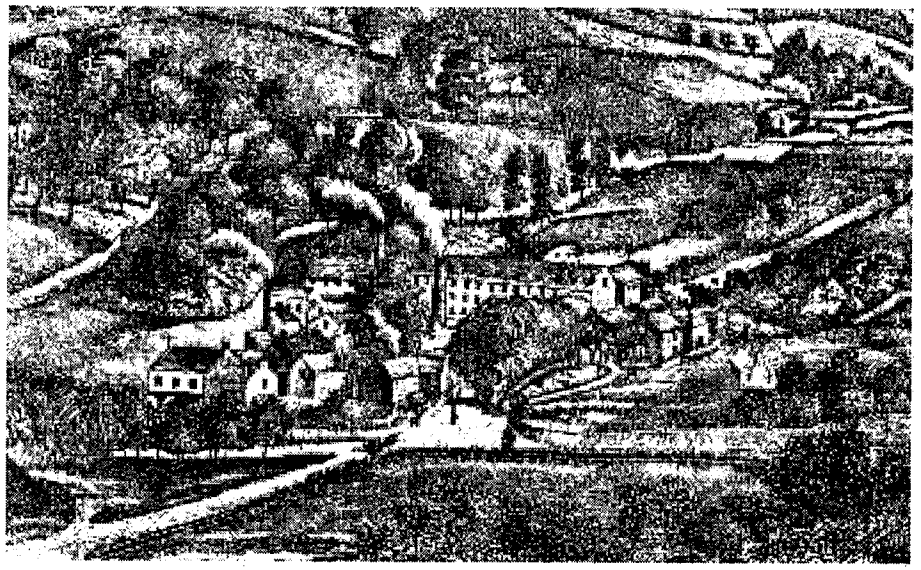


Figure 11. Part of an engraving from the middle of the 19th century showing Lea Bridge Textile Mill.

Three mill chimneys can be seen in an etching given various dates, one as early as 1825.[47] The last built chimney was dismantled in 1976, the others are hidden by later mill buildings or the mill yard. Later maps record a chimney from the 'gas house' where coal gas was created, some of which was used in the village, and the waste tar from Lea Bridge was a product exported for sale. The final phase of steam power generated steam in two Lancashire boilers.[48]

The land occupied by Smedley's Mill was confirmed by alternate kerb stones embellished with engraved brass plates recording Smedley's name. Maybe such assertion was associated with increasing wheeled traffic. The remains exist of a smithy incorporating a date stone of 1844. This site is currently subject to an exploratory excavation subsequent to its inclusion in the Derwent Valley Mills on the World Heritage List and hence it will obviously be the subject of a much more authoritative account after this excavation. Consideration is also being given to exposing more of the original textile mill building which is still in existence.

11. Lea Bridge Lead Mill (SK 317562)

This mill was also known as Lea Wood Lead Mill and also as Mr. Alsop's Mill. This surname adds to the confusion, there being two Alsop family lines in these villages with a John Alsop in five successive generations of the family that is of interest. When Richard Arkwright developed Cromford, and prior to the

completion of his intended residence, Willersley Castle, in 1788,[49] the smelter in Cromford belonging to the Alsop family, which would have spoiled Arkwright's view, was dismantled. The site of this smelter, which can be seen in a water colour of 1786, was then used for the building of St. Mary's Church.[50] When Peter Nightingale left the bulk of his estate to the ten year old William E. Shore (eventually Florence Nightingale's father) a John Alsop seems to have been involved as a trustee, especially in the dealings of the other working smelter at Cowhay.

The mill was specifically referred to between 1802 and 1846. There is evidence that in 1802 Joseph Wass, senior, took over a lease of cupolas and smelting works next to the wharf (which at that time was just below Lea Bridge).[51] It is reported that there was a cupola for smelting lead belonging to Mr Alsop.[1] A partnership involving John and Luke Alsop, with Joseph Wass, persisted until John Alsop's death in 1834. Bagshaw in his trade directory of 1846 lists a smelting mill of Alfred Alsop at Lea Wood (alongside Lea Brook below Lea Bridge) but Alfred then went bankrupt in 1848, having also been associated with the Via Gellia Smelter.[52] The smelter must have used up-to-date techniques for it attracted many visitors, even from overseas.23 In 1839 it produced 686 tons of lead, 15% of Derbyshire's production.[53]

No dam can be traced but reference is made to pipes and troughs belonging to Mr. Alsop, whose house still stands facing Lea Bridge.[26] Adam refers to a "beautiful little cottage... belonged to the Allsops (sic)".[54] The mill may have utilised water directly from the textile mill as the textile mill tail-race is piped to below Lea Bridge and/or later could have depended on steam power. The Ordnance Survey labels "spoil" where Smedley's car park is now situated below Lea Bridge[55] and a large but un-named building is shown on a map drawn sometime after 1819[26] as well as on one dated 1835.[56] Its biggest dimensions were about 9 metres by 18 metres. Masonry in the stream bank may well be the only surviving remains of this site.

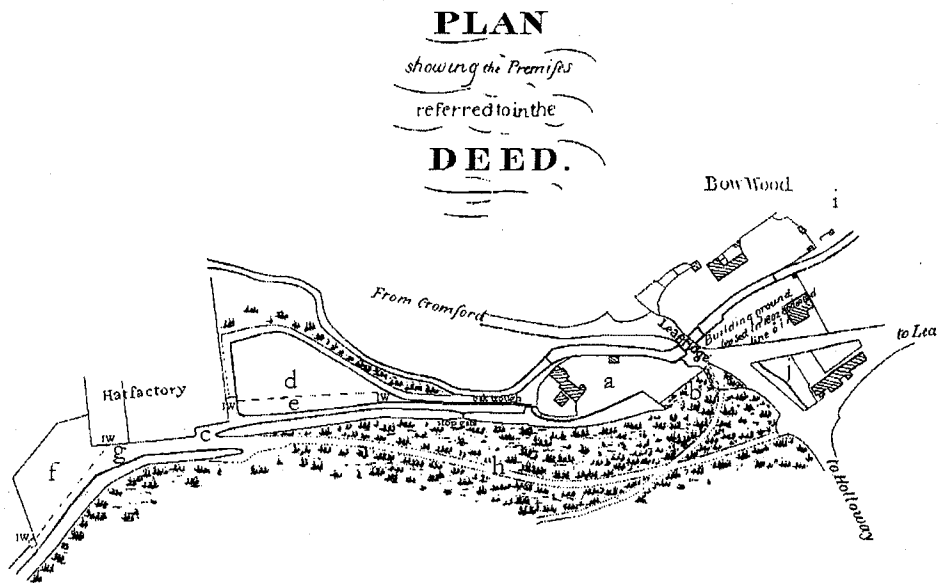
12. Stone Saw Mill (SK 317561)

The field south-east of the turnpike road and north-west of Lea Brook, between the hat factory and Lea Bridge, was labelled as a saw yard. It was here that gritstone from White Tor Quarry was cut to make the coping stones for the construction of the locks and bridges on the Grand Union Canal. They were exported on the Cromford Canal starting from the wharf at the end of the Nightingale Canal arm, also known as the Lea Cut. Hopton Marble was also cut and exported.[57] James Platts was one occupier of Saw Mill Field[42] and he is variously described as carter, sawyer and farmer. Gauging records at the start of the nineteenth century show he owned three barges operating from here, mainly carrying stone.

The reservoir is too low to serve the wheel at the hat factory (see below) and presumably served one at the sawmill on the other side of the stream. In 1835 a map shows three small buildings on the Saw Mill Yard field but the only remains now are the dam wall and the concrete foundations for a footbridge.

13. Hat Factory (SK 316561)

The factory was built in 1792 by the younger Peter Nightingale, and on 6th July of that year he leased it, and the essential water supply from Lea Brook, to a Stockport hatter called James Daniel, for 200 years at an annual rent of £50.



The division of the old New Leasehold is shewn by red dotted lines & the Letters IW

a Old Lea bridge Wharf yard leased by Peter Nightingale in 1802.

b A part of old yard planted after 1819 when it became less useful

c Lea Bridge Canal where divided by W.E Nightingale Esq^re in 1819

d New Reservoir made in 1819. Part e is original Leasehold

f New Wharf yard made 1819. Part g is original Leasehold

h Carriage Road in Lea wood to a part of Canal & New Wharf in 1819

i Bow wood containing the Pipes & troughs belonging the late John Alsops executors & to be repaired or removed by them

j The late John Alsops Garden still remains according to Deed of 16 June 1836:-

Figure 12. Plan showing the premises at Lea Wood, 1836.[26]
(Reproduced by permission of the Derbyshire Record Office.)

In 1796 Daniel went bankrupt and, until the factory was taken over by William Walker, operation and responsibility for the factory were complex, exacerbated by the death of Peter Nightingale. The many names involved include executors, trustees at one time or another, tenants and lawyers. The most frequent names are Thomas Saxton and William Downall. In 1811 Saxton employed 120 hands.[1] William Walker operated the site from 1820 until about 1858. During the Crimean war Walker made considerable profits from the manufacture of military headwear but then, faced with the expense of mechanising the process to counter American developments, the Walker family opted to close the business and live on their

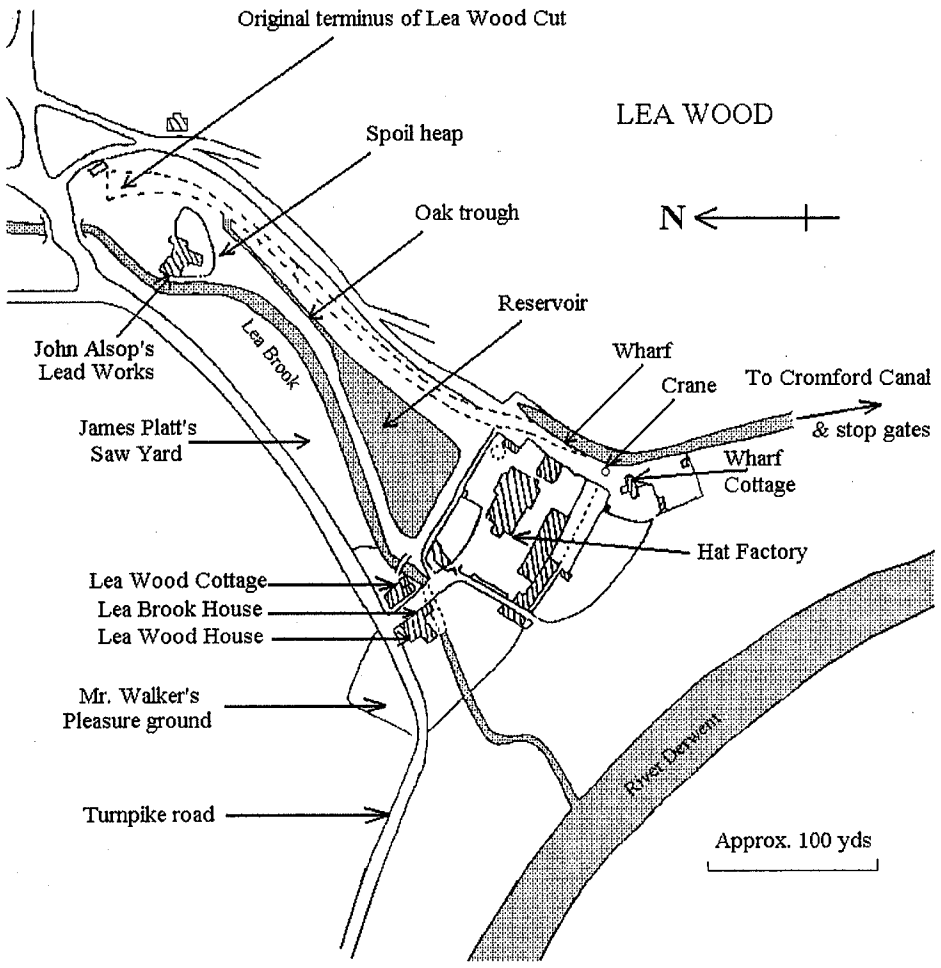


Figure 13. Features of Lea Wood in the 19th century.[58]

money. William Walker was taken to task by the mill owners at Belper for wasting water, a view hard to understand in that it was fed back into the Lea Brook from which it had come. Water was a long lasting source of contention. The Belper mill operators relied on the water in the Derwent, and therefore also its tributaries, to operate their mill wheels. Such concern led them to require Peter Nightingale to separate the water from the Cromford Canal by lock gates and ultimately to shorten this arm so that it was not watered from Lea Brook.[59] It must be realised that the Derwent had a more varied flow before the river was dammed by the construction of the Ladybower Reservoirs. The low levels previously experienced allowed a ford to be crossable at Lea (replaced by a footbridge at the water treatment works) and stepping-stones to be viable at Holmesford, which are only visible today when the river is very low.

The Walker family long played its part in the local community, for example, from involvement with the local unitarian chapel to providing a hand cornmill for employees to use when flour prices were high. Even at times in the twentieth century they gave the lectern and pulpit for the parish church and £1100 towards the building of its tower. From 1874, the main mill building was used as a wool and shoddy warehouse by Robert Lowe, who died in 1889. It is possible that it was also used as a bobbin mill. From 1888 to 1912 the buildings in the mill yard

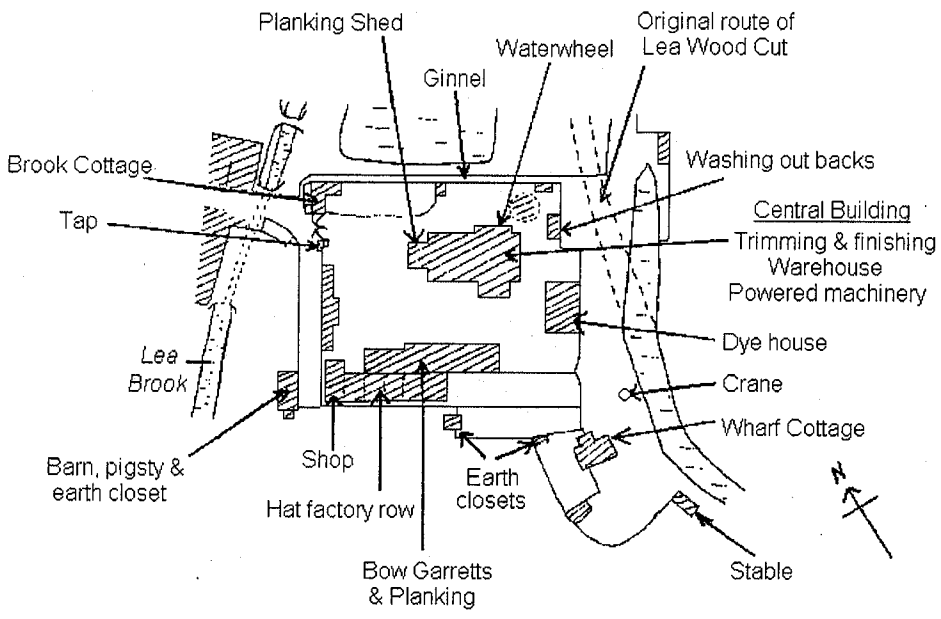


Figure 14. Plan of the Hat Factory, c.1850.[58]

were used by John Else, and his sons William and Robert, for the manufacture and bottling of aerated mineral water made from Lea Wood Spring.[58]

The hand-making of hats involved powered machines for separating individual hairs prior to felting.[60] Various styles of hat were made but essentially the manufacturing process always started with the body of the hat. For this loose hair was used which might be separated or cut free from the skins on site. Beaver, rabbit, hare and even camel were used. Long guard hairs were plucked out by hand, then loose hair was separated in tunnels about 36 feet long lined with flannel to catch the coarser hair which would not take up the dye as effectively. The hair was then prepared for felting using long wooden bows such as can still be seen in Nepal. The felt was then "planked" by employees or out workers, a job which could take as long as four hours a hat to make the rough shape. Finally it was "blocked" into its final shape and dyed. The ultimate products, in addition to those for the military, were top hats, exported to London to be labelled as "London Hats",[54] "Wideawakes" (which had no nap!), felt hats similar to those worn by cowboys in films, "Hossuth" hats favoured by bohemians such as the Pre-Raphaelites, and "Bobby Todds" named after a Chesterfield man.[58] The finished hats were transported in barrels and dispatched from the adjacent wharf on the Nightingale Arm of the Cromford Canal.

Figure 15. The Hat Factory (disused) and the Mineral Water Factory, c.1900.

For the separation of the hairs, and other uses, there was an overshot water wheel 26 feet in diameter and 5 feet wide which ran in a pit.[61] Its headrace consisted of a 6 inch pipe fed from Lea Bridge by a watercourse along the line to be temporarily taken by the canal cut. The tailrace ran into Lea Brook. Today the wheelpit and a two-hole toilet are the sole remains of the hat factory apart from the boundary wall (stained in parts by the blue dye used).

14. Peaselees or Bow Wood

There is a reference in the Chatsworth lead sale account, of lead being taken from "Bowood" to Bawtry in 1683.[62] This might well be Bow Wood (actually in Matlock parish) alongside which Lea Brook runs. Slag has been found in the stream and banks where it runs near the ancient field called Peaselees which is perhaps an ancient "assart".[63] Whereas in 1571 the then Earl of Devonshire brought in men to operate a "footblast" at Chatsworth, and by 1573-4 a water-powered smelter was being built elsewhere, so a Bow Wood site could have been established anytime after this date.[64]

Acknowledgement

This article has resulted from my local history researches over a period of fifteen years and, being those of a biologist without specialist knowledge of waterpower, it is enriched by the expertise of Alan Gifford and the water mills fraternity. Many people have contributed in producing this summary of the mills. Lynn Willies, David Kiernan and Peter Kirk, for example, have helped greatly. Special mention must be made of Stephen Turner of Derby (now deceased) who shared with me his extensive knowledge arising from his mother's childhood at Pear Tree Farm and the documents he had pertaining to the Nightingales, which are now in the Derbyshire County Record Office.

It will have become obvious there is a long and varied history to the very diverse water powered industries of our ancestors in this valley, as in the many neighbouring gritstone valleys in Derbyshire. It is equally obvious that the evidence of this history has already extensively disappeared and continues to do so. Maybe continued searches through the documentary evidence will bear further fruit and I will be happy if any more evidence is found, even if it shows any of my assertions to be wrong.

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LOGWOOD MILL, KINLET, ITS HISTORY & ARCHAEOLOGY

By David Poyner

Introduction

The Borle Brook is minor tributary of the River Severn, rising in Chetton in south-east Shropshire and flowing about 10 miles, to enter the Severn between Highley and Kinlet. On the main course of the brook there are four known mills; Down, Eudon (both in Chetton), Glazeley and Borle Mill (the largest, in Highley).[1] It in turn has a number of tributaries, some of which are so small that they carry no name on Ordnance Survey maps. However, these provided power to probably another nine mills. The longest lasting of these was Logwood mill or Log Mill, in Kinlet (SO 740820, see Figure 1).

Logwood Mill lies on what is now a nameless tributary of the Borle Brook, entering it less than three quartes of a mile from its confluence with the Severn. The stream is 2½ miles long with a fall of 230 feet. Although totally within the parish of Kinlet, it marked the boundary between the two townships that formerly comprised this parish; Kinlet and Earnwood. Today there is a large pool 500 yards from its junction with the Borle brook; this however is of 20th century date, owing to obstruction of the brook by the spoil tips of Kinlet Colliery (1894-1937). Logwood mill itself is located just before the junction of the stream with the Borle so that it got the benefit of the full catchment of the stream. Although the stream is small, the flow is regular, even in dry weather.

History

The mill stood within the boundary of Earnwood Park. In the middle ages this belonged to the powerful Mortimer family; it was stocked with deer and was used to ensure that good hunting was available for the family in the Wyre Forest. In due course, the manor of Earnwood and its park passed to the crown and was leased out. By 1565, when a survey was carried out for the crown, the park had been abandoned and was held by Sir George Blount of Kinlet.[2] At this stage there is no mention of any mill. However, in 1583 and again in 1587 the manor court rolls for Highley refer to a mill at Earnwood.[3] Thus in 1587 the water mill in Earnwood held by Robert Jones had flooded land in the manor of Highley when its mill pond had overflowed. This must be Logwood Mill. In 1590, 1592 and 1593 the mill again flooded the surrounding land; this time it was held by Christopher Blount. In 1592 it was called Park Mill and in 1593 it was described

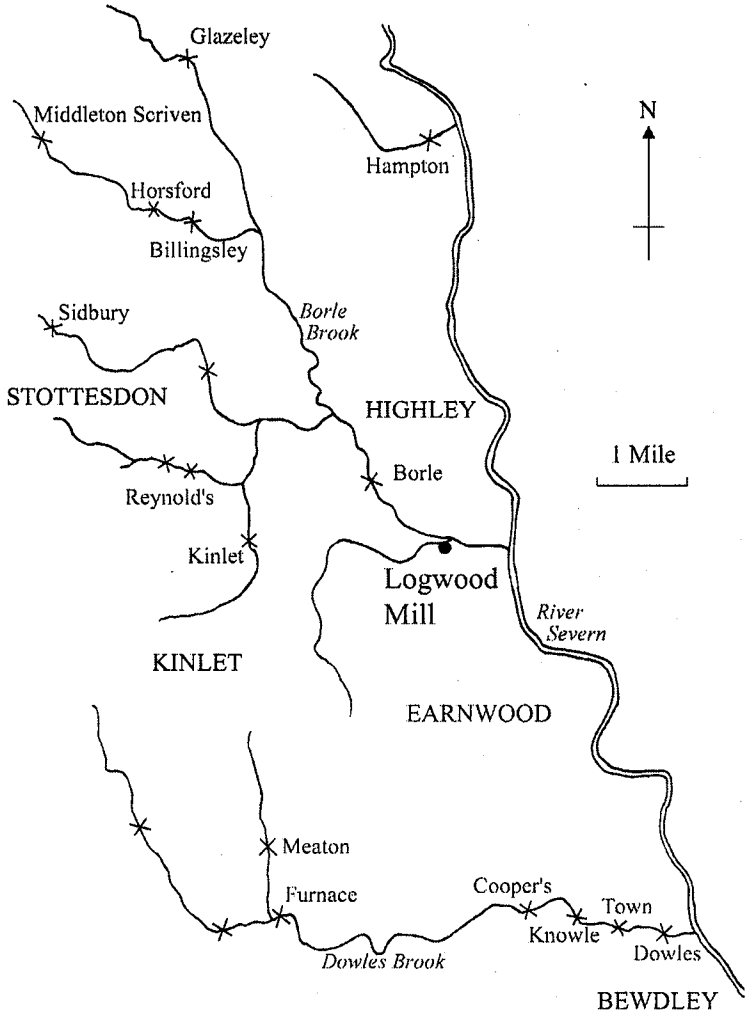

Figure 1. Waterpowered corn mills in the vicinity of Earnwood, 1650. Also shown by crosses are waterpowered iron working sites. Note that Furnace Mill was converted from a blast furnace to a corn mill c.1600.

as lying in Earnwood Park.[4] The manor of Highley was not the same as the ecclesiastical and later civil parish as it extended south of the Borle Brook into Kinlet; it is this part of the manor that was perhaps being flooded.

Thus the mill had been built between 1565 and 1583. It may be significant that this coincides with the ownership of Earnwood by Sir Robert Dudley, Earl of Leicester (1531-1588). Dudley also owned Cleobury Mortimer and so controlled

most of the Wyre Forest in Shropshire; on his Cleobury lands he established two blast furnaces.[5] As he was developing the Cleobury part of his estate, it would be entirely natural to do the same in Earnwood by building a new mill. The nature of the mill is not specified but it was almost certainly a corn mill. On the face of things, the area was already well supplied with mills. Within a three mile radius of the centre of Earnwood there were existing corn mills at Meaton (probably the original mill of Earnwood), Kinlet, Borle Mill in Highley, and Coopers, Knowle, Town and Dowles mills on Dowles brook to the south. However, both Meaton and Kinlet mills were on very small streams and the mills on the Dowles could only be reached by indifferent roads through the Wyre Forest. Furthermore, with the conversion of the former park of Earnwood into farmland, the centre of Earnwood had been shifted further north, towards the new mill. Grain prices rose throughout the later part of the 16th century, making cereal growing profitable.[6] If Dudley did build the mill, he correctly calculated it would meet a need.

Of the mill's early owners, Robert Jones in 1587 was presumably a miller who leased the mill from Dudley. Christopher Blount was one of Dudley's successors to the ownership of the manor of Earnwood, acquiring it via his marriage to Lettice, Countess of Essex.[7] Perhaps he worked the mill directly, employing journeymen millers, rather than subletting it. Blount was to be executed for treason and Earnwood was purchased by the Lacon family of Kinlet Hall. Their descendants, the Childe family, continued to own the site of the mill until the 20th century.

In the early 17th century, the Highley Manor Court rolls continue to record floods caused by the Park or New Mill.[8] A survey of 1643 shows the mill was rented by Francis Malpass from Sir Francis Lacon at 7s-10d p.a. on a life-long lease.[9] This survey specifically describes it as a corn mill. The mill was still known as Malpass Mill over a hundred years later. It is unclear how long the mill worked as a corn mill. The 17th and 18th centuries saw the concentration of grain milling at fewer, larger mills. Locally this saw the end of Meaton and Kinlet mills and expansion of Borle Mill and the mills on the Dowles. Logwood Mill survived to the late 18th century by changing use. In *Berrow's Worcester Journal*, 20th February, 1789 it was advertised to let "in perfect repair as a logwood mill and may be converted to a corn or oil mill or forge or any other iron work". Logwood was the name given to the heartwood of the tropical hardwood *Haematoxydon campectonium*, imported from Central America. This yields a dark blue or black dye, used in the textile and leather industries. The wood was cut into short lengths, reduced to chips and then ground to a powder. The powder was then used by dyers to produce their dye. Imports of logwood began in the 1660s and inventories of Bewdley grocers show that from that point and throughout much of the 18th century, they were holding significant stocks of the

commodity, in the form of cordwood, chips or ground powder.[10] Local demand is likely to have remained high, driven by the woollen textile industries (latterly including carpet making) as well as the leather trade.

The mill was part of the Kinlet Hall estate but in the 1789 advertisment, prospective lessees were directed to Curtis Hale of Hopton Court who had three paper mills on his estate on the slopes of the Clee Hill. He may have held the mill from the Kinlet Estate and in turn sub-let it or he may simply have been acting as an agent for the Kinlet estate in this matter.

The fact that the advertisment indicated that the mill could be converted to other uses is perhaps a sign that its proprietors felt its days as a logwood mill were numbered. By this date Samuel Skey had set up a major chemical works in Bewdley where products such as logwood might have been processed. In any case, the mill was inconveniently sited in a rural backwater. Of the other uses suggested in the advert, the days of the rural water-powered forge were rapidly ending and corn milling had already shown itself to be uneconomic at the site. Its relative remoteness would have made oil milling unattractive. The last years of the mill can be charted in the account books of the Kinlet estate. In 1791 there was a payment to George Brooks by the estate for producing posts and rails at the mill. The probability is that Brooks simply set up a saw-pit next to mill, rather than using any of its machinery. The last reference to the mill comes in 1795, when a coal mining company working at Billingsley paid £30 "for materials at Malpass Mill used to grind logwood". The wording may suggest that the machinery had been dismantled and was being sold off. There was further activity at the site in 1817. In May 26,000 bricks were moved by boat from the mill, down the Borle Brook to Bargate wharf on the Severn about half a mile downstream of the mouth of the Borle. As the Borle Brook is scarcely navigable by canoe, never mind a boat, it is not surprising that this enterprise was not repeated, although the next month more bricks were moved from the mill to Bargate by road.[11] The bricks were probably used to build a bark barn at Bargate but how they came to be at the mill is a mystery. The obvious suggestion is that they arose from the demolition of the mill building. However, this still appears to be in place on the 1841 tithe map, perhaps converted to a cottage. Logwood Mill was at the junction of a road that led north to Highley and the bricks may have been first hauled from that parish for the use of the Kinlet estate.

There had been a pair of cottages next to the mill since at least 1782.[12] These continued to be occupied after the end of milling and in the early 19th century there were typically two or three households living there. Perhaps the most notable residents were the Broom sisters. Although nominally servants, Ann in particular appeared to have plied another trade. Between 1811 and 1822 she gave birth to four illegitimate children; in 1815 the vicar described her

occupation as "strumpet". She died in 1824 aged 31. The cottages were demolished in the early part of the 20th century.[13]

Surviving Remains

The head-race of the mill is clearly visible for all of its length. It is possible that the brook channel above this may be substantially man-made but this remains speculation. There are traces of brickwork where it meets the brook and remains of a timber frame in the bed of the brook. These features may have been part of a sluice gate to regulate the entry of water into the leat. It is not clear how deep the original leat was; it now begins about five feet above the base of the brook and is around ten feet wide. The entrance to the head race is no more than 10 yards from the confluence of the brook with the Borle Brook and so there must have been a weir between these points. The brook runs in a deep and narrow gorge cut through sandstone and so construction of a dam would not have been difficult, but all trace of it has been washed away. There are a number of dressed stone blocks sticking out of silt that might have come from a dam; without excavation it is impossible to say if any are in situ and they may have come from a bridge just above the head-race (see below). About two yards downstream of the head-race there is a sharp right-angle bend cut into the sandstone wall on the east side of the stream; this may be the site of the dam but it may also be the remains of quarrying for building stone.

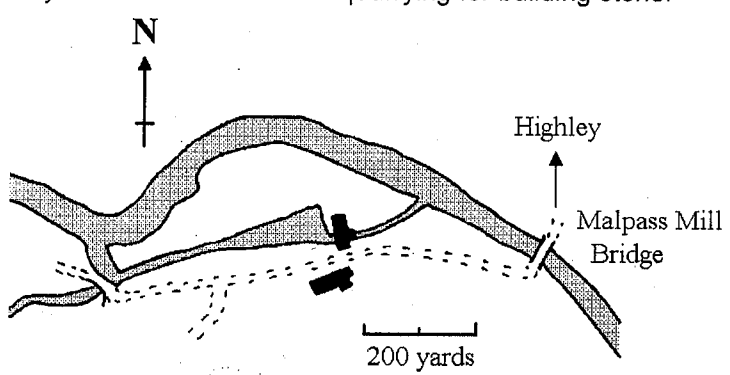

Figure 2. The position of Logwood Mill redrawn from a map of 1782.

The head-race can be followed to where it opens out into the mill pond. The boundaries of this are still obvious; it terminates in a low earth dam. Just to the south of this is a platform and then a gully that was the wheel pit for the mill. This is stone-edged. Due to the amount of undergrowth it is not possible to accurately estimate the dimensions of the wheel; it was probably something like six feet in diameter and three feet broad. It was probably a low breastshot wheel. The undergrowth has obscured the site of the mill, although this is marked on a

1782 map.[14] The tail race is visible as an obvious gully leading back to the Borle brook; its final few yards are completely silted up. About twenty yards from the wheel pit there is a large pile of probably 18th century hand-made bricks; these are the remains of Logwood mill cottages.

Apart from the mill, there are the abutments of two bridges close by that were probably used by customers of the mill. To the east of tailrace there is a stone abutment on the north bank of the Borle Brook, marking what was described in c.1570 as the road from Highley to Bewdley.[15] "Malpass Mill" bridge was repaired in 1744, 1754 and again in 1789 by Highley parish.[16] The southern abutment of this bridge only survives at the waterline of the brook. The road this bridge served was still open in 1817 when the Ordnance Survey produced their preliminary drawing of the area but it has been stopped by the time of the Kinlet tithe map in 1841. A second set of abutments are found on the mill brook itself, just above the take-off of the head-race. Within living memory this bridge was intact. It consisted of sandstone abutments and wing walls with a brick arch; although the arch has collapsed, the brick springing survives on the west bank. It carried a road leading to the nearby farms of Tippers and The Birch.

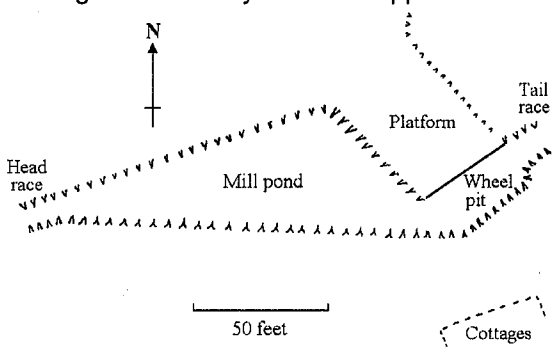

Figure 3. The surviving features at the site of Logwood Mill.

The site of the mill is difficult to investigate due to the density in places of the undergrowth and fallen trees. However, it appears not to have been disturbed since the mill and then the cottages were abandoned. Significant quantities of 18th century earthenware have been thrown up by moles on the edge of the mill pond. Its archaeological potential is high.

Conclusions

Logwood mill was a small unit, starting life as a Tudor corn mill. It survived longer than most small mills in this area due to its conversion to a logwood mill. This was probably viable for a while due to its proximity to the Severn. However, with greater concentration of industry towards the end of the 18th century, eventually its isolation told and it closed. Today, two features make the site

important. Its possible connection with Robert Dudley allows it to be seen as part of a wider plan by Dudley to industrialise his Shropshire estates by constructing water powered mills for both iron working and corn milling. Its archaeological potential suggests that it might be possible to recover both the plan of the original 16th century mill and its subsequent alterations.

Acknowledgements

I would like to thank Elaine Gregory for allowing me access to her land to survey the remains of Logwood Mill, the Engleheart family and Moffat's School for access to the Kinlet estate ledgers, Dr Gwyneth Nair for giving me her transcripts of the Highley Court Rolls and John Nunn for sharing the results of his researches into Samuel Skey and suggesting a link with logwood milling.

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MULTIPLE SAILED WINDMILLS IN ENGLAND

By Alan F. Gifford

Introduction

My interest in multiple sailed windmills arose from my association with Heage Windmill in Derbyshire. This mill was originally built with four sails in 1797, but after being tail-winded in 1894, was rebuilt with six patent sails, mounted on an iron cross and the restored mill still survives as such. I was asked the simple question by a visitor to the mill some years ago - "Were there many more windmills with six sails, like this?" Frankly, I could not answer properly. This event has led me to look for data on multi-sail mills and the following is an attempt to collate available information.

Note. The use of the term "multi-sailers" in this article refers to windmills having more than four sails, which is the most common number of sails found on windmills in England.

Why have more than four sails?

The chief advantage of the multi-sailed mill is the obvious increase in sail surface area, developing a consequently greater driving power, although unfortunately, the increase in power obtained is not proportionate to the increase in sail area. An obvious increase in power could be gained by lengthening or widening four sails, but lengthening or widening them increases their cost, both capital and in subsequent maintenance, and obtaining very long, sound, stocks or whips has never been easy. A longer sail must also be made so much stronger in order to carry its own weight and, as such, the overall weight, and the costs of the sail, soars. When increased width is considered much the same problem arises and, in addition, a double frame with sail areas on both sides of the whip has been found not to be as efficient as a single sail which has a leading board fitted.

Additional advantages for the multi-sailed mill over one with the conventional four sails includes an easier start-up and much smoother running of the mill, arising from the fact that when one sail is at its lowest position it is shielded from the wind by the mill structure. At that point it does little work, but the remaining sails generate all the possible power. It follows that if there are more than three exposed sails then more power can be expected to be generated.

It would therefore seem logical that the more sails fitted the more power can be developed and hence greater financial benefit obtained. This is not the quite the case and in practice the cost of repair and maintenance becomes an increasing factor in the equation. Whilst multi-sail mills are easier to start up, offering greater torque, they often run slower than four sailers so that airflow effect between multiple sails is minimised.

The first multi-sail mills in recent times appeared in the mid-eighteenth century and were fitted with five sails. There is however one major disadvantage with five sailed mills: if one sail is disabled a five sail mill must close down, there being no way that the remaining sails can be satisfactorily balanced to give smooth running. This is economically damaging in a commercially operating mill, since new sails do not come "off the shelf" nor are they normally "kept in stock".

This difficulty, however, is overcome in the six-sailed windmill, which evolved soon afterwards. These have a significant practical advantage over a five sailer. If a sail is damaged, or rots, its opposite number can be taken off and the mill can continue to operate whilst a new sail is obtained. In fact, if yet another sail is damaged, one more sail can then be removed and the mill will continue to operate with three sails. In desperation the mill can even still work with only two sails!

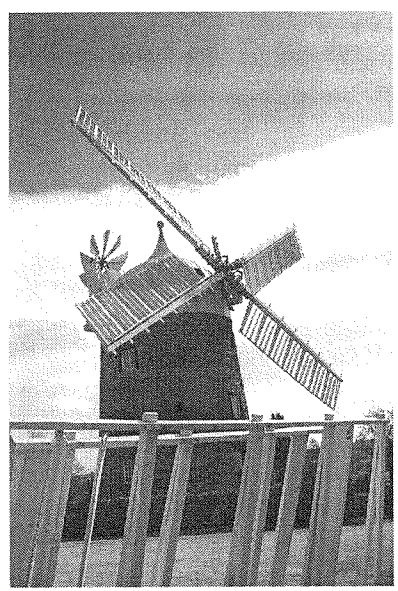


Figure 1. Heage Windmill had two sails removed due to rot in March 2005. They lie in the foreground, prior to being cut up and burnt. The mill continues to operate with the four sails whilst replacements are obtained.

The increasing use of cast iron for windshafts in the early nineteenth century favoured the adoption of "iron crosses" to which the whips could be directly mounted, using clamps and bolts, rather than using the traditional poll end, much favoured in southern Britain, but which normally limited the number of sails to four. The cross is normally cast separately and keyed onto the windshaft. The use of the iron cross was greatly favoured in Lincolnshire, in the north east of England and in counties adjoining Lincolnshire, such as Yorkshire, Nottinghamshire and Derbyshire, but saw little favour elsewhere.

Early records of multi-sail mills

It comes as a great surprise to many people that any windmills have more than four sails! Four sails in fact represent the stereotype view of the windmill in this country and is also the case in much of Europe. Multi-sailed windmills generally appeared in England from about the mid-eighteenth century although there are records of some mills from earlier times.

Rex Wailes reported that rents were received from a "six-sail post mill" and mentioned in a Department of the Environment guide to Saxtead windmill, that "in 1279 the combined income from a six-sailed and a four-sailed windmill at Saxtead was œ7-6s-9d per year". This is obviously a very early use of multiple sails and perhaps represents the earliest record in this country. Martin Watts (private communication) has noted an account, at about that time, of a six-sailed windmill on the Manor of Framlingham, in Suffolk, described alongside a four-sailed mill, so clearly the important difference was recognised by the writer at the time.

Some two hundred years later, an eight-sailed post windmill, known as "The Kings Mill", was observed by Sir Christopher Lowther, in Pontefract, Yorkshire, complete with common cloth sails. A very positive record of a six sail mill has been found in "The Great Diurnal of Nicholas Blundell, 1702-1711", in fact this is quite a comprehensive diary of his life as a mill owner. Blundell owned a windmill at Little Crosby, in Lancashire (SD 32 01). In a very well kept record of the mill, over a number of years, he includes:-

"28th November, 1709

Millwrights at 8p per day, when they fitted up my shaft with six sails

£1-14s-9d"

The mill is marked, complete with six sails, on a sea coast chart of the area published in 1736/7. Unfortunately he tells nothing of the type of mill, but although it was probably a post mill, we can only imagine the type of sails it had. The writer was clearly proud of his unusual mill.

In the later part of 1754, Mr. R. R. Angerstein, from Sweden, reported on touring the various iron industries of England, during which he saw a windmill,

built by a Mr. Melin. He describes how the mill had eight sails, each fitted with board panels which could be closed by moving iron bars hanging from them, but which opened up in strong wind.

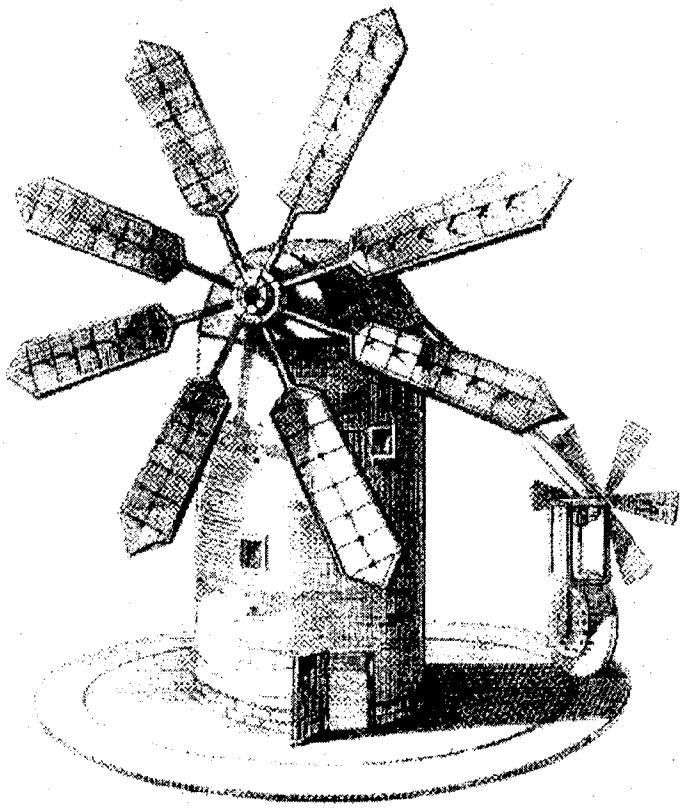


Figure 2. An eight sail windmill was described and sketched by Angerstein in 1754, who said it was owned by a "Mr. Melin", possibly a "nom de plume" for Edmund Lee. (Reproduced by permission of the Science Museum.)

Around the Mediterranean, multi-sailed jib mills, fitted with what are sometimes called "Cretan Sails", have been present for many centuries. For example an etching, dated 1483, clearly shows a number of six-sailed tower mills standing on the quay at Rhodes, a Greek island.

Multi-sailed mills were therefore clearly in use much earlier than is normally recognised but this paper focuses on those which were built from about 1750 onwards.

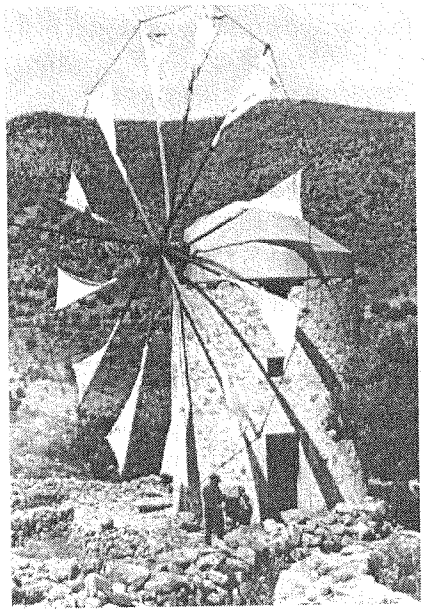


Figure 3. The mills of the Mediterranean area are typified by their "Cretan" triangular canvas sails. This example has twelve sails but they may have between 8 and 16 sails.

A scientific approach - John Smeaton's Windmill Experiments

Until the mid-eighteenth century the development of the design of windmills, and of the sails in particular, had evolved empirically over many centuries and in many countries, but there had been no significant attempt to evaluate scientifically the most effective design, or the ideal number of sails. About 1760, John Smeaton, a noted civil engineer, who had already used models to conduct a series of experiments into the efficiency of water wheels, turned his attention to windmills.

He had, of course, a major problem. There were at that time no electric fans or wind tunnels to provide him with a steady airflow which he could use against a stationary model. Instead he devised an apparatus where the model he planned to use was moved against an "artificial wind", generated by moving the model, mounted on a rotating arm, in a constant circular path, The speed of movement was determined by manually pulling on a cord attached to the main central spar of the device and this was regulated by timing against a metronome. To avoid external wind effects the tests were all conducted inside a large closed room. Smeaton used this device to measure the efficiency of various designs and numbers of sails by their ability to raise standard weights over a given distance/ time.

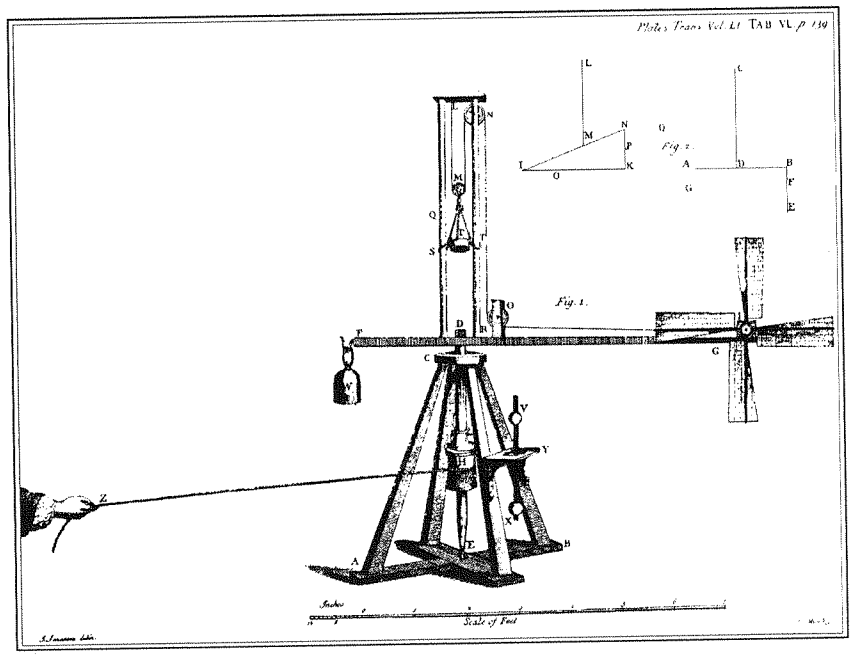


Figure 4. The apparatus used by John Smeaton, in about 1760, to rotate models of windmills in still air to measure the efficiency of various designs and number of sails. (Reproduced from the Philosophical Transactions, Vol. 51.)

He used a series of models and set out to demonstrate the effect of the structure and shape of the sail, its weather, the area of the sail and the wind velocity (i.e. determined by the speed he rotated the model). Whilst this article does not consider the general outcome of this work one important conclusion he reached was the most efficient number of sails for a windmill was five. Smeaton's experiments into the design and efficiency of windmill sails using these models, indicated to him that a five sail mill gave the optimum output and this directed his practical mill work into the building of full-sized five-sailed windmills.

Smeaton's Windmills

Perhaps the earliest well documented record of a multi-sail mill in England is that of a five-sailed mill which ground flint for use in pottery making. This was built by John Smeaton, at Leeds, Yorkshire, in 1774, his earlier oil and logwood windmill at Wakefield in 1754 having had only four sails. Drawings of the sails of this mill at Leeds, which are reproduced from folios held by the Royal Society are contained in a paper in the Newcomen Society Transactions, presented by

Rex Wailes in 1952. Unfortunately, these are not really suitable for further reproduction, therefore see references for further information.

John Smeaton was a great believer in five-sailed mills and in 1781, fitted five sails onto an oil mill at Sykefield, Yorkshire, near his home at Austhorpe Lodge, on the outskirts of Leeds. This was followed, in 1782, by a flour mill which became known as known as Chimney Mill, in Newcastle-on-Tyne. This was a smock mill and the whips were bolted onto an iron cross mounted on the windshaft. Apart from the five sails it was perhaps an unusual mill in that the upright shaft was very long and drove the millstones which were on the ground floor. The much modified smock still stands in Newcastle today, used until recently as offices, but is currently for sale. In addition he built a five sail oil tower mill in 1783, at Stepney, Newcastle-upon-Tyne. The windshaft casting for this mill had a five arm cross and integral box to take the clasp arm brake wheel. It is also possible that he also had the same number of sails on a mill he built in Barking which was used for wood grinding or turning but the date of building this is not recorded.

Figure 5. Chimney Mill in Newcastle-on-Tyne, built in 1782, shown when it was still in use. (Reproduced from the the Transactions of the 2nd Mills Research Conference.)

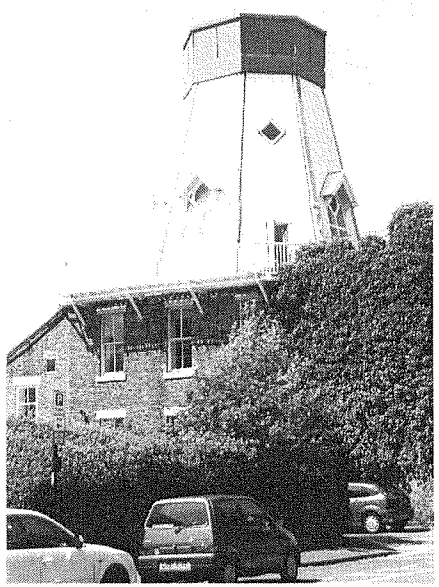


Figure 6. The smock of Chimney Mill is still standing, having been used until recently as part of an office. (Reproduced by permission of J. Bolter.)

Smeaton had devised a special complex joint configuration for the junction of the five wooden whips to enable them to be attached to an iron cross which was cast integral with the iron wind shaft. The design of the joint was such that he claimed any single whip could be withdrawn and replaced at any time without disturbing any of the others. He provided very clear instructions to the millwrights as to how the sails were to be test assembled on the ground prior to erection to ensure the correct fitting of this complex mortise and tennon joint.

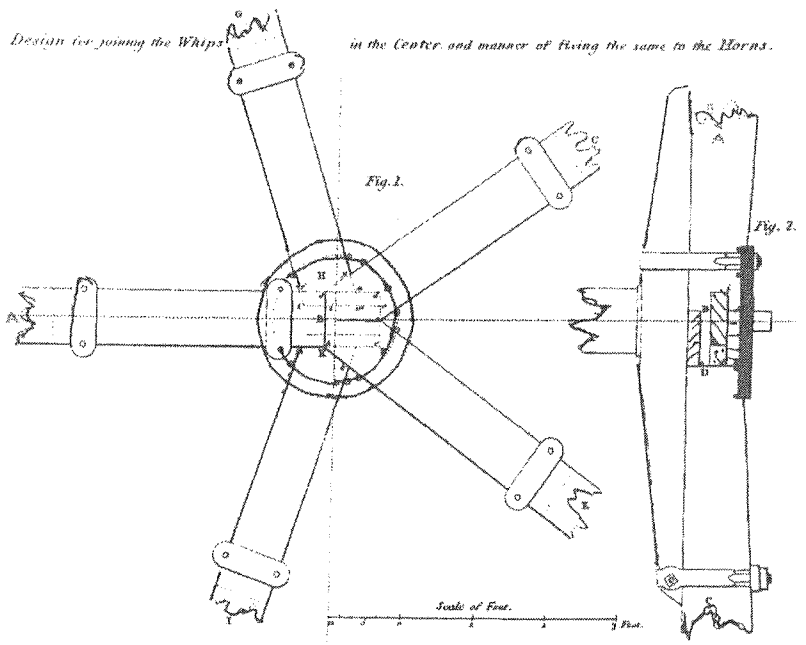


Figure 7. A very careful designer, John Smeaton provided detailed drawings of the method to be used to join five sails in such a way that any one could be removed without affecting the others. Reproduced from the Royal Society.

Some notable five sail mills used for corn milling

Many of the multi-sail mills used for corn milling were in Lincolnshire but, outside the East Midlands and the north-eastern region, just a few other multi-sail mills were built.

There were in fact very few multi-sail mills in the southern counties although Hills, millwrights of Ashford, Kent, built a five-sailed pumping mill at Margate. At Sandhust, in Kent there was a five-sailed smock mill, built in 1844 by Warrens of Hawkhurst, but they had so little experience of this feature that they had to send for help from a Lincolnshire millwright for advice on the fitting of the sails!

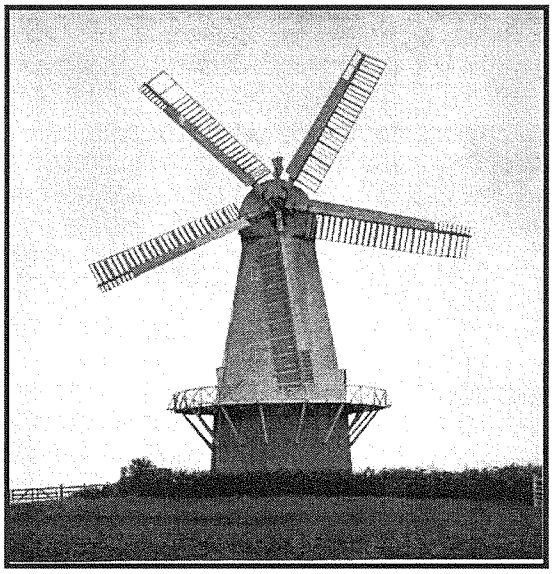


Figure 8. The five sailed mill at Sandurst, Kent, was one of the few multi-sails mills to be built in the south of England.

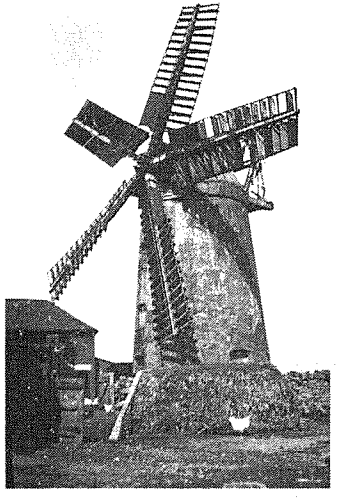


Figure 9. Tuttle Hill Mill, near Nuneaton, was fitted with five sails in 1905 when the original four sails had to be removed.

Figure 10. Burgh le Marsh windmill is owned by Lincolnshire County Council and is regularly opened to the public.

The mill at Tuttle Hill, near Nuneaton in Warwickshire, was originally built with four sails, the tips of which came very close to the ground. In 1904 the local council ruled that the sails constituted a danger to the public and required them to be shortened. To obtain the same power output as before five shorter sails were therefore fitted, in 1905, by a millwright from Preston in Lancashire.

Typical of many Lincolnshire multi-sailers, Dobson's Mill, at Burgh le Marsh was built in 1813 although un-typically the five sails rotate clockwise. The mill worked commercially until 1964. Now owned by the county council, the mill is open most weekends, staffed and run by volunteers.

The five-sailed Maud Foster mill, at Boston in Lincolnshire, was built in 1819 and worked commercially until 1948. The mill was then sold, together with a fully equipped millwright's shop which unfortunately disappeared under un-sympathetic owners. Restored to full working order in 1988 the mill, fitted with single-sided patent sails, is now the only multi-sailer still in regular commercial operation in Britain.

Tables 1 - 3 listing all known five sail windmills are included in the Appendix.

Figure 11. The "Maud Foster" windmill, at Boston has five sails and is currently working commercially powered by wind – when it is blowing!

And the Six Sailers

Ashcombe Mill, near Lewes in Sussex, was a six-sailed post mill with a fan tail. It was built in 1827 when Jesse Pumphery made the framing while working for the millwright Sam Medhurst and the mill then worked continuously until 1912. The mill had a triple canister poll end on the iron wind shaft with six large double shuttered sweeps. Due to the heavy weight of these over the years the mill became very headsick, slowly tipping forward until the mill fell down in 1916. It was probably the only six-sailed post mill ever built in this country.

Multi-sails were first visible on the eighteenth century mill at Heage, in Derbyshire, when after the mill was tail winded in 1894 it was rebuilt with six single-sided patent sails. These replaced the four patent sails, which had been mounted on an iron windshaft and cross which had been smashed, together with the cap, in a tremendous gale. The replacement windshaft and iron cross etc. were reputedly cast at the nearby Ripley works of "The Butterley Company" and the machinery probably represented "state of the art" design of the period. The mill continued to work until 1919 when it was struck by lightning and

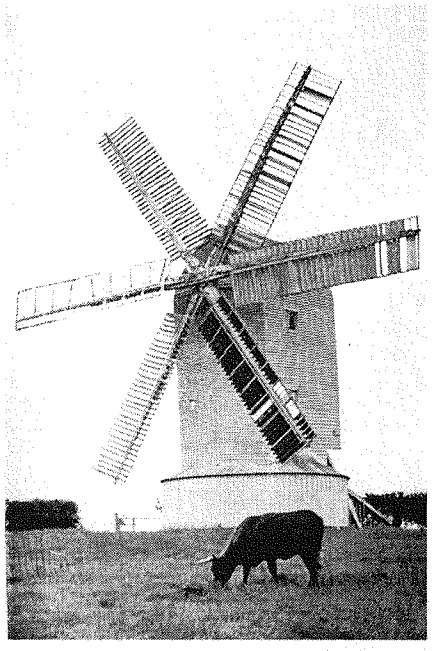


Figure 12. The six-sailed post mill, near Lewes in Kent, called Ashcombe Mill was one of the very few post mill to be built with more than four sails.

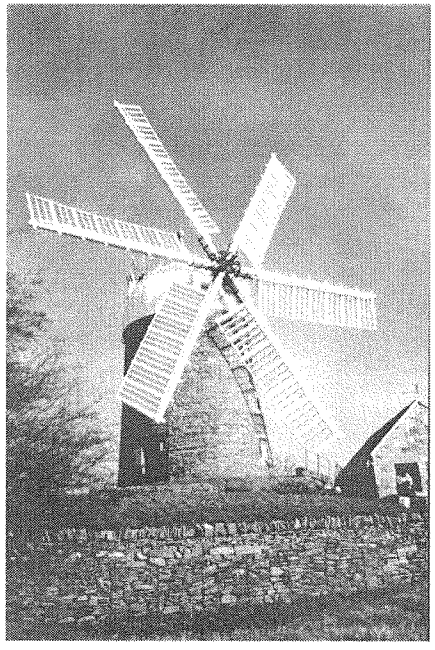


Figure 13. Heage windmill, two miles north east of Belper, in Derbyshire, was converted to six sails in 1894. The mill was restored to working order in 2002.

abandoned. After eighty three years of idleness and decay the mill was restored to working order in 2002.

Believed to be the last two windmills to be built in Derbyshire, "James" and "Sarah", a pair of large brick tower mills, built at Riddings in 1870 for James Oakes, were primarily provender mills, aimed at providing fodder for the owner's pit ponies. Both had six arm iron crosses and galleries round the ogee caps but only "James" was ever fitted with the full complement of six double-sided patent sails. For reasons that can only be speculation, "Sarah" was driven by an oil engine throughout her life! They were both eventually destroyed by fire in 1963 and the windshafts and crosses were scrapped by simply tipping them over the curb to the ground! No other multi-sailed windmills are known to have been built in Derbyshire.

Figure 14. The twin mills at Riddings were the last mills to be built in the county and were both designed for six sails, although only James ever had them fitted. Note that Sarah is even complete with the iron cross but has no sails!

The six sail mill at Metheringham in Lincolnshire was built in open country in 1867, with six patent sails, but over the years progressively lost sails which were not always replaced. It did however exhibit the great flexibility of six sail mills by working first with six, then four, down to two and finally back to three sails. The elaborate brick tower still stands, now in the middle of a housing estate, and reports suggest that much of the machinery may still be in place.

A six sail mill at Coleby Heath, near Lincoln, was damaged by fire in the 1860's and the cap was re-built by Rushtons, of Lincoln, using iron plates mounted on an iron girder frame. It was reputed to be very noisy in operation and was demolished during the 1939-45 war, due to it being in the flight path of a new aerodrome. Until 1932 Alford in Lincolnshire had three mills, a four, a five and a six-sailed windmill, but only the five-sailer, Hoyle's mill, survives complete today.

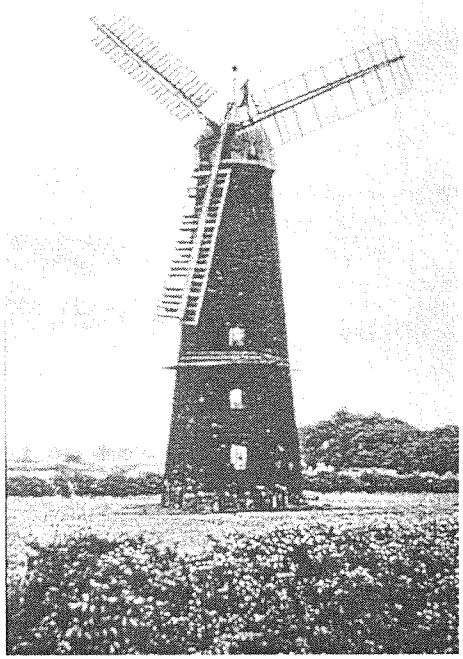


Figure 15. Metheringham, in Lincolnshire, was built in 1867 with six sails, but lost sails at various times, eventually working with just three – again clearly showing that a six-sail mill can still operate with less than a full complement of sails.

Figure 16. Coleby Heath windmill, in Lincolnshire was reputedly "very noisy in operation" and was demolished during the Second World War to clear the flight path for an adjacent airfield.

In Northamptonshire, Millfield Mill was originally built with only five sails but by 1900 the mill had an ogee cap complete with six anti-clockwise patent single-sided sails. The mill worked until at least 1923, but by 1935 the cap and sails had been removed. The tower was demolished about 1937 and its existence is only marked by the street name, "Windmill Road".

Tables 4 - 6 listing all known six sail windmills are included in the Appendix.

Eight and more sails..

There are at least eight mills which have, at some time in their life, had eight sails but only one, at Heckington in Lincolnshire (TF 145436), survives today as a complete, working, mill.

Figure 17. The only surviving windmill in England with eight sails, Heckington, in Lincolnshire, was built with five sails in 1830, converted to eight sails in 1891 and is still in full working order.

It is a fine example of a large working corn windmill, reputedly built in 1830 with five sails and converted to eight after being tail winded in 1890. This change was achieved by the transfer to the site, by road and rail, of the cap, sails and all the machinery from nearby Tuxford's mill, in Boston (TF 335432). This latter mill was built in 1813 and had an unusual set of bars connecting the ends of the eight sails together, a feature not noted elsewhere. The business folded in 1891 and the mill was advertised to be sold, with a condition it be "pulled down". As noted earlier the machinery, etc., was transferred to Heckington.

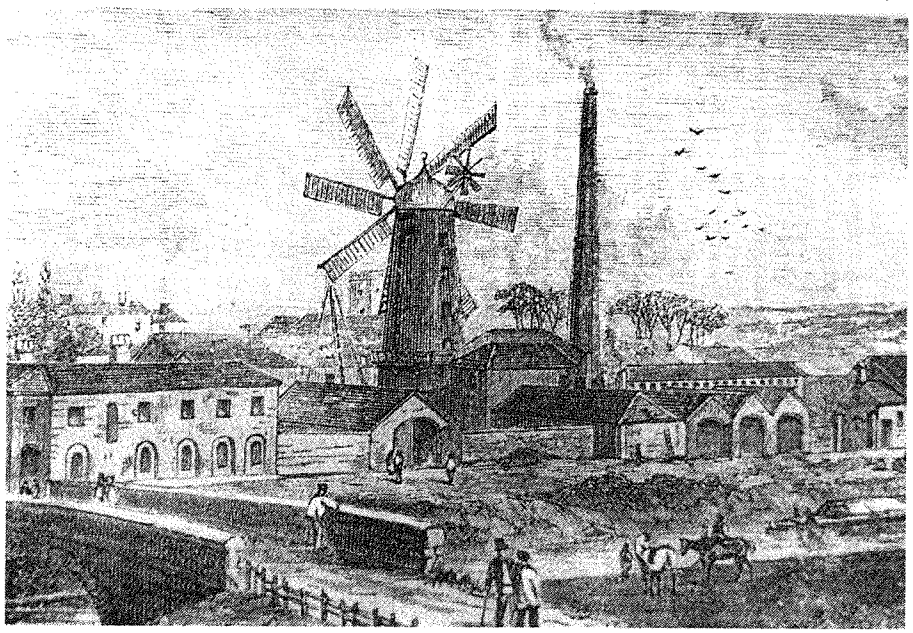
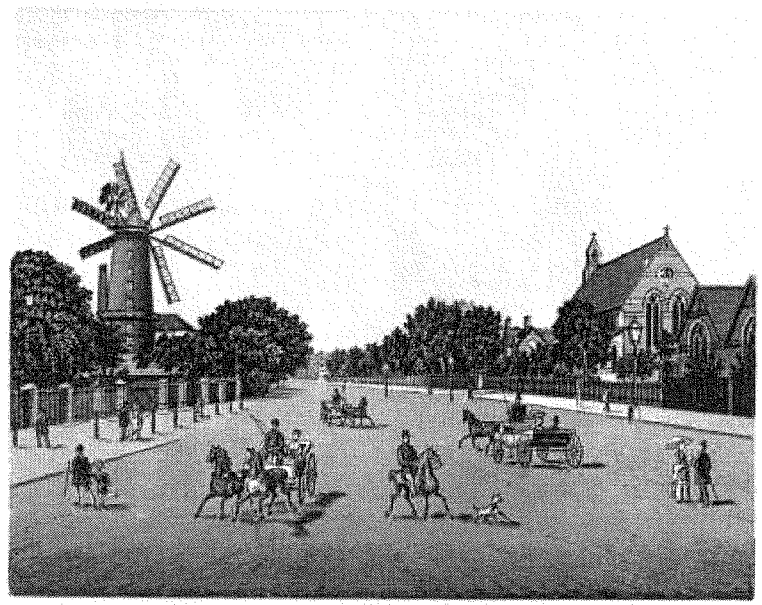


Figure 18. Tuxford's Mill, at Skirbeck in Lincolnshire, was demolished in 1891. The sails and machinery were transferred to nearby Heckington windmill. Reproduced by kind permission of James Waterfield.

The tower mill at Wisbech, Cambridgeshire (TF 464101), was built in 1778 and had common sails until it was raised in the nineteenth century and fitted with eight, single sided, patent sails, above a gallery . The local council forced its closure in 1897, due to the proximity of the road and it still retains its full height, and remains as a house convertion.

The mill at Holbeach, Lincolnshire (TF 634240), was built in 1828. A large mill, with eight floors, a reefing stage and single side patent sails, it worked until the 1890's and the sails were removed after gale damage in 1894/5. The remains of the tower were eventually demolished in 1955.



The Lynn Road & St. Augustine's Church.

Figure 19. The eight sail mill at Wisbech was closed by the local council in 1897 due its proximity to the road. The tower still stands having been converted into a house.

Again in Lincolnshire, Hills Mill in Market Rasen (TF 110887) was originally home of a four sail mill but the tower was raised and fitted with eight sails in the mid-nineteenth century. Various illustrations show it with both double and single-sided patents. The business was closed in 1923 after a disastrous fire and the tower was demolished.

Built about 1836 the mill at Eye, Cambridgeshire (TF 231030), had a reefing gallery and also a gallery round the cap. The mill worked with eight sails (most of the time) until 1934 when it reverted to four. The sails were finally removed in 1948 and the tower stump eventually demolished in 1980.

Much Hadden Mill, in Hertfordshire (TL 422183), was not built until 1892, considered a very late date for the building of a windmill. A large mill, its internal diameter was 36 feet. Storm damaged in 1895, it lost some sails at that time, but its entire working life was only 13 years, after which all the sails were removed! It can never have paid for itself.

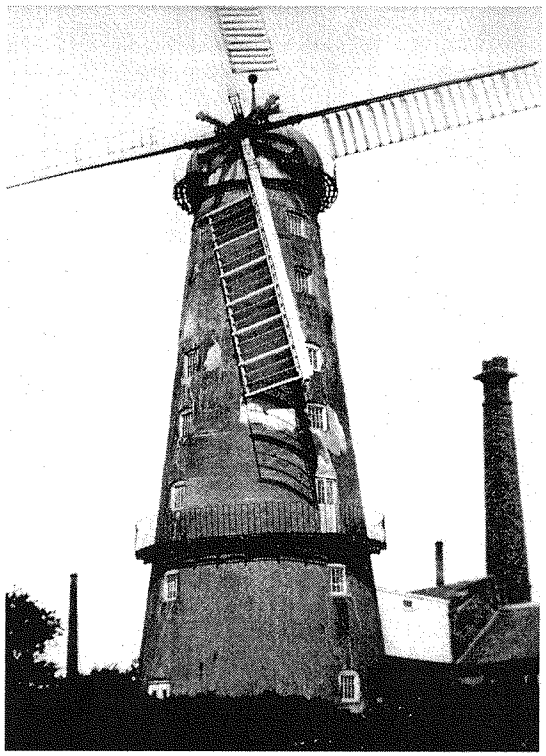


Figure 20. The eight sail mill at Eye in Cambridgeshire, built about 1836, shown here, in 1934, reduced to four patent sails. This again shows the benefit of having an even number of sails, enabling the mill to continue working with a reduced number of sails.

The only eight sail mill in Norfolk was the Victoria Mill, at Diss (TM 123792), which was built in the 1820's. Severely damaged in a gale in 1836 the eight sails were replaced by four, which worked alongside a steam mill, driving the four sets of overdriven stones. After more storm damage it ceased operations in about 1928, was incorporated into a saw mill and has subsequently been converted into a house.

Two further possible eight sail mills have so far not been fully substantiated. One, at Old Buckenham, Norfolk, was allegedly owned by Colmans, the mustard makers, whilst an advertisement in 1819, refers to "an eight sail saw mill - used for cutting veneers" in Church Street, Hull, but no other information is to hand presently.

There was an unusual eight sailed windmill at St Mary's, on the Isles of Scilly. This had jib type sails, rather like those found in the Mediterranean area,

and the spars were tied to each other, and to a bow sprit projecting in front of the wind shaft. Again all traces of this mill have, unfortunately, now disappeared.

Note that neither this uncommon mill, nor the two mentioned in the previous paragraph, have been included in the Tables of Mills in the Appendix

One unusual monster mill had twelve patent sails and was at Cottenham in Cambridgeshire (TQ 13 12). The mill has been dated as having been being built in about 1846 but was then apparently significantly damaged when it was tail-winded and was re-built with four sails with a normal poll end and canister. One cannot imagine the complexity of the striking gear when it had twelve sails or even how the sails were mounted on the wind shaft!

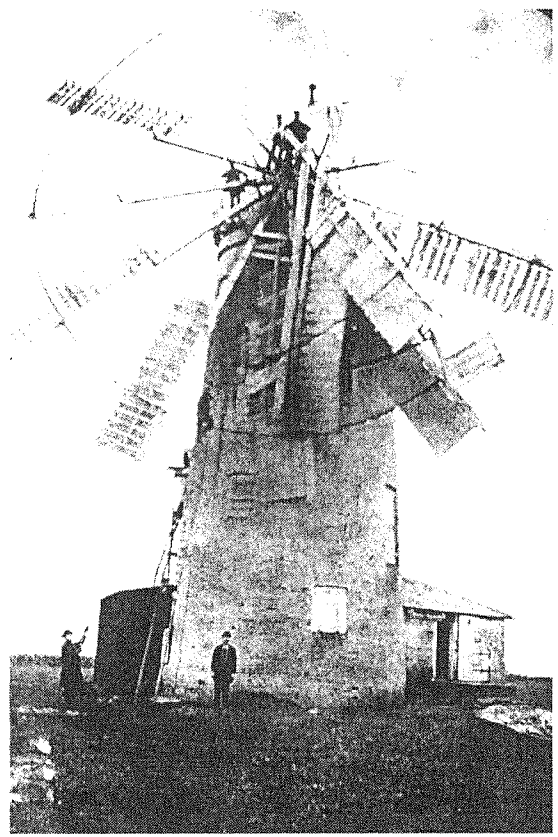


Figure 21. This unusual twelve patent sailed mill at Cottenham was built about 1846 and is shown here after she was tail winded. The damage was immense and the rebuilt mill only had four sails.

Annular Sails

The stage beyond multi sails is to use an annular sail, that is to provide a complete ring of shutters which are mounted on normal whips. This construction does not suffer from the effect of airflow between sails and, as such, is quite efficient. The use of this design dates back to a patent by a John Burlington, in 1832, who described his windmill as having the space swept by the sails "appropriate to the reception of an convenient number of vanes (shutters) so that they form an almost continuous circle". In some cases multiple extension pieces were added on the whips, beyond the annulus, rather like small

Figure 22. Haverhill Mill with an annular sail ring of 48 feet diameter.

conventional patent sails, to further increase the surface area and hence the power available.

A model was built with an annular sail in 1838 and soon after this a full sized mill followed, but this early structure collapsed. Soon afterwards another annular-sailed mill was built at Haverhill, Suffolk, by Richard Ruffle (TL 66 45). The sail ring was 48 feet diameter and had 120 shutters.

The mill worked well but was eventually demolished because it was on the flight path of an aerodrome during the Second World War.

A brick tower pumping mill at Owlesbury, Hampshire (SU 51 23), was originally built with an annular sail about 1874 but this had been modified to ten normal sails by about 1900, but all trace of the mill has now disappeared completely. A few other such mills were built, for example a post mill at Feltwell, near Downham Market, and a smock mill at Boxford, Suffolk (TL 959403), but all of them have long since gone.

The concept of the annular sail remained for many more years in the form of wind pumps, used on farms etc, and some of these may still be seen, scattered around this country and overseas.

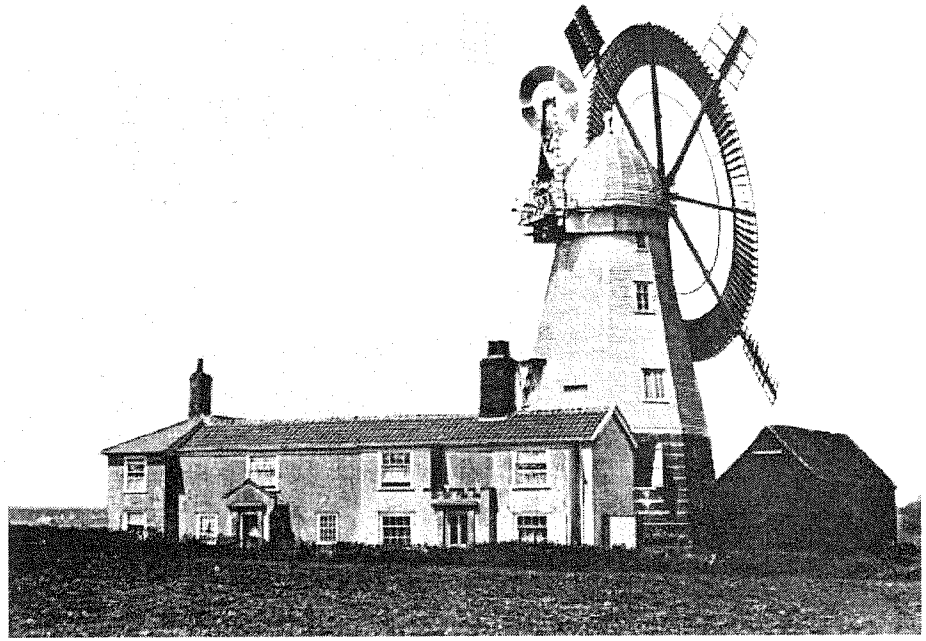


Figure 23. Boxford Mill, Suffolk, had an annular sail, fitted with four short radial extensions to increase the available power. Nothing remains on site today.

Water Pumping Mills

While the vast majority of water pumps had four sails there were also believed to be a number of very small pumping mills in Cambridgeshire, dating from the mid nineteenth century, which had six sails, although little documentary evidence has come to light. Of these, only Foxton pumping smock mill, to the south west of Cambridge, survives and this midget only has her sails fitted "only on special occasions". No attempt has been made to include these mills in the tabulations.

Windmills used for Industrial Purposes

Whilst for convenience details of industrial mills with multiple sails are included in Tables 1 -6 in the Appendix, as appropriate to the number of sails employed, a brief mention is made here of just few of the more notable ones.

It is quite clear that a number of windmills with multiple sails were used by industries other than corn milling, particularly in the days before steam had become fully established. In a recent publication, Roy Gregory, confirms that multi-sail mills were utilised in wide a variety of industries. Of these the vast majority of mills had five sails and these include Leeds Pottery Mill (c.1770); Stoneferry Whiting and Oil mills, Hull, (c.1790); Maister Oil Mill, Hull; Stepney Oil Mill, Newcastle-on-Tyne; Hessle Whiting Mill, near Hull (c.1806) and Beverley Road Paper Mill, Hull (c.1790).

Gregory only reports on one industrial mill, Wedgwood's Mill in Etruria, Staffordshire (c.1779) as having six sails. This was probably used to provide supplementary motive power for his pottery industry. For more details, and illustrations of many, of these mills the reader should consult "The Industrial Windmill in Britain", by Roy Gregory - see references.

Summary of Multi-Sailed Mills

Information has been collated on multi-sailed windmills. As a starting point all references to multi-sailed mills which were still standing were extracted from the "Windmill Gazetteer for England", published by the Mills Research Group in 1998. This lists some 42 such mills, of which 8 still were reported as having a full complement of sails. The author has been unable to confirm that Moulton, in Lincolnshire, ever had six sails, as recorded in the above Gazetteer.

Tables 1 - 3 in the Appendix list the five-sailed mills, most of which were in East Yorkshire or Lincolnshire. The total of 51 mills includes three which are still in working order, 15 standing in various condition and 33 which have disappeared completely. Forty six, six-sailed mills are listed in Tables 4 - 6, of which three are currently in working order, 19 are still standing and 24 have now disappeared. Most of these mills are in the northern and the eastern counties. The eight mills known as having eight sails are noted earlier in the text.

The ten-sailer at Owlesbury, Hampshire, and a twelve-sailer at Cottenhan, in Cambridgeshire, have been included, although the latter was reduced eventually to a more conventional four sails,

This information is summarised below, although it is not by any means claimed that all the mills listed were in existence at any one time.

No. of sails	Complete with sails	Still standing	Lost completely	Total
Five	3	15	33	51
Six	3	19	24	46
Eight	1	-	7	8
Ten	-	-	1	1
Twelve	-	-	1	1
	7	34	66	107

Note - Of the above mills 46, or nearly 50%, were in Lincolnshire.

From the data obtained in this study it therefore appears that there have been at least 100 windmills used for corn milling or other purposes in this country which at some time or other had more than four sails. There were of course far more mills which operated with what is considered to be the "conventional" four sails hence the "multiple-sailers" represent only a small percentage of the total mills built. Of the multi-sailers still remaining only seven still have their full sail complement and are in working order at the time of writing. No doubt most, or all, of the other surviving mills will never turn by the wind again. The few that remain must therefore be retained at all cost.

The working multi-sailers are generally listed Grade 2* whilst the eight sail giant, at Heckington, and, unusually, the five sail Hoyles Mill, at Alford, are both listed Grade 1. One hopes that given such high standings the future of all these important mills might be assured.

More multi sailers?

There is no doubt more data to be established on the mills included in the Tables and also probably even more mills which should be included. The author will welcome any input which will enable this collation to be extended.

Figure 24. There were three windmills in Alford, a four sail, a five sail and a six sailer but only the five sailer, Hoyles Mill still stands. The six storey mill, which is a listed Grade 1 building, is still in full commercial use, producing organic flour and cereals. The mill is open throughout the season.

Terminology

In preparing this paper many terms used in windmill construction and operation have been used. Rather than including a glossary of such terms the reader is referred for more information to "A Consolidated Glossary of British Mill Terms" prepared and edited by Tony Yoward, for the Society for the Protection of Ancient Buildings, and published in 1996. (Available from SPAB Mills Section, 37 Spital Square, London, ED1 6DY.)

APPENDIX

Abbreviations

COUNTIES: BD - Bedford, CB - Cambridgeshire, DR - Derbyshire, EY - East Yorkshire, KE - Kent, LA - Lancashire, LE - Leicestershire, LI - Lincolnshire, LO - Greater London, NF - Norfolk, NT - Nottinghamshire, NY - North Yorkshire, ST - Staffordshire, SU - Sussex, TN - Tyne & Wear, WA - Warwickshire, WI - Wiltshire, WY - West Yorkshire.

MILL DATA: C - Common sails, P - Patent Sails, RR - Roller Reefing Sails, ? - Lack of data.

Table 1. Five sail windmills, complete and in working order.

County	Place	Name	Date built	Sail type	Condition	Grid ref.
LI	Alford	Hoyle's Mill	1813	P	Working	TF 457765
LI	Boston	Maud Foster Mill	1819	P	Working	TF 332447
LI	Burgh-le-Marsh	Dobson's Mill	1813	P	Workable	TF 503649

Table 2. Five sail windmills still standing, not complete or not in working order.

County	Place	Name	Date built	Sail type	Mill status	Condition	Grid ref.
EY	Beverley	Lowson's Mill	1801	P	truncated	house	TA 027386
EY	Beverley	Union Mill	1802	P	truncated	business	TA 022385
EY	Beverley	Whiting Mill	1837	?	truncated	store	TA 020392
EY	Hessle	Cliff Mill	1820	RR	truncated	store	TA 022254
EY	Seaton Ross	Preston's Mill	1816	RR	truncated	?	SE 78 41
KE	Sandhurst	smock mill	1844	P	base only	store	TQ 79 28
KE	Margate	?	?	?	?	?	TR 35 70
LI	Brigg	Bell's Mill	1836	P	no m/c	good	TA 004732
LI	East Kirkby	?	1820	P	?	derelict	TA 333623
LI	Gainsborough	Spital Hill Mill	c1800	RR/P	full tower	derelict	SK822904
LI	Horncastle	Spilsby Road	1916	P	truncated	repairing	TF 266696
LI	Wainfleet	Salem Bridge	c1820	P	full tower	derelict	TF 495586
NY	York	Holgate Mill	c1790	P	full tower	restoring	SE 584517
TN	Newcastle	Chimney Mill	?	P	smock	business	NZ 224656
WA	Caldecote	Tuttle Hill Mill	1821	P	full tower	store	SP 344933

Table 3. Five sail mills which no longer exist.

County	Place	Name	Built/ demol.	Sail type	Grid ref.
EY	Driffield	North End Mill	1819/c1882	RR	TA 022584
EY	Hornsea	Brickworks Mill	c1866/c1900	P	TA 201464
EY	Kingston-upon-Hull	Beverley Rd paper mill	1796/?	RR	TA 090303
EY	Kingston-upon-Hull	Cent per Cent Street	before1820/?	P	TA 089279
EY	Kingston-upon-Hull	Dansom Lane	?/?	P	TA 107298
EY	Kingston-upon-Hull	Dansom Lane	1800/?	RR	TA 107296
EY	Kingston-upon-Hull	Holderness Road	1775/?	C	TA 108295
EY	Kingston-upon-Hull	Holderness Road	1786/?	?	TA 108295
EY	Kingston-upon-Hull	Holderness Road	1796/?	RR	TA 113298
EY	Kingston-upon-Hull	Maister's Oil Mill	c1810/?	?	TA 101293
EY	Kingston-upon-Hull	Stepney Mill	1795/?	?	TA 089302
EY	Kingston-upon-Hull	Stepney Paper Mill	1796/?	RR	TA 090303
EY	Kingston-upon-Hull	Stoneferry Whiting Mill	1791/?	RR	TA 103313
EY	Kingston-upon-Hull	Stoneferry Oil Mill	1790/1830	RR	TA 103312
EY	Kingston-upon-Hull	Wincolmlee Mill	1810/?	RR	TA 101293
WY	Leeds	Pottery Mill	1770/c1818	C	SE 302322
NY	Whitby	Union Mill	1800/1880	P	NZ 894111
LA	Salford	Peel Park Mill	?/1933	P	SJ 823990
LI	Barrow-on-Humber	Brocklesby's Mill	?/1970s	?	TA 062227
LI	Brigg	Bratley's Mill	1794/1933	?	SE 987067
LI	Cleethorpes	Mill Place	1803/1922	?	TA 307088
LI	Conningsby	Watson's Mill	1826/1970	?	TF 224579
LI	Donnington	Rippon's Mill	?/1960	?	TF 204355
LI	Epworth	Subscription Mill	1805/1921	?	SE 78 03
LI	Gainsborough	Morton Union Mill	c1804/1935	?	SK 806908
LI	Gainsborough	Ashcroft Mill	1826/?	?	SK 819888
LI	Horncastle	Mill Lane	c1803/?	?	TF 260695
LI	Hundleby	Goodwin's Mill	c1823/1902	?	TF 395664
LI	Laceby	Black's Mill	c1822/c1922	?	TA 221066
LI	Louth	Horncastle Road	c1820/c1910	?	TF 321865
LI	Scartho	Heaton's Mill	1869/c1960	?	TA 266071
LI	Winterton	Northlands Mill	1795/?	?	SE 920200
TN	Newcastle	Stepney	1783/c1878	?	NZ 259655

Table 4. Six sail windmills complete and in working order.

County	Place	Name	Date built	Sail type	Grid ref.
DR	Heage	Shore's Mill	1797	P	SK 367507
LI	Sibsey	Trader Mill	1877	P	TF 352514
LI	Waltham		1880	P	TA 259033

Table 5. Six sail windmills still standing, not complete or not in working order.

County	Place	Name	Date built	Sail type	Mill status	Condition	Grid ref.
BD	Potton	?	1840	?	truncated	ruin	TL 014218
CB	Manea	Station Road	1818	P	tower	?	TL 478893
CB	March	?	1866	?	tower	?	TL 417968
CB	Foxton	smock pump	?	?	?	can work	TL 497483
CB	Thorney	?	1787	P	truncated	house	TF 278043
CB	Whittlesey	Elderkin's Mill	1860	P	tower	ruin	TL 264975
LE	Wymondham	?	1819	P	no sails	moderate	SK 850192
LI	Gedney Dyke	Musson's Mill	1836	P	tower	derelict	TF 418262
LI	Holbeach	Penny Hill Mill	1827	P	tower	derelict	TF 358268
LI	Lincoln	Le Talls Mill	1845	P	tower	house	SK972703
LI	Long Sutton	Brunswick Mill	1817	P	tower	derelict	TF 441222
LI	Long Sutton	Roman Bank Mill	1843	P	tower	derelict	TF 439229
LI	Metheringham	Scott's Mll	1867	P	tower	moderate	TF 064614
LI	Wragby	?	1831	P	tower	derelict	TF 131778
LO	Clerkenwell	?	1708	?	stump	store	TQ 312827
NF	Ringstead	?	1845	?	tower	house	TF 705416
NF	Terrington St. Clement	Balsam Fields Mill	1841	P	stump	store	TF 551188
NF	West Walton	Ingleborough Mill	1824	P	roofed		TF 473149
WI	Devizes	?	c1675	C	tower	house	SU 00 61

Table 6. Six sail windmills which no longer exist.

County	Place	Name	Built/ demol.	Sail type	Grid ref.
BD	Leighton Buzzard	?	?	P	SP 91 25
CB	Peterborough	Millfield Mill	1831/?	?	TL 188996
DR	Riddings	Sarah	1870/1963	0	SK 426529
DR	Riddings	James	1870/1963	P	SK 426529
NY	Whitby	Wren's Mill	1746/?	P?	NZ 894103
LI	Alford	Myers Mill	1827/?	P	TF 455758
LI	Bardney	James Green's Mill	1830/1946	P	TF 120696
LI	Binbrook	Topliss's Mill	1879/1936	P	TF 209938
LI	Coleby Heath	?	?/?	P	SK 97 60
LI	Horncastle	Louth Road	?/1909	P	TF 26 69
LI	Louth	Charles Street Mill	?/1910	P	TF 32 87
LI	Louth	Topham's Mill	1831/1910	P	TF 32 87
LI	N. Somercotes	Cartwright's Mill	1797/?	P	TF 416965
LI	Spalding	Birch's Mill	1819/1909	P	TF 234216
LI	Willingham	?	1854/?	P	SK 87 84
NF	Sulthorpe	?	?	?	TF 892303
NF	Walsoken	?	?	?	TF 47 10
NT	Kneeton	?	1769/1841	P	SK 71 46
NT	Retford East	Storcroft Mill	1866/?	P	SK 70 81
NT	Sutton in Ashfield	Textile mill	c1820/?	P	SK 49 59
SU	Lewes	Ashcombe Mill	1870/?	P	TQ 41 10
SU	Keymere	Model only	1950s	P	TQ 30 15
ST	Etruria	Wedgwood's Mill	1774/?	?	SK 86 46
KE	Great Chart	smock mill	?/1928	?	TQ 98 42

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A TERRIBLE MACHINERY ACCIDENT AT BLYTHE MARSH MILL, STAFFORDSHIRE

By Barry Job

Introduction

In our Health and Safety conscious world of today, the working conditions in wind and water mills 100 years ago must appear to have been fraught with potential danger. Yet accidents would seem to have been relatively uncommon, or at least they were not regularly reported. The accident at Blythe Marsh Mill, Blythe Bridge, in August 1907 was extensively reported in the local newspaper, but there were unusual elements to this fatal accident. Firstly, the deceased was a woman and secondly, she was a joint owner of the mill, along with two of her sisters. This article sets out the circumstances surrounding this tragic accident.[1]

Location

Two mills existed at the settlement of Blythe Bridge, to the south east of Longton in Staffordshire (see Figure 1). Historically one was called Blythe Bridge Mill, the other Blythe Marsh Mill (with alternative spellings of Blith, Blithe and Blyth). It is the latter that we are concerned with in this article, at grid reference SJ 959409[2] (see Figure 2).

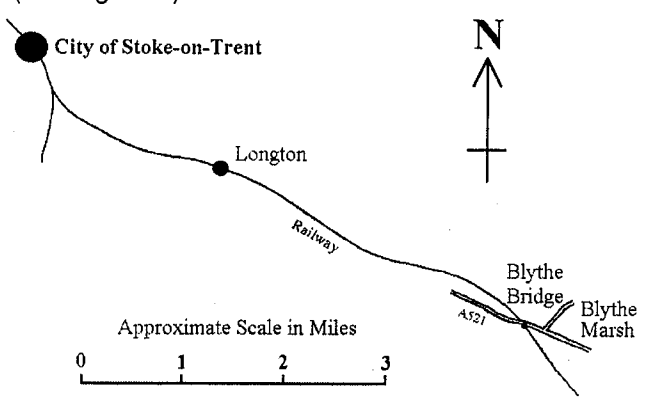

Figure 1. The location of Blythe Marsh south-west of Stoke-on-

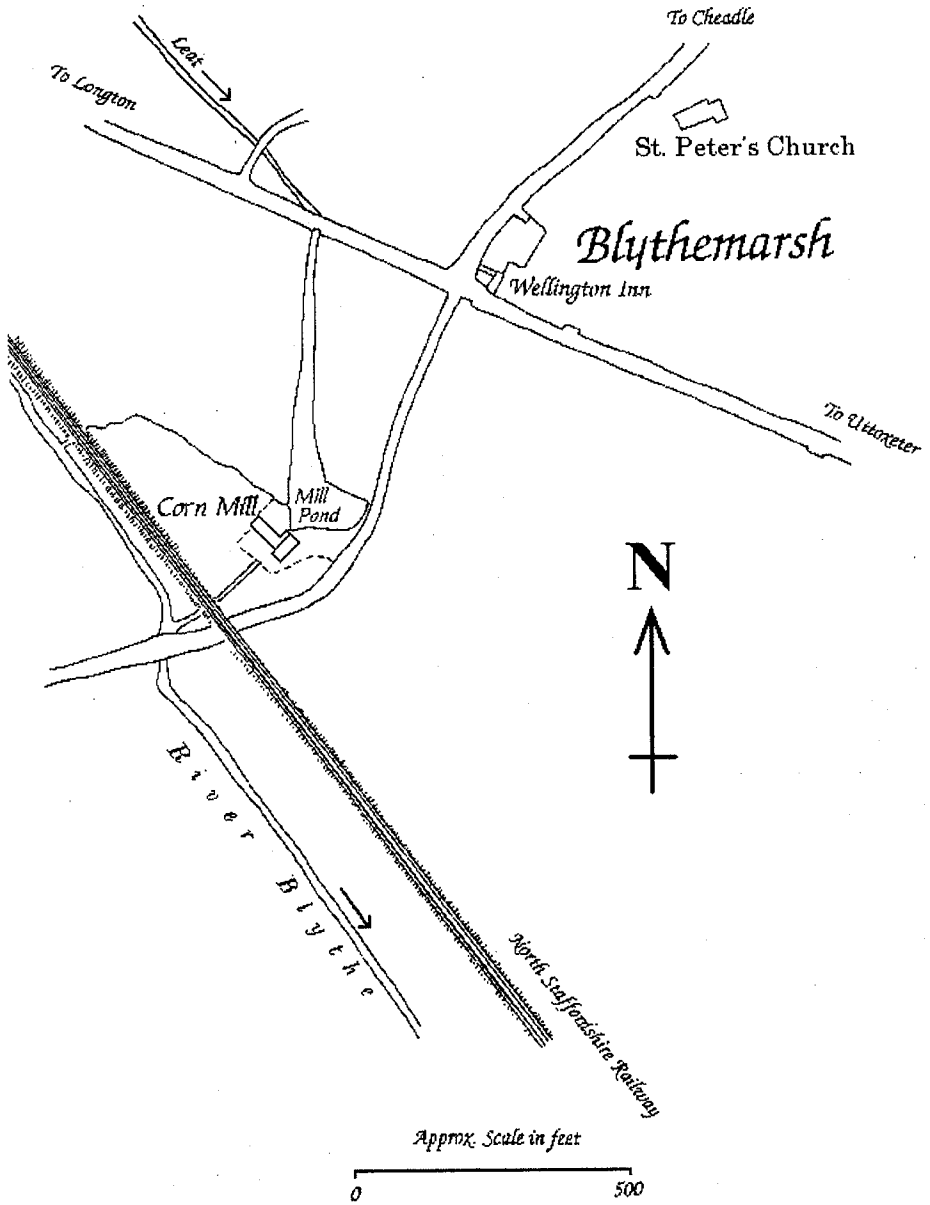

Figure 2. Sketch map showing the location of Blythe Marsh Corn Mill relative to the railway, roads and watercourses. Information supplied by the Ordnance Survey based on surveys carried out in 1879.

History of Blythe Marsh Mill[3]

The mill is on an old site and was operated as a corn mill in the early 18th century. In October 1726 Thomas Parker, of Park Hall, leased to Richard Reyd (also Rede, Reed and Read) of Dilhorne (or Dilhorn), "All those two ancient water corn mills under one roof and also one other water corn mill for wheat lately erected adjoining to the same situate upon Blyth Marsh ... now in the occupation of Richard Reyd together with all manner of gearing and running gears belonging to and used with the same mills ... from 1st January next for a term of 99 years paying yearly £12 ... ." But the Dilhorne Parish Register records the baptism of his daughter Dorothy in 1727, the death of Richard Rede in December 1728, followed by the death of Dorothy the following year. Letters of administration were granted on Richard Reed's estate in May 1729 with an inventory of his goods made on Christmas Eve 1728 giving a total value of £14.

The discovery of the potential use of flint in pottery manufacture at this time resulted in many mills in "The Pottery Towns" being converted to flint grinding.

Improvements in the road transport system into "The Potteries" allowed outlying mills to be converted for this lucrative trade. An Account Book held at the County Record Office shows that flint was being delivered to Blythe Marsh Mill for grinding from about 1764. However, the subsequent opening of the canal system then placed those mills that were situated at a distance from a canal at a significant disadvantage. *Aris's Birmingham Gazette* for 25th July, 1774 records the bankruptcy of Ralph Lewis and the sale of the "Flint Mills called Blithe Marsh Mills" together "with Running Gears, Mill Pool, and Stream of Water, and also a Dwelling House, Garden and a close or Parcel of Meadow Land .... The Mills, House and Buildings have lately been put into good Repair at a considerable Expence."

Thus, when Thomas Parker leased the mill to Thomas Wilshaw for 41 years from 1775 it was with the proviso that within the first year he shall have "taken down ... the ancient mill called Blyth Marsh Mill and lay out and expend... the sum of £200 in erecting and building a new corn mill with two water wheels upon the place where the old mill stood ... ." Land Tax Assessments show that from 1796 to 1800 the owner of the new corn mill was now Robert Parker, with the occupier being Thomas Wilshaw, but by 1801 it was Salt and Broster. In June 1802 the *Staffordshire Advertiser* records that the partnership between Joseph Salt the younger and Thomas Broster had been dissolved by mutual consent. Land Tax Assessments from 1803 to 1807 still give Robert Parker as the owner, but with Richard Ash as the occupier. From 1808 to 1831 the ownership had passed to Thomas Hawe Parker, the occupier now being Thomas Broster from 1815.

Summary of Millers[4]

1796 to 1801 Thomas Wilshaw.
1801 to 1802 Joseph Salt & Thomas Broster.
1803 to 1807 Richard Ash.
1815 to 1836 Thomas Broster.[5]
1838 to 1851 Frances Broster.[6]
1860 to 1890 Richard Ash Broster.[7]
1890 to 1912 Louisa Broster,[8] Florence Irene Broster and Henrietta Constance Broster.[9]
1912 to 1921 R. A. Broster & Co.[10]
1921 to 1927 Ernest John Holdcroft Senior.
1927 to 1949 Ernest John Holdcroft Senior, Harold John Holdcroft & Kenneth Holdcroft in partnership.
1949 to 1961 Ernest John Holdcroft Senior.
1961 to 1982 Ernest John Holdcroft Junior.
1982 to 2004 Howard Holdcroft.

Description of Blythe Marsh Mill[11]

The three storey, brick mill building still stands in Stallington Road, to the south of the A521. It was served by a leat well over a mile long from the River Blithe to the north west, leading to a small pond. The river course was altered by the railway about 1848 and alterations to the mill may have occurred then. The flow along the leat used to be constant but, as the surrounding area has been built up, the steady flow off the fields disappeared and the run-off increased dramatically. Thus, the flow was heavy directly after rain but quickly dwindled in drier weather. The pond was too small to provide a steady supply for the mill and, as problems were also experienced with keeping the long leat clear, water power was dispensed with. The mill continued to grind animal feed but now relied on electric power. More recently the weir has been broken and the river level lowered so that the only supply to the pond today is rainwater. In January 2004 production at Blythe Marsh Mill ceased altogether and the business was transferred to more modem premises capable of producing the higher capacities necessary to remain competitive in today's market.

The last water wheel was cast iron, 14 feet by 6 feet, but this replaced a wooden spoked water wheel. About 1926/27 the iron wheel was replaced by a Gordon Gilkes turbine. This ran well with about 15 feet of water fall until the problems previously noted began to reduce the water flow to it, the turbine needing large quantities of water. The turbine, which is still in position, was last used about 1975, although the belting and shafting for it were retained in

Plate 1. Blythe Marsh Mill seen from the entrance on Stallington Lane, the mill pond is behind the hedge on the right.

place. Then the cross shaft, which was formerly driven by the turbine, was driven by a 30 horsepower slip ring induction electric motor. The electric motor has now been removed and the shafting disconnected. Other smaller electric motors drove ancillary machinery such as augers, mixers and elevators. They were fitted with novel mechanical trips for stopping in an emergency.

The water power drove a 14 feet diameter spur wheel which drove four pairs of stones in a line along the rear of the first floor wall. The stones, which were supported on cast iron columns, were said to be removed in the 1930s. Grinding was then carried out on the first floor with a Booths of Congleton roller mill and a home made hammer mill. This machinery was supplemented by a seed cleaner.

The slack belt sack hoist was reputedly still using only the second belt in its history. One rope pulled to one side a notched piece of wood; this allowed a beam, weighted with railway sleeper "chairs", to drop and tension the belt engaging the drive. To disengage the drive another rope was pulled to raise the beam. Releasing the first rope allowed the notched wood to swing back and

engage with the beam to hold it up. A third rope lifted a brake lever with a wooden brake pad which rubbed against the underside of the belt pulley. The sack hoist chain wound onto a fabric covered hoist drum which moved along the shaft to move the chain across the drum.

During the Second World War, when flax was being ground for cattle feed, a box of matches was accidentally mixed with the flax. When the matches were ground, they exploded and the flax caught fire. The fire was extinguished with stirrup pumps, but the Fire Brigade arrived, put hoses through the roof and flooded the mill destroying much stock. The charred ceiling beams from this incident can still be seen.

All of the traditional gearing was, no doubt, removed when the turbine was installed. The depression in the floor for the pit wheel would have also been filled in at this time. All that remains today of the site of the tragedy is an unprepossessing corner of the ground floor of the mill with holes in the wall for belts from the turbine and the disconnected line shafting lying on the floor.

Plate 2. Blythe Marsh Mill seen from the south-west, the rear of the mill retains numerous storage hoppers for the animal feed business.

Narrative

The local *Staffordshire Sentinel* newspaper of 3rd August, 1907[12] records the details of the accident:-

Terrible Machinery Accident.
A Blythe Bridge Lady Loses Her Life.

A terrible accident occurred yesterday at Blythe Bridge by which Miss Louie (sic) Broster lost her life.

Broster's Mill is well known throughout the district and Miss Broster, in conjunction with sisters had successfully carried on the business for many years, personally directing its management. During the past week there has been a change in the employees, and Miss Broster went to the mill yesterday morning to superintend the work. It appears that the deceased lady went into that part of the mill where the machinery is in operation, and as she was not seen for some time one of the men went to look for her. It was found that Miss Broster had become entangled in the machinery, and after being terribly crushed had fallen into the well below the driving wheel [presumably this was the well beneath the pit wheel - Author].

One theory as to the occurrence is that in moving one of the levers the deceased lady overbalanced herself and fell or had her clothing entangled. The injuries she received to the head and body were so severe that death must have been instantaneous. The body was removed home as quickly as possible and Dr. Williams was summoned but his services were, of course, of no avail.

The sad affair has provoked deep regret throughout Blythe Bridge, where Miss Broster had been, with the rest of her family, held in the highest respect and sincere sympathy is expressed to the relatives.

The inquest was held at Blythe Bridge and is reported by the *Staffordshire Sentinel* newspaper of 5th August, 1907[13] where further details are revealed:

The first witness called was Miss Henrietta Broster, sister, who said her deceased sister was 44 years of age. She, deceased, and another sister were joint owners of a corn mill at Blythe Bridge. About a quarter to seven on Friday 2nd August her sister left the house for the mill in her usual health to start it. She had never known her sister to faint or complain of dizziness or giddiness or anything of that nature, her sight was good. Her sister was accustomed to the milling processes, and of the machinery and at the moment there was no man about the place who understood the machinery, having had reason to dismiss the services of the chief man about a week ago.

Lowndes, a labourer employed at the mill, saw Miss Broster go into the mill about half past seven. A few minutes later as she had not reappeared he thought there must be something the matter and went and stopped mill, he

had heard no cry whatsoever. He went to the wheel hole to see what was the matter, but could not see her. He then went for a fellow workman Thomas Wood and together they found the deceased in the wheel hole. She was dead, her dress was torn a little. Witness said he knew nothing about the machinery and had only been employed at the mill a short while. Wood, a waggoner employed at the mill, had seen "the missus" go into the mill, but had not seen her come out. Lowndes had stopped the mill and gone into the mill but could not see her. Witness at once entered the mill and had a look for himself, but he could not see her and told Lowndes he must be mistaken, but Lowndes replied "*I aren't, she's in there somewhere.*" He fetched a candle, lighted it and looked in the wheel hole and in one corner all of a heap saw the deceased. He got her out, she was quite dead.

The local constable found a spanner in the wheel hole. This was used for lowering the millstones. There was a hole provided from which the spanner could be safely used without going into the wheel hole. Witness said he thought it easier to move the millstones from inside the wheel hole rather than in the hole provided.

Doctor Williams of Longton said that he was called between half past seven and eight. When he examined the deceased he found the neck broken and there were other severe injuries. He considered that death would be instantaneous.

The coroner reported that the three ladies carried on the occupation of millers. About a fortnight ago the man who did the work about the mill left and the ladies had not been able to find another to take up his place. On the morning in question, unfortunately for Miss Broster duties were undertaken which were scarcely suited to a lady, at any rate the risk was intensified by the fact it was a lady and not a man working among the wheels and stones. It seems that the place made for the spanner was not used. This was a sad end to a life which had apparently been very industrious, he could only come to one conclusion; that the death was due to an accident, the family had the coroner's sympathy and also the deep sympathy of the local people, a sentiment which he endorsed. A verdict of "Accidental Death" was recorded.

Explanation[14]

It seems quite clear that Louisa Broster was altering the gap between the stones, to alter the quality of the flour being produced, whilst the mill was running. This is quite normal but this tentering is usually safely achieved by making the adjustment from outside the hurst frame which supports the stones on the floor above. It may have been the case here that centre-lift tentering was employed, where the adjustment is sometimes made to a screw directly below the footstep bearing on the bridgetree.

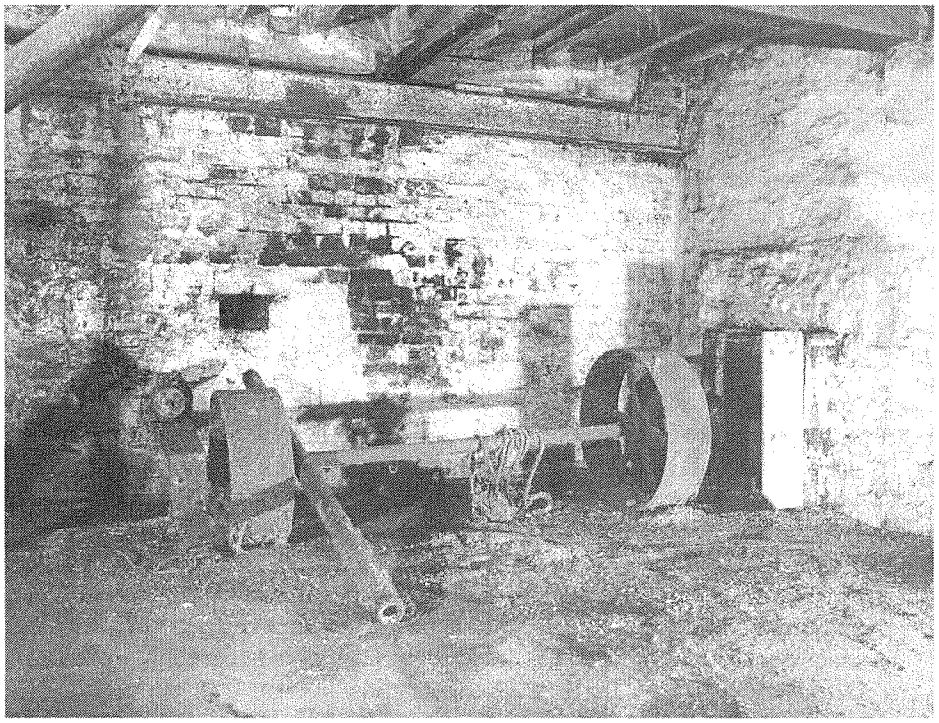

Plate 3. The place where the tradgedy occurred. The original machinery has been removed and the floor levelled, but a slot for the belt from the turbine can still be seen.

Blackford Mill at Henley-in-Arden is an example of this, although at Blythe Marsh Mill the screw would be turned by a nut and spanner rather than the tommy bar arrangement at Blackford Mill. If the hurst frame was boarded on the outside, as is commonly the case, then a hole would have to be provided for access to the screw with the spanner. Quite why it was "easier" to adjust the millstones by entering the machinery pit, which Louisa Broster had clearly done, is not clear. It might have been possible to achieve greater leverage on the spanner from inside the hurst rather than through a small, restricting hole in the boarding. It may be that the access hole was blocked by stored sacks of grain, or something similar. The ground floor of the mill is reasonably well lit, with large windows in the front wall, however, there would be no natural light behind a boarded burst frame. Once Louisa Broster had entered the machinery pit, with the mill running, and in the dark, it is easy to speculate that she slipped, or her clothing became entangled in the gearing, hence she fell or was drawn into the machinery, with tragic results.

References

1. Personal Communication; Richard Cresswell. I am grateful to Richard Cresswell for supplying me with copies of the Death Certificates, and for other information on the Broster family.

2. Confusingly, the locality is now commonly referred to as Blythe Bridge and the mill in the article is now called Blythe Bridge Mill, for example, the last business traded as "E. J. Holdcroft & Sons, Millers, Blythe Bridge Mill." However, in 1907 the locality was known as Blythe Marsh (or Blythemarsh) and the name Blythe Marsh Mill is used throughout the article.

3. Personal Communication; Andrew Dobraszczyc. Andrew Dobraszczyc has carried out considerable research into the early history of mills in the area and the relationship between the milling processes and the transport systems for the raw materials and the ground products. I am grateful for his generosity in placing his work at my disposal, this section is only a brief summary of his research.

4. Information taken from the notes of H. E. S. Sirnmons, held at the Science Museum, Kensington, London, plus the notes of Andrew Dobraszczyc, the Census Records held at the County Record Office, Stafford, and from Trade Directories held at the Salt Library, Stafford.

5. A gravestone at the Church of Saint Nicholas, Fulford, records "Thomas Broster, late of Blythe Marsh Mill, died October 9th, 1836 aged 67."

6. A gravestone at the Church of Saint Nicholas, Fulford records "Frances, the wife of Thomas Broster of Blythe Marsh Mill and daughter of Richard and Mary Ash who died June 8th, 1861 aged 86 years."

7. Richard Ash Broster, the son of Frances Broster, died 2nd February, 1890, aged 79 years, from "Senile Decay" and "Congestion of the Lungs" according to his Death Certificate. His memorial is at St. Peter's Churchyard in Forsbrook. He had married twice, first to Mary Finney (the Finneys were a well-known milling family) and then to Clara Swettenham. Clara was much younger than Richard, but died before him on 28th February, 1883 "of brain effusion" at the age of 44, her memorial is also at St. Peter's Churchyard, Forsbrook. Louisa, the daughter of Clara and Richard, was born on 24th May, 1862.

8. Louisa Broster died 2nd August, 1907, described as "aged 44 years" (from her birth date this should be 45), on which date she was "Accidentally drawn into the machinery in the Flour Mill whereby her neck was broken and other severe injuries sustained causing instant death" according to her Death Certificate. However, she continued to be listed in the Trade Directories after that date. Her memorial is at St. Peter's Churchyard, Forsbrook, where her age is now incorrectly given as 42 years.

9. Whilst it may be accepted that Louisa, Florence and Henrietta Broster operated the mill, a tenancy agreement signed 20th March, 1890 in the Stafford Record Office (SRO: D1798/684/12/14) clearly shows that the Honourable Edward Swynfen Parker-Jervis of Aston Hall leased the mill, house, garden and numerous fields to Louisa Broster and Annie Broster at a yearly rent of £120.

In the ensuing years Annie Broster married Thomas Henry Averill, a farmer. A draft conveyance in the Stafford Record Office (SRO: D1798/684/20/20) shows that William Robert Parker-Jervis of Meaford Hall sold the water corn mill, mill pool, house, garden, barn, stables and land to Louisa Broster, spinster of Blythe Marsh Mill, Annie Averill of Stallington Lane, Blythe Marsh and Florence Broster, spinster of Blythe Marsh Mill, for £2,750 on 24th December, 1898.

10. Mr. Cresswell, a local ironmonger, had married a Miss Broster and assisted in running the mill during this period.

11. Personal Communication; Holdcroft family. The information for this section has been kindly supplied originally by Mr. E. Holdcroft and Mr. J. Holdcroft, and latterly by Mr. H. Holdcroft, owners and millers, and recorded in visits to the mill, principally in 1981 and 2005.

12. The *Staffordshire Sentinel*, Saturday, 3rd August, 1907, page 7, copy held at Hanley Reference Library. This text is a slightly shortened verbatim account of the original.

13. The *Staffordshire Sentinel*, Monday, 5th August, 1907, page 3, copy held at Hanley Reference Library. This text is a slightly shortened verbatim account of the original. However, it must be noted that the microfiche that was examined was copied from a newspaper which had the report partly within a fold of the page; hence very short parts of the sentences were omitted. Thus, likely words have been substituted, but this text must be regarded as an approximation of what was originally written.

14. This section has been written with kind assistance from Mr. D. T. N. Booth.

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