



University of
Salford
MANCHESTER

Finds Report

Mellor Mill

Client: Revealing
Oldknows Legacy
Project

Technical Report:
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Finds Report

Post Excavation report of materials recovered during the

excavation of Mellor Mill, Mellor, Stockport

Introduction

This report concerns the archaeological material recovered from Mellor Mill Excavations in 2015, carried out by the Salford Archaeology (SA) along with Mellor Archaeological Trust (MAT). The works formed part of the Heritage Lottery Fund (HLF) funded Revealing Oldknow Project supported by Canal and River Trust (CRT), MAT and SA.

The aims of the works were to uncover record, interpret and conserve the remains of Mellor Mill for future display to the general public.

The findings from these works will inform the future treatment of the study area and enhance the presentation to the wider public.

Aims and Objectives.

The principal aim of the present report is to evaluate the artefact data generated during the excavations of 2015 at the site of Mellor Mill.

Material Assessed.

The entirety of the stratigraphic archaeological artefact data along with a brief overview of the unstratified archaeological data was viewed and assessed for the production of this report. The quantifications are incorporated into each individual assessment.

Procedure of Assessment

The methodologies adopted for the assessment varied depending on the class of the material under examination. All classes of find were examined in full, with observations supplemented by the finds records generated during the course of the excavation.

The Assemblage

The totality of the assemblage of artefacts recovered from the excavations at Mellor Mill, were processed and assessed in a controlled laboratory environment based at Salford Public Archaeological Resource Centre (SPARC), hosted by the Centre *for* Applied Archaeology (CfAA) at the University of Salford.

The initial assessment consisted of the collecting and cleaning of all artefact material, and the calculation of the volume of artefacts recovered, the assemblage counts are as follows:

Material	Totals
Glass	70
CBM	37
Ceramics	50
Metals	298
Misc	23
Total Count	478

***Fig 1:** The above table shows the artefact assemblage count by material type and to total number of artefacts found at Mellor Mill.*

The assemblage count gives a brief view into the overall distribution of artefacts recovered from the excavations at Mellor Mill, giving a clear indication that the predominant collection centred ferrous metals collected from the mill complex at 62%. Miscellaneous materials accounted for 5% with glass at 15% building materials at 8% and ceramics at less than 10% of the assemblage.

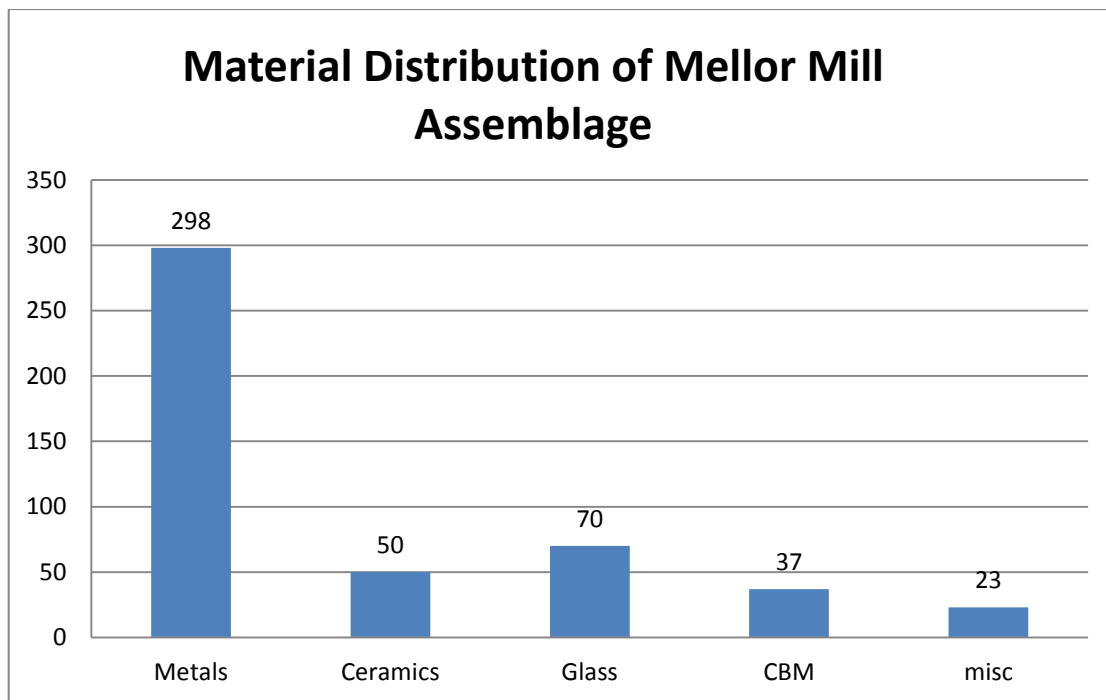


Fig 2: *The bar chart above shows the distribution of the assemblage recovered from Mellor Mill*

The metals assemblage has little information of the machines or the manufacturers of those machines and as such adds little to the already well established archaeological information of the site. A few of the metal items reflect a more personal history of the site and as such, can offer information on the social impact of the mill. However, these items are few and in a poor level of conservation.

The assemblage in context reflects how the archaeology of the mill has been uncovered and shows evidence that the site has been used as a refuse area in the years after the destruction of the mill. A George V sixpence dated 1922, reflects the continued use of the area and the potential dates of the refuse deposits which overlay the Mill complex.

The pie chart below shows the contextual distribution of the material assemblage.

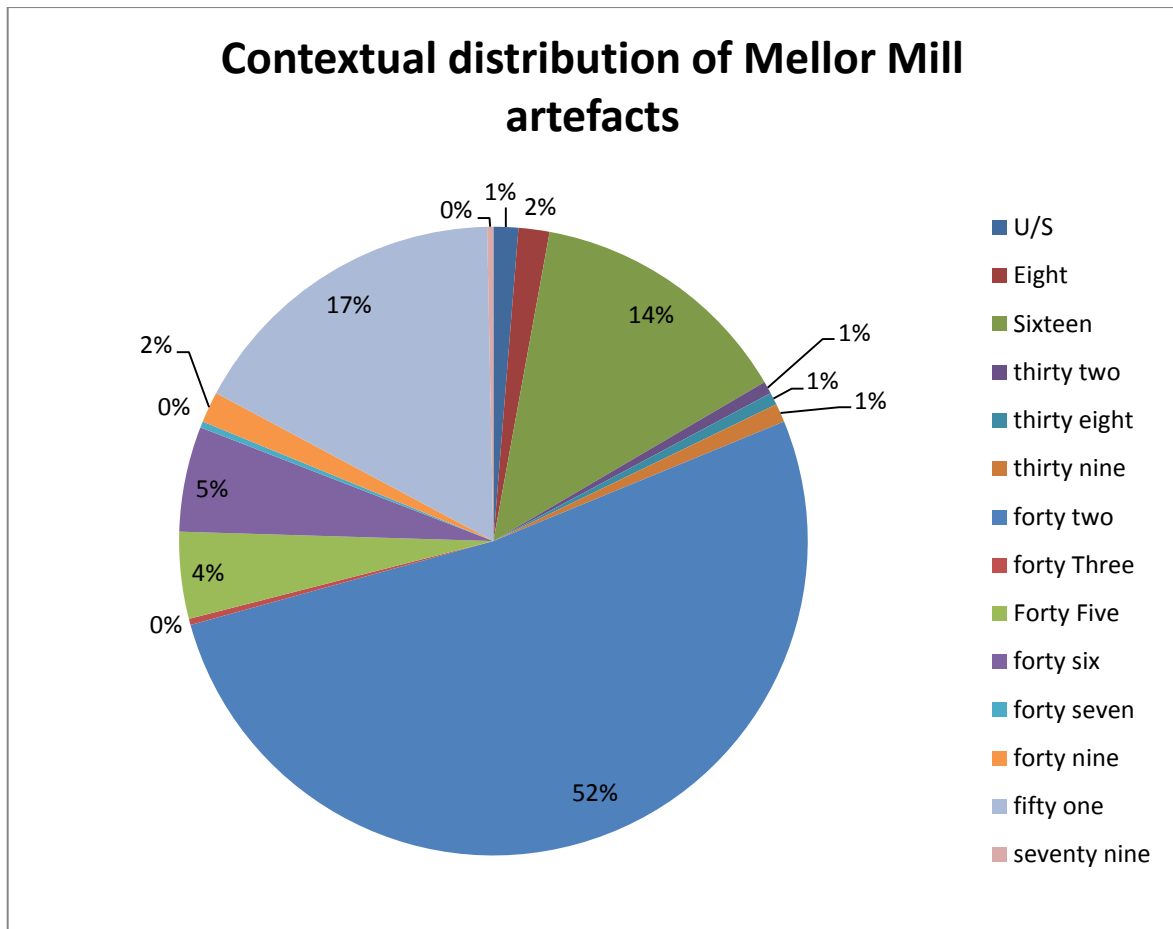


Fig 3: Pie chart showing the contextual distribution of the recovered artefacts

The contextual breakdown of the material which has been recovered, allows us to view a snap shot of the distribution pattern of the artefacts at Mellor Mill, the most abundant context is (*42) with 52% of the assemblage being recovered from this context. (*42) is described as the fill of Sub division 4 which is within the area of the drive shaft. (*51) is the second most abundant context at 17% and is described as the fill of sub division 8. (*16) accounts for 14% of the artefacts and is described as a dark brown silty rubble filled deposit within sub division 2.

To this extent it is possible to state that both sub division 2 and 4 are the most prolific in archaeological items, however, without further information on how these sub divisions relate to the remains of the mill, little can be said for their archaeological values.

All of the items recovered from Mellor Mill are in a poor state of preservation and many will be required to undergo further conservation treatments before they can be used for any artistic or interpretive purpose.

Interpretive Artefacts

Part of the assessment criteria was to identify artefacts which would be suitable to be used as potential interactive items for handling and museum display. To this extent each object was assessed for three characteristics which would be required for the use outlined above, these characteristics are as follows:

Level of preservation:

This characteristic looked at the items stability, current level of preservation and potential for conservation.

Level of information:

This characteristic looked at the level of intrinsic significance for each of the items, assessing if an item would hold a suitable amount of information in regard to the industrial and social history of the site to be considered for handling and display.

Survivability:

This characteristic looked at the form and the fabric of the items to assess if the item would survive the handling with minimal conservation, these criteria was essential for the formation of the potential teaching collection.

A gazetteer of potential items was constructed from the objects which were identified using the above characteristics and are listed in appendix A, however some of the items within the gazetteer are of particular archaeological interest and as such are discussed in further detail below.

Mechanical key

Two of the mechanical keys have been uncovered at Mellor Mill, these keys are tapered in shape and form part of a machine. The mechanical key allows the owner to

remove a part of the machinery to effectively stop that machine for functioning, by replacing the mechanical key, it completes the machine and allows it to work. Mechanical keys are commonly found in gears, pulleys, couplings and washers.

Fig 4: Mechanical Key recovered from the flywheel pit.





Fig 5: Stanchion from the mill and a comparison of a stanchion in situ.

Stanchion

The Stanchion is cast iron standing at 2feet 6inches, and may have formed part of the guard rail surrounding the engine. The stanchion is in a good level of preservation and would do well by conservation and re-situation as an interpretive item on the site of Mellor Mill. The addition of information boards with images of other in situ stanchions will offer a form of scale for the visitors.



Fig 6: Image of the larger cotton burner, used in the gassing stages of yarn production

Burners

During the spinning process of the manufacture of cotton yard, one of the final stages of the production is gassing. This stage uses cotton burners to pass the yarn through a flame in order to remove loose fibres. Mellor Mill has produced 2 of these burners with information on the face “..J.Stubbs...1820....Manchester”

This date is consistent with the functional life of the mill..

Discussion

The assemblage collected from the excavations at Mellor Mill, reflect the nature of the building, a majority of the ferrous metals which have been recovered form parts of machines, including flywheel fragments, rollers, pulleys and cogs.

The assemblage is 62% ferrous metals, 10% ceramics, 15% glass and 8% building materials. This is an average spread of materials to be recovered from this type of mill complex, and although there are a lot of machine fragments that have been recovered, very few of these have any form of traceable characteristics. The items which do have maker's marks on them are fairly arbitrary pieces and would not offer any new insights into the archaeology of Mellor Mill.

The mechanical key is one of the better preserved items, which does offer somewhat of an insight into the construction of one of the machines at the mill, this type of tapered key is associated with pulleys, cogs and couplings. However, without detailed information on the contextual deposition, the mechanical key loses some of its significance.

Similarly the cotton burners which would have had cotton yarn pass by them to remove any residual loose fibres, gives information on the production company along with a date of "1820", however, this information only confirms the use of the cotton burners during this time, a fact already established at Mellor Mill.

The consistent low levels of preservation of the materials made it difficult to fully identify items and their associated machines; this also makes it difficult to identify potential tactile and engagement pieces. The majority of the metal items were ferrous and corroded beyond the point of salvage, however, the gazetteer in appendix A offers some of the items which may be able to be used in this manner.

The spread of the assemblage at Mellor Mill is predominantly within context (*16) with 14% of the assemblage, and was situated with sub division 2 and was the area of the boiler house and engine house. (*16) produced a moderate amount of finds, with 2 particular items being of intrinsic significance, the fly wheel fragment and the previously discussed mechanical key.

Context (*42) noted in the report as context (002) the refuse infill, overlaying (012) the fill to the north of the drive shaft, (*42) accounted for the majority of the spread at 52% of the recovered finds. However, as noted in the description for (002), a large

percentage of the finds recovered from this context may relate to the later use of the site as an unofficial refuse deposit, rather than the mill itself.

This overlaying refuse deposit has complicated the distribution somewhat as it has produced unclear contexts, containing both mill and non-mill materials. The site therefore suffers from unclear contextual assemblages with little to no traceable characteristics, deposited within demolition and refuse strata.

For the items which have been identified as holding potential for further use as interpretive and tactile objects, it is highly recommended that conservation is considered, particularly for the stanchion, if this is to be resituated. Although the items recovered offer very little new information on Mellor Mill, they would be beneficial for use in a museum or for handling and education.

Appendix A – Gazetteer of items for interpretive use.

Location: Mellor Mill, Stockport

Assessment: stable



Summary

Cotton burner used in the gassing of cotton yarn, part of the final production of yarn prior to the winding on to the bobbins, although only one is pictured there are 2 of these items, inscription on the smaller reads "...J.Stubbs....Manchester...1820"

S:F: 164 context: (*42) Also known as (002)

Date Range 19th century

Recommendation: handling/ interpretation

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Small button with R.A.F design, depicting a crown with an eagle below, typically associated with WWII.

S.F. No: 191 context: (053)

Date Range: 20th century

Recommendation: Retain for interpretation/display

Location: Mellor Mill, Stockport

Assessment: Unstable



Summary

Metal cogs from a machine, the majority of the cogs uncovered at Mellor Mill, are in low levels of preservation like the ones pictured above, although some information can be gained from the number of teeth and the diameter of the cog, little can add the already established information about the mill.

S:F: 147 context: (051)

Date Range 19th century

Recommendation: handling/ interpretation

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

A small fragment of the fly wheel, as indicated on the drawing, this fragment may have been part of the central area of the wheel with the upper concave surface being between spokes.

S.F. No: 34 Context: (016)

Date Range: 19th century

Recommendation: Retain for interpretation/display/ Caution advised on weight of item.

Location: Mellor Mill, Stockport

Assessment: Unstable



Summary

Iron stove top kettle, missing the lid, high levels of corrosion with adherence of stones to the body of the kettle, will be beneficial as a teaching aid.

S:F: 39 context: (039)

Date Range 19th century

Recommendation: dispersal/none tactile museum piece

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Gentleman's Razor, C.1850's with a steel handle, no blade present. This is a relatively stable item with fair level of preservation, some text on handle, and crack on handle. Good for teaching aid, and tactile.

S.F. no: 16 Context (016)

Date Range: 19th century

Recommendation: Retain for interpretation/display

Location: Mellor Mill, Stockport

Assessment: Unstable



Summary

Plough Slider, recovered from over burden at Mellor Mill, low levels of preservation. Good as a teaching aid.

S:F: 36 context: (038)

Date Range 19th century

Recommendation: dispersal/none tactile museum piece

Location: Mellor Mill, Stockport

Assessment: stable



Summary

Well preserved metal spanner, found within the Mill complex. Good levels of preservation with very low levels of corrosion

S:F: 86 context: (046)

Date Range 19th century

Recommendation: handling/ interpretation

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Brass Tap end, slight corrosion from oxidation present, fair level of preservation, good for teaching aid and tactile use.

S.F. No: 26 context: (026)

Date Range: 19th century

Recommendation: Retain for interpretation/display

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Part of the steam engine pipe which would transfer the steam through the mill, very large and heavy piece, substantial corrosion present, with the aid of conservation would be excellent for museum display. Approximately 3feet long.

Date Range: Early 19th Century

Recommendation: Conservation required, museum display.

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Guard Rail stanchion, located around the bed of the fly wheel, moderate level of preservation and with the aid of conservation could be resituated to form part of an onsite on going display, this would allow people to understand the size of the machinery involved.

Date Range: Early 19th Century

Recommendation: Conservation required, museum display.

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Metal file, highly corroded but highlights the types of tools recovered from the mill site, this along with the other tools such as chisels, files, spanners, would make a good museum display.

Date Range: Early 19th Century

Recommendation: Conservation required, museum display.

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Two of the mechanical keys have been uncovered at Mellor Mill, these keys are tapered in shape and form part of a machine. The mechanical key allows the owner to remove a part of the machinery to effectively stop that machine for functioning, by replacing the mechanical key, it completes the machine and allows it to work. Mechanical keys are commonly found in gears, pulleys, couplings and washers. This would be an excellent teaching and display item.

Date Range: Early 19th Century

Recommendation: Conservation required, museum display.

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

A roller – likely to derive from a spinning machine, -possibly a water frame or throstle. This item would do well under conservation as the small roller parts are brass and will stand out well after conservation, and this would be a good aid for teaching and engagement.

Date Range: Early 19th Century

Recommendation: Conservation required, museum display.

Location: Mellor Mill, Stockport

Assessment: Stable



Summary:

Leather shoe recovered from the mill, mostly likely to be part of (002) or the overlaying refuse deposit; however, it is a relatable item and in a good level of preservation. This item will need conservation to prevent decay, but will also be beneficial to the teaching collection.

Date Range: Early 19th Century

Recommendation: Conservation required museum display.

Appendix C – Raw Database

BAG	FRAG 34	context	Description
1	1	(016) 149	1 GREEN GLASS WINE BOTTLE, HIGH FONTEL, ADHESIVE RESIDUE.
1	1	(016) 149	1 GREEN GLASS WINE BOTTLE, HIGH FONTEL, ADHESIVE RESIDUE.
2	1	(016) 138	DONKEY CLUTCH
3	1	(042) 162	1 GREEN GLASS WINE BOTTLE, WITH HIGH FONTEL, AND A CORK STOPPER
4	2	(042) 164	2 COTTON BURNERS, SMALLER OF WHICH HAS WRITING "J. STUBBS" WITH A DATE 1820/1830, "MANCHESTER"
5	1	(050) 39	IRON KETTLE WITH SPURS AND ARCHING HANDLE
6	1	(016) 16	OLD ARMY ISSUE LAZOR WITH TEXTURED HANDLE, SLIGHT CRACK ON HANDLE
7	1	(053) 191	1 RAF BUTTON, DEPICTING ON THE FACE THE CROWN & AND UNDERNEATH AN EAGLE
8	9	(016) 46	NINE BLUE PLASTER FRAGMENTS, TWO OF WHICH HAVE FADED IN COLOUR.
9	1	(016) 26	BRASS TAP WITH THREADED SCREW ATTACHMENT.
10	1	(046) 86	SPANNER
11	1	(016) 34	CAST IRON ² STEAM ENGINE PART WITH UNEVEN BASE
12	1	(042) 103	MACHINE PART, ADDITIONAL PART
12	1	(042) 103	MACHINE PART, ADDITIONAL PART
			SCREWED IN AT A RIGHT ANGLE WITH RINGLET AT BASE.
13	5	(051) 147	2 LARGE WHEEL COGS WITH HOLE AT THE CENTER, 2 SMALLER COGS WITH NO HOLES, 1 FRAGMENT OF POSSIBLE BASE.
14	1	(042) 119	FOOT OF MACHINE. INCLUDES A SPOOL FOR WINDING COTTON WITH A LEVER TO LOCK SPOOL IN TO AVOID LOSING TENSION. PIVOTED ATTACHMENT ON RIGHT.
15	1	(051) 203	SLIVA CANLID. 3 SETS OF 2 HOLES ACROSS TOP AND 2 HOLES AT BASE
16	1	(042) 112	GAS "T" JOINT WITH RIDGED ENDS ON INSIDE.
17	1	(042) 120	MACHINE PART
18	1	(042) 116	MACHINE FOOT. WITH PIVOTED ATTACHMENT.
19	1	(038) 36	PLOUGH SHARE, HOLE AT TOP FRAMED BY SQUARE, SLIT HOLE AT MIDDLE AND BACKWARDS "P" SHAPED HOLE TOWARD BOTTOM.
20	1	(042) 61	PICK AXE HEAD, WITH OVAL JOINT FOR HANDLE TO BE ATTACHED.

BAG	FRAG 23	context	Description
21	1	(016) 53	LARGE STEAM ENGINE PIECE FOUND IN FLY WHEEL. TWO TRIANGULAR SHARP GROOVES
22	1	(042) 27	Roller Wheel, ONE FLAT SIDE, SCREW HOLE GOING RIGHT THE WAY THROUGH.
23	1	(042) 113	SASH WINDOW NELBUT. HOLE ON TOP.
24	1	(042) 169	BRASS COG, 12 RIDGES, ONE HOLE STRAIGHT THROUGH.
25	2	(051) 204	CHURN LID AND INSERT . WOODEN INSERT WITH OFFSET TOP.
26	1	(042) 107	ECCENTRIC CAM?
27	1	(016) 13	BOT WHITE BOTTLE STOPPER WITH RED WRITING WHICH READS "J. GRUNDY LTD" 'STOCKPORT'.
28	3	(045) 89	SLIGHTLY CHIPPED ON ONE SIDE. 3 HANDLES, ONE OF WHICH APPEARS BROKEN AND ABOUT HALF THE SIZE OF THE OTHER TWO.
29	1	(042) 56	POSSIBLE GAS TAP. FUNNELLED NOZZLE WHICH THINS OUT TOWARDS END.
30	3	(038) 97	POSSIBLE CARRIAGE LAMP PARTS, 1 piece APPEARS TO BE BASE OF LAMP 1 piece OF ROUNDED, BUT CHIPPED, FRAGMENT OF RED GLASS, AND A RINGLET, POSSIBLY TO HOLD GLASS IN PLACE.
31	2	(045) 90	MACHINE PARTS OF ARTICULATED LINKS.
32	2	(042) 79	TWO MASONRY ANCHORS. ^{BOTH} HAVE BROAD ANGLED RIDGES ALONG BOTH SIDES.
33	1	(016) 206	PLATE FROM BOILER. EMBOSSED LETTERS READS "HOPKINSON PATENT HUDDERSFIELD"
34	1	(016) 44	FIRE BRICK. TWO INDENTS ON EITHER SIDE, ONE HAS EMBOSSED LETTERS "TYMM'S MARPLE"
35	1	(008) 10	COG WHEEL
36	1	(042) 111	BRACKET. 4 SQUARE HOLES.

BAG	FRAG	29	context	Description
37	5	(042)	114	SPINNING MACHINE PARTS, ONE HANDLE, ONE ROUNDER ^{eccentric} ITEM ONE RIGHT ANGLED JOINT, ONE CURVED ITEM WITH RIDGE DOWN THE MIDDLE.
38	1	(016)	51	GAS PIPE, RIGHT ANGLED
39	1	(016)	23	SHAPED FIRE BRICK WITH INITIALS "T.R." EMBOSSED INTO IT.
40	2	(042)	118	GEARED SLIDER x 2, ONE WITH WHEEL COG AND HANDLE ATTACHED THE OTHER WITH JUST WHEEL COG. HANDLE APPEARS SNAPPED OFF.
41	4	(042)	145	3 x Smaller 16 RIDGE COGS AND 1 x LARGER 22 RIDGE COG.
42	1	(042)	77	1 x ECCENTRIC CAM
43	1	(008)	9	11 BOLT THREADED, ONE SIDE LONGER THAN THE OTHER.
44	34	(042)	54	1x DOOR HANDLE, THREE SCREWS AT TOP WHICH SCREW INTO DOOR + 2 SCREWS AT BOTTOM, WHICH 8x WOOD FROM DOOR ATTACHED TO TOP 3 SCREWS AND A LEVER TO PRESS TO OPEN DOOR. 3 SEPARATE PIECES OF THE LOCK, BIGGER OF WHICH SEEMS TO HAVE KEY HOLE ON.
45	1	(042)	151	CHAIN WITH LOCK ON ONE END.
46	1	(042)	106	SILVER CAN FEEDER, FUNNELLED
47	1	(042)	33	SPINNING MACHINE PART WITH PART OF A NAME, FIRST NAME IS EITHER SAMUEL OR SAMUEL'S.
48	3	(042)	198	CAN HOOPS + PART LID. ONE VERY FRAGILE.
49	1	(016)	11	STEAM PIPE FLANGE OR SEAL
50	1	(016)	17	?
51	1	(042)	154	COUNTER BALANCE WEIGHT, CURVED UNDERNEATH WITH A HOOK ON TOP.
52	1	(042)	115	BASE CORNER OF MACHINE. ONE SQUARE SLOT ON UPRIGHT WITH 2 RAISED RIDGES ON BASE.

BAG	FRAG	T.	context	Description
53	1	(C42)	110	IRON FRAMEWORK, TWO JOINTS STICKING OUT WITH RECTANGLE HOLES IN.
54	1	(C42)	55	MACHINE PART IN A "T" SHAPE WITH ADDITION PART ATTACHED TO THE BASE.
55	1	(O16)	32.	BOILER BAR.
56	1	(C42)	68	1 SHARD OF POTTERY (CREAM). APPEARS TO BE A BASE TO A JAR. EMBOSSED ON BASE IS "BRY FAULDER + CO'S SILVER... RESERVES"
57	2	(C45)	91	2 x BRASS FERRULES, ONE LARGER THAN OTHER.
58	1	(O16)	50.	STEAM ENGINE PART FROM FLYWHEEL.

BAG	FRAG	94-	context	Description
59	16	1	(016) 20	METAL FILE?
60	16		(003)	1X DECORATIVE FIREPLACE LEG. 3X DECORATIVE PLASTER, 2X WHITE CERAMIC, 6X ORGANIC MATERIAL, 1X SHOTGUN SHELL, 2X GLASS STOPPERS, 1X SMALL GLASS BOTTLE. SHOTGUN SHELL MADE IN BIRMINGHAM.
61	21		(003)	2X WILLOW PATTERN POT FRAGMENTS 1X BROWN GLAZED CERAMICS 18X WHITEWARES
62				
62	5		(047) 194	5X CORNICE LIME PLASTER.
63	1		(045) 85	GATE/DOOR HINGE.
64	1		(046) 83	1X WASHER
65	1		(045) 94	1X METAL PLATE
66	1		(015) 21	1X METAL SHAPED FIREPLACE BAR.
67	3		(005) 2	3X COAL CHUNKS
68	1		(046) 88	LOCK (FOUND IN AS)
69	1		(053) 190	1X BUTTON. "LEWIS'S MANCHESTER"
70	1		(053) 186	1X BUTTON WITH HOOK ON BACK
71	1		(016) 52	1X POSSIBLE METAL TOOL (FOUND
71	3		(042) 64	END OF BOILER)
72	3		(042) 64	3X WEIGHTS
73	1		(042) 148	WINDOW MULLION
74	2		(UNSTRATIFIED)	2X CLEAR GLASS BOTTLE NECKS WITH 2 STOPPERS. ONE STOPPER HAS "SALFORD" ON.
75	4		(008) 7	SIGHT TUBE. 3 OF FRAGMENTS HAVE WHITE STRIPE GOING THROUGH
76	1		(016) 12	STEEL RIVET - BOILER.
77	1		(042) 42	1X WEIGHT
78	1		(042) 139	
78	1		GENERAL POIL 191	PART OF MANTLE SURROUND.
79	1		(042) 139	POSSIBLE MACHINE LEG.
80	1		(047) 178	1X GREEN MARBLE
81	25		(050) 153	4X NAILS, 6X CLEAR GLASS FRAG, 1X PART OF SHELL, 1X BROWN GLASS FRAGMENT, 1X METAL DOOR HANDLE, 2X WILLOW PATTERN POTTERY, 5X WHITEWARES, 1X GREEN STONE STONE WARE (ROUNDED), 4X BROWN GLAZED STONE WARE

BAG	FRAG	98	context	Description
82	10	(016)	15	FRAG OF WATER LEVEL GAUGE.
83	1	(016)	14	POSSIBLE WEDGE.
84	1	(042)	193	MACHINE JACK FOOT.
85	3	(042)	74	MISCELLANEOUS BRASS + COPPER OBJECTS x3.
86	1	(046)	95	1x COG
87	28	(042)	126	28x NAILS
88	1	(016)	22	LEAD SHEET
89	1	(005)	6	PIECE OF FIRE BAR
90	1	(016)	18	1x SHAPED BRICK RED, WITH UNIDENTIFIABLE MARKINGS
91	1	(008)	8	FIRE BAR 1x
92	1	(042)	201	MACHINE PART?
93	1	(042)	150	SASH WINDOW WEIGHT
94	1	(042)	81	1x WEIGHT WITH AN ATTACHED CHAIN AND HOOK
95	7	(042)	66	MIXTURE OF FILES + CHISELS
96	1	(042)	202	MACHINE PART, WITH SQUARE HOLE AT TOP.
97	1	(042)	117	SLIVA CAN
98	3	(042)	144	SLIVA CAN HOOPS x 3.
99	1	(042)	73	IRON POLE SUPPORT FROM BEARING BLOCK.
100	1	(049)	155	1x COLD CHISEL
101	10	(016)	29	10x BOLLER RIVETS.
102	1	(042)	105	1x GAS PIPE, ARCHED.
103	6	(042)	16	6x STINDLES
104	4	(042)	71	4x ROLLERS
105	1	(049)	163	PIPE JOINT x 1
106	2	(046)	100	ROLLERS x 2
107	1	(046)	159	FOLOED LEAD SHEET.
108	1	(008)	1	POSSIBLE IRON TOOL.
109	1	(049)	156	1x IRON FILE
110	1	(049)	156	1x ROLLER
111	1	(049)	157	1x GAS PIPE
112	3	(042)	109	PLATES METAL PLATES
113	1	(042)	65	RED BRICK WITH EMBOSSED NUMBERS

114	1	(008) 47	1x COMPLETE GREEN GLASS BOTTLE WITH HIGH POINT AND ADHESIVE RESIDUE.
115	1	(016) 19	LEATHER BOOT WITH NAILED SOLE, LACE HOLES IN TACT.
116	16	(051) 133	3x BROWN GLAZED STONEWARE, 5x WHITEWARE, 2x WILLOW PATTERN POTTERY SHERDS, 6x WHITEWARES WITH PATTERNS ON.
117	1	(047) 172	1x COMPLETE CLEAR GLASS VESSEL. "PROPERTY OF CANTRELL AND COCHRANE LTD, NOT TO BE REFILL REFILLED"
118	1	(014) 131	GLASS LID. "FOSTER'S GLASS CO LTD, ATLAS TYPE LID"
119	5	(053) 188	DOOR / GATE HINGE?
120	1	(053) 184	GATE LATCH.
121	14	(051) 129	METAL PARTS.
122	17	(051) 133	5x CLEAR GLASS BOTTLE NECKS. 2 OF WHICH HAVE STOPPER / LID ON. 1x FRAG OF CLEAR GLASS, 1x FRAG OF BROWN GLASS.
123	1	(016) 131	1x METAL LID
124	2	(042) 146	2x ROLLERS
125	2	(016) 45	2x SPINNING MACHINE ROLLERS
126	3	(051) 171	3x MISCELLANEOUS METAL
127	7	(042) 122	7x COGS PARTS.
128	9	(042) 132	1x BROWN GLASS BOTTLE "ARMOTO CHEM. CO LTD, LONDON", WITH LID, 1x BROKEN CLEAR GLASS BOTTLE WITH "ANDERSON GRATTON'S ON, 1x BROKEN CLEAR GLASS VESSEL, 1x SQUASHED CLEAR GLASS BOTTLE, 2x COMPLETE BOTTLES ONE WITH LID, 3x STOPPERS
129	1	(039) 80	1x FLIER.
130	5	(042) 128	5x MISCELLANEOUS FASTENERS
131	1	(080) 38	1x TILE WITH BLUE AND GREEN PATTERN ON. ON BACK "R ² NO 440212"
132	1	(042) 136	1x BOLT.

BAG	FRAG	44	context	Description
158	5		(042) 63	ASSORTED METAL MACHINE PARTS.
159	1		(053) 187	CAST IRON GUTTERING
160	1		(042) 87	SQUARE KEY
161	1		(047) 167	WHITE JAR, NO LID
162	6		(042) 70	6X ASSORTED MACHINE PARTS
163	3		(042) 69	3X METAL HANDLES
164	2		(042) 60	1X SPANNER, 1X KEY
165	1		(042) 67	1X MACHINE PART
166	5		(042) 192	2X WHOLE COBS, 3X FRAG OF COBS
167 167	3		(042) 68	1X CLEAR GLASS BOTTLE WITH NO NECK - LEADS "HALF PINT IMPERIAL, TOWNEND AND TETLOW, HMOE". 2X GREEN GLASS FRAGMENTS.
168	2		(045) 828	1X HOOK, 1X GUE.
169	2		(016) 189	2X BLUE GLASS RODS
170	1		(016) 35	COMPLETE GLASS BOTTLE WITH MARBLE AND TOP IN NECK. FRONT OF BOTTLE SAYS "O. CLIPTON, TRADE MARK, STOCKPORT". BOTTOM SAYS "J.W. DOBSON, MAKER, BARNESLEY".
171	1		(041) 40	1X OYSTER SHELL, (WRAPPED IN TISSUE)
172	1		(049) 168	
172	1		(049) 168	VENTILATED, GRAIN TILE.
173	1		(045) 93	1X CHEMIST CONTAINER WITH "HEOGES, BIRMINGHAM"
174	2		(047) 177	2X ORNATE TILE PIECES 1X BRASS MACHINE PART, HORSESHOE SHAPE WITH HOLE AT TOP CENTRE.
175	2		(042) 72	WEIGHTS x 2 WITH HOOK HOLES ON TOP.
176	1		(042) 59	1X CAST IRON HANDLE
177	1		(053) 182	1X THREADED KNURLED NUT
178	3		(038) 81	LEATHER BELT FRAGMENTS WITH BRASS BUCKLE.

BAG	FRAG	3A	context	Description
179.	2	(042)	57	WOODEN Box lid WITH OTHER WOODEN OBJECT
180				
180	1	(047)	181	1x WHITE MARBLE FRAG.
181	1	(047)	76	1x DECORATED GREY BLOCK
182.	1	(047)	179	BASE OF COLUMN
183	1	(045)	92	1x SUITCASE LOCK. FOUR HOLES, ONE IN EACH CORNER
184	2	(008)	3	BRASS NUT x 1 AND BAR x 1
185	1	UNSTRAPPED		METAL TOOL ??
186.	1	(042)	62	SQUARE FLOOR TILE.
187	1	(016)	30	STEAM ENGINE PART
188	2	(045)	84	2x WASHERS
189	1	(042)	76	1x NUT AND PART OF BOLT.
190	4	(047)	174	4x STONE TRIM
191	11	(016)	19	LEATHER SHOE, WITH 2 x HEEL PIECES, 1 x NAIL SOLE (2 of 2)
192.	1	GENERAL SPILL	75	DRILL BIT x 1
193	1	(045)	87	1x IRON ALG
194	4	(046)	96.	1x PLIERS, 1x BROKEN SCISSORS 1x PARTIAL FORK.
195	2	(042)	165	2x MACHINE PARTS
196.	1	(046)	196	LEAD FOOT?
197.	1	(046)	195	CLOG IRON

Appendix C

Information gathered by John Clithero in regard to the Mill and its materials.

The 1860 Goodfellow Steam Engine at Mellor Mill.

Horizontal cross compound,	2 x 20hp nominal,	to Goodfellow's patent.
High pressure cylinder	14in bore x 4ft	stroke, slide valve.
Low pressure cylinder	27in bore x 2ft 6in	stroke, slide valve.
Flywheel	12ft 3in diameter;	rim, 8in wide by 9in deep.
Condenser and air-pump	Horizontal, 2ft 6in	stroke, double acting.
Speed	56rpm?	
Gear drive	4ft 9in spur gear on crankshaft	driving 8ft spur on 2 nd
motion		shaft,
	~1.67	reduction.
Boiler pressure	65psi?	
Power	125shp?	
Installed	September	1860
Replaced	1879?	
Boilers	Originally 1 Goodfellow,	probably Lancashire.
	Later 2 Lancashire, 30ft x 7ft?	

Suggested History

- 1860 Goodfellow engine installed to power mill in drought.
This is the earliest horizontal engine driving a spinning mill so far identified.
One Goodfellow boiler installed, probably Lancashire, 65psi.
- 1877 The engine was advertised for sale, may be because more power was required.
- 1878 A second boiler was installed (higher pressure). The original might have been replaced.
The Goodfellow engine was uprated or replaced.
Steam power was used full time to assist waterwheels with extra load.
- 1892 Mill burnt out.
- 1905 Engine sold. (For scrap?)

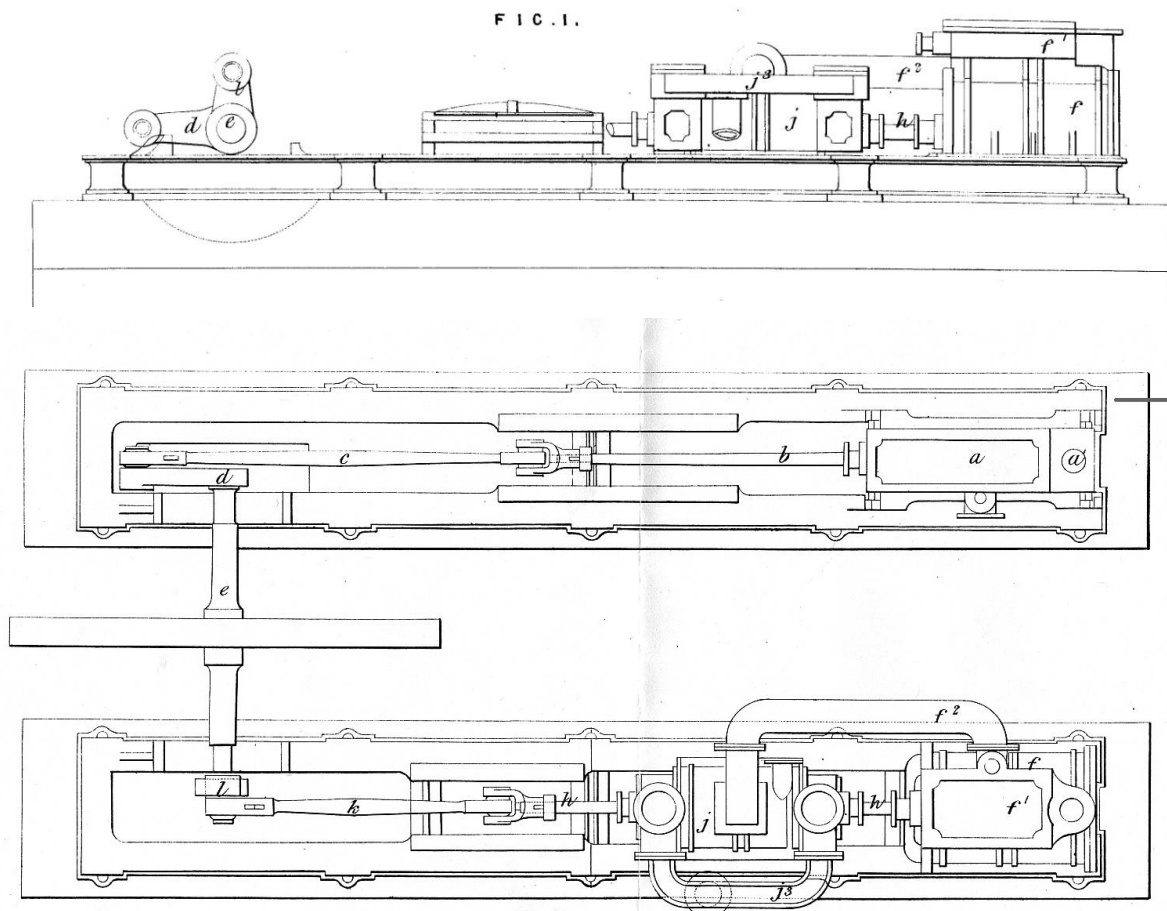
A Note on Goodfellow's Patent Engine.

Benjamin Goodfellow (1811-1863), engineer of Hyde, took out a patent for improvements in steam engines in 1858. It covered the placing of the condenser and air pump of a horizontal engine between the cylinder and crank, the advantage being

that the air pump valves and stuffing boxes were more accessible than in an ordinary engine.¹ In a cross-compound engine, the air pump was placed on the low-pressure side, and the stroke was made shorter than the high-pressure side to reduce the air pump bucket speed. In a simple beam engine the air pump and condenser were placed between the beam centre and the crank so that the air pump bucket speed was half that of the steam piston. In a compound beam engine, the air pump was placed between the high-pressure cylinder and the beam centre. The low-pressure cylinder was between the centre and crank. The piston speed in the low-pressure was therefore half that in the high. This was the opposite way round to the McNaught arrangement and would not have been as convenient when an existing simple beam engine was compounded. The Goodfellow Engine Register later recorded ten horizontal cross-compound engines in which the stroke in the low-pressure cylinder was about two-thirds that in the high-pressure cylinder. The last of these was ordered in 1874. In 1883 George Ben Goodfellow (1850-1923) stated that he 'had got out of the 'ruts' of the long and short stroke engines nine or ten years ago'.² No references to Mellor Mill have been found in the surviving Goodfellow records.

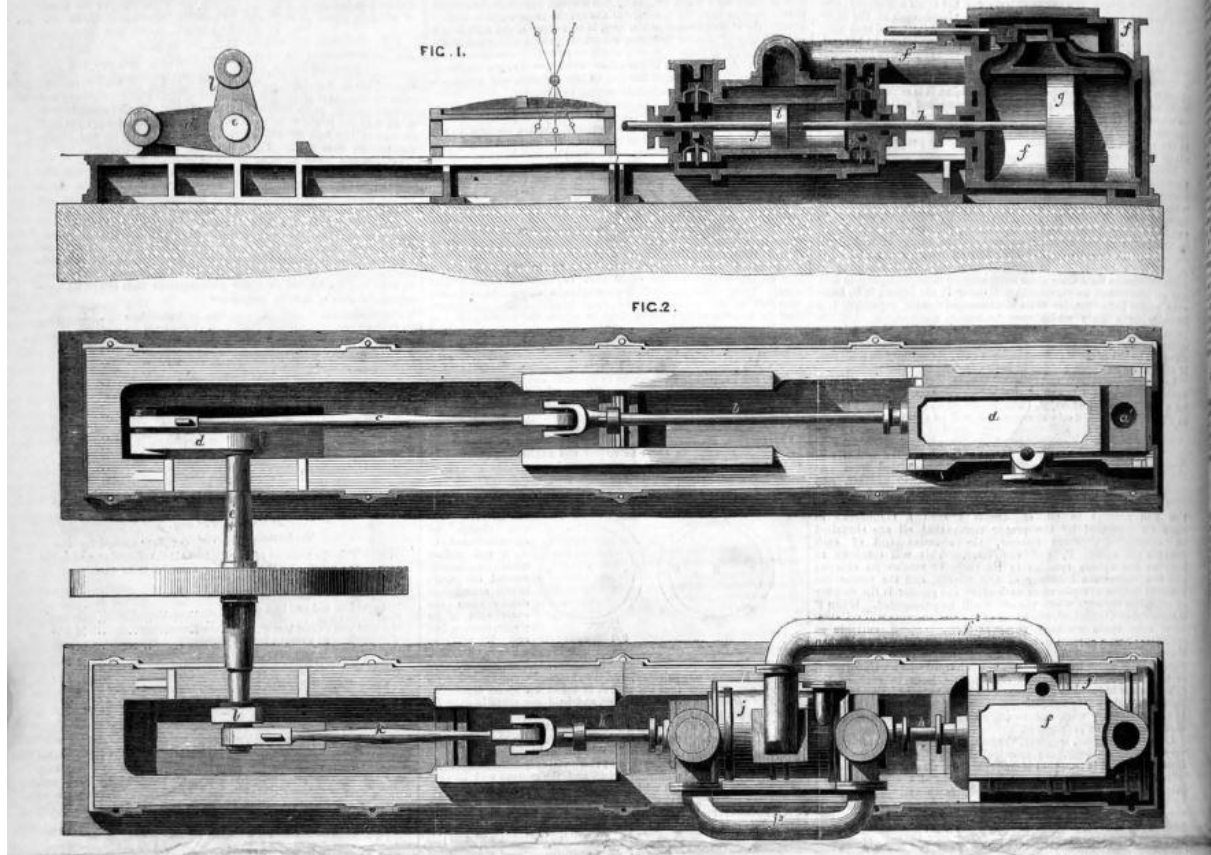
References.

From Goodfellow's Patent AD 1858 No 2387



GOODFELLOW'S STEAM ENGINES.

PATENT DATED 27TH OCTOBER, 1858.



THIS invention, by B. Goodfellow, of Hyde, Chester, is particularly applicable to horizontal condensing engines, and consists in placing the air-pump between the cylinder and the crank, and in attaching the air-pump piston to the piston rod of the cylinder.

Fig. 1 is a longitudinal section of the principal parts of a compound horizontal condensing steam engine, and Fig. 2 a plan. *a* is the high-pressure cylinder, in which works a piston connected to a piston rod *b*, the connecting rod *c* of the piston *b* is jointed to the longer crank *d* of the crank shaft *e*; *f* is the low-pressure cylinder in which works the piston *g* fixed to the piston rod *h*, to which is also fixed the piston *i* of the air-pump *j*; to the end of the piston rod *h* is jointed the connecting rod *k*, which is in communication with the shorter crank *l*, fixed to the crank shaft *e*. The steam is supplied to the high-pressure cylinder *a* through the orifice *a'*, see Fig. 2, and after it has acted upon the piston in this cylinder, it is conveyed by suitable pipes in the ordinary manner to the valve box *f₁* of the low-pressure cylinder *f*; the exhausted steam from this cylinder is conducted by the pipe *f₂* to the air pump *j*, which is double acting, being furnished at each end with an ingress valve *j¹* and an egress valve *j²*, as is sometimes customary; these latter discharge the condensed steam and air into the pipe *j²*, which is in communication with a condenser surrounding the air-pump, or which may be of the ordinary construction.

14 September 1860

On Friday evening last
Swain, the Navigation

use of Mr .George
and a number of

employees belonging to the cotton spinning establishment of Peter Arkwright Esq. At Mellor, on the occasion of the erection of 2 new engines, boilers and a large chimney on the premises. It is somewhat remarkable that this model factory was erected 60 years ago by the late Samuel Oldknow Esq., of Mellor Lodge, and up to this time the machinery has been turned by a large and well constructed waterwheel supplied by an extensive reservoir on the premises, and from the River Goyt. Owing, however, to the drought which has prevailed for the last 2 or 3 years, that vast spinning establishment could not be carried on so regularly as heretofor, and hence the necessity for providing additional motive power which has now been successfully and satisfactorily completed by, and under the direction of Mr. Benjamin Goodfellow of Hyde. On testing the engines, which gave unqualified satisfaction, the above mentioned "spread" was given, which reflects much credit on the caterers. Mr. Wheeldon, the manager, was called upon to preside.

1867	Auction	Sale
Two Steam Engines, each of 20 (nominal) H.P. by Goodfellow, of Hyde.		
Boiler House 47ft	4in	by 11ft 3in.
Engine House 47ft 4in by 18ft.		

18 December 1877 Manchester Guardian, p7

ONE Pair of Compound Horizontal ENGINES,
 by Goodfellow, of Hyde; high-pressure cylinder 14in. diameter, 4ft. stroke, 2½in. piston rod, cast-iron slides, 9ft. connecting rod and strong cast-iron bed complete; Low-pressure cylinder 27in. diameter, 2ft. 6in. stroke, 3½in. piston rod and connecting rod; horizontal air pump in front of low-pressure cylinder and on same piston rod, cylinder and air pump on cast-iron bed, complete; crank shaft, 6in. necks and 7ft. centres of engines; spur wheel, 20 cogs, 12 in. pitch, 8½in. wide; flywheel, 12ft. 3in. diameter; 17in. 3in. wide 67 dia. deep. Can be seen at work at Bottoms Mill, Mellor, Marple.

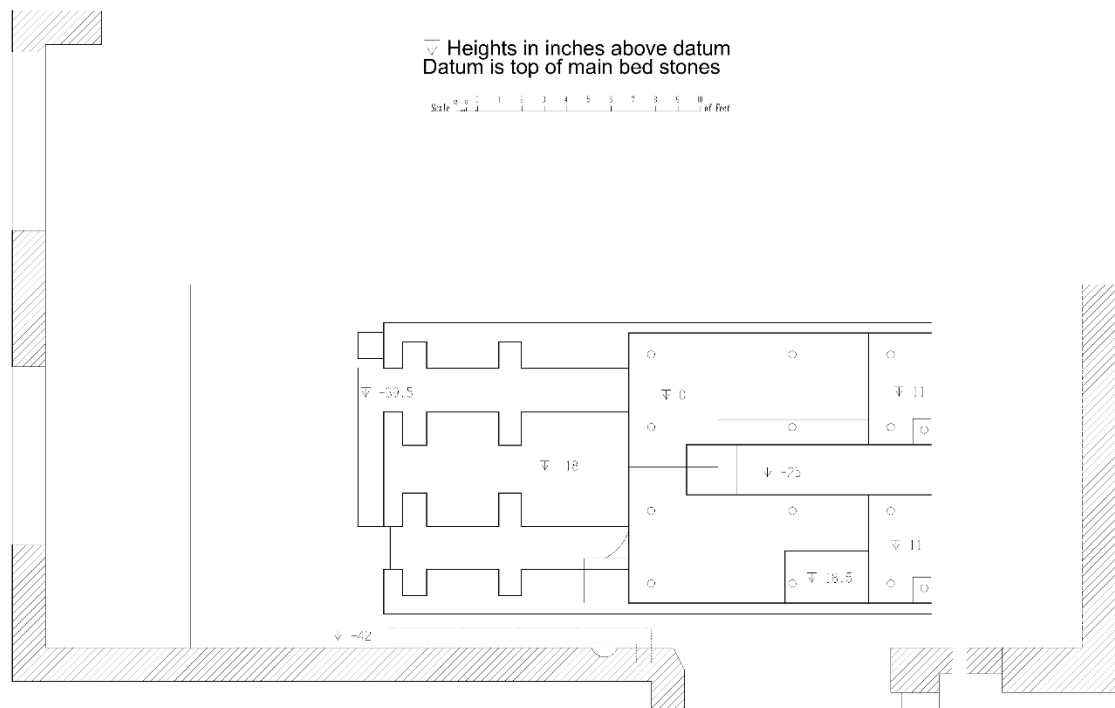
ONE Pair of Compound Horizontal ENGINES, by Goodfellow, of Hyde; High-pressure cylinder 14in. diameter, 4ft. stroke, 2½in. piston rod, cast-iron slides, 9ft. connecting rod and strong cast-iron bed complete; Low-pressure cylinder 27in. diameter, 2ft. 6in. Stroke, 3½in. piston rod and connecting rod; horizontal air pump in front of low-pressure cylinder and on same piston rod, cylinder and air pump on cast-iron bed, complete; Crankshaft, 6in. necks and 7ft. centres of engines;

Spur wheel, 60 cogs, 3in. pitch, 8¼in. wide;
 Flywheel, 12ft.3in. diameter; rim, 8in. wide by 9in. deep.
 Can be seen at work at Bottoms Mill, Mellor, Marple.

13 May 1905 Arkwright's Mellor and Marple Estates Ledger.

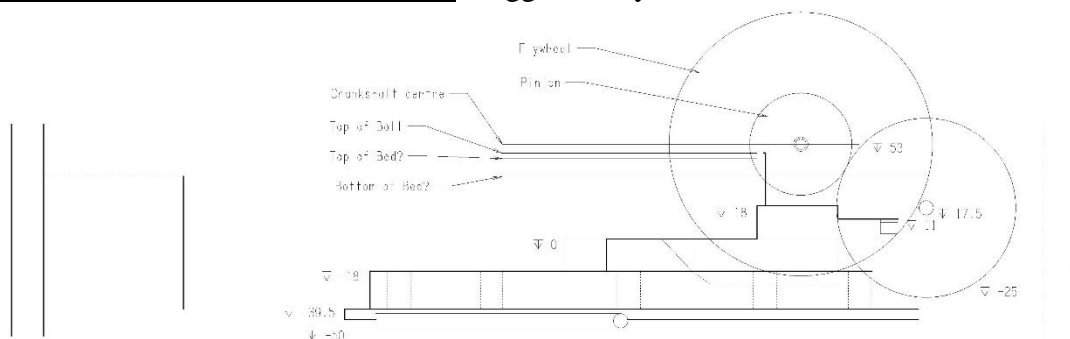
Sold Old engines etc., £230

The Engine Bed, 2015.



Measured and drawn 2015. Since then more has been uncovered.

The Flywheel and 2nd Motion Shaft. Suggested layout.



Measured and drawn 2015. Since then more has been uncovered.

The Engine Bed.

The brick base, about half of the bottom course and some of the middle course of stones of the engine bed remain. The engine bed was about 24ft long and about the right size for the 1860 Goodfellow engine. However, the Goodfellow patent drawings and drawings for an 1863 Goodfellow unequal stroke engine bed show the holding down bolts to be equally spaced, unlike those at Mellor. There are two possibilities. The bolt spacing on the original Goodfellow engine might have been made different because of the gear drive; it did not sell in 1880 but was uprated to run at a higher pressure. Alternatively, the Goodfellow engine might have been replaced by one of similar size but higher pressure.

The engine house is about 45ft long inside and the floor at the western end has been raised. It might have been designed for a longer engine, perhaps a tandem compound.

The Boilers and Boiler House(s).

The 1867 Sale Plan shows one boiler house, 47ft 4in by 11ft 3. The 1880 OS map shows the boiler house to be twice that width (or another similar one alongside it). One boiler would have been sufficient to supply the engine if it was being used only on a part time basis during droughts. The addition of a second boiler implies that the engine was being used full time probably, because more machinery was installed in the mill and the waterwheels were not able to cope with the extra load. The engine was probably uprated or replaced at that time. Water power would have been used as much as possible to reduce coal bills.

The boiler settings suggest that they accommodated 30ft by 7ft Lancashires.

Miscellaneous Calculations.

Spur wheel, 60 cogs, 3in pitch (circumferential) $\therefore Pcd = 60 \times 3 \div \pi = 57.296in = 4ft 9\frac{1}{4}in$.

From drawing on CAD, 2nd motion gear = 8ft 1 $\frac{1}{2}$ in Ratio = 1:0.588

If hp mean piston speed = 450 ft/min, stroke = 4ft, \therefore Speed = 56 rpm. Lp mps=281 ft/min.

\therefore 2nd motion shaft = $56 \times 0.588 = 33\text{rpm}$.

Wellington Waterwheel, 22ft dia. If 4.5ft/sec circ speed, then $4.5 \times 60 \div (\pi \times 22) = 3.9$ rpm.

Ratio $33/3.9 = 8.46:1$ Just possible with one pair of gears?

If boiler pressure = 65 psig, intermediate = X psig, condenser = -10 psig.

for equal power hp $(65 - X) \times 48 \times (\pi \times 7^2)$

$$= \text{lp} \quad (X - 10) \times 30 \times (\pi \times 13.5^2)$$

The Engine House, August 2011.



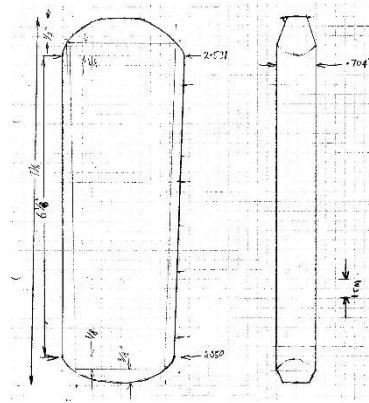
The Engine and Boiler Houses, April 2017.



Finds.

Taper Key, wrought iron, 7in long, bright, flywheel pit, July 2013.

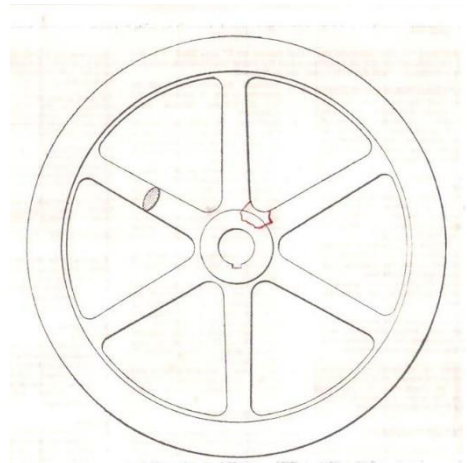
Taper Key, similar, corroded, by engine bed, 2016.



Broken Pieces of Eccentrics, cast iron, about 18in diameter, bright, flywheel pit, July 2015.



Broken Piece of Flywheel? cast iron, bright, found in flywheel pit, July 2015



Hand Rail Stanchion, cast iron, about 2ft 6in high, engine house, 2016.

Holding down bolts, 1 nut, engine house, 2015.

Spanner, about 3ft long, open ended, cranked head, to suit holding down nut, engine house, 2015.

Fire Bars.

Musings on Millwork.

These are my thoughts up to now. They are rough notes only. I have not yet got a measured drawing of the site nor the final archaeology report nor desk based assessment.

The main sources of information on the early millwork at Mellor are:

A letter from Thomas Lowe's wife about delivery of a waterwheel.

2 statements from Smiths of Chesterfield/Manchester of 1798,

7 Stock Books drawn up for the Oldknow-Arkwright accounts, 1799-1803,

Contemporary publications such as Rees's Cyclopaedia,

Some archaeological evidence.

1792 The 6-storey Main Building.

A large gear wheel, the pit wheel, was fixed to the waterwheel axle on each side of the waterwheel. Each pit wheel engaged with a train of spur wheels which drove a horizontal shaft in the cellar, one shaft powering the north end of the mill, the other powering the south end. The horizontal shafts were on the north-south centreline of the mill. They were not single rigid shafts but were made of a series of tumbling shafts joined together by coupling boxes. The tumbling shafts were probably square section and fitted loosely into square sockets in the ends of the coupling boxes. This system would accommodate any small misalignment. The 1799 Stock Book listed twelve coupling boxes and twelve tumbling shafts. The main block was 25 bays long, each bay being 7ft 10in. The middle three bays at ground/cellar level being taken up by the waterwheel. Therefore each tumbling shaft was about 14ft long and so spanned two bays. They were cast iron and about 5in square.

Bevel wheels were fixed to the horizontal shafts at intervals and meshed with smaller bevel wheels with vertical axes. The Stock Books refer to these as

flywheels and counter wheels. The counter wheels drove drums shafts on the floor above, a drum being a large pulley. Each drum shaft drove a pair of spinning frames and also drove a drum shaft on the floor above. This was repeated as far as the fourth floor. The drum shafts were positioned next to the floor joists so that the spinning frames were between the windows.

The horizontal shafts were supported by brass bearings. These were by the bevel wheels or on the coupling boxes. No cast iron bearing housings were listed in the Stock Books but 760 feet of oak were. May be the bearing housings were made of oak, each being bolted down to a bed stone.

1797 The South Wing/Old Smithy.
The south waterwheel was installed.

The heavy gearing listed in the 1799 Stock Book was similar to that in the 6-storey. Six coupling boxes and six tumbling shafts were listed. As the South Wing was nine bays and 70ft long, each shaft must have been about 10ft long and spanned one and a third bays. However, the 14ft tumbling shafts were valued at £6 each but the 10ft shafts at £7 each. No pinions to connect the waterwheel to the horizontal shaft were listed. Perhaps I have not understood the situation properly. Eight pairs of flywheels and counter wheels drove eight pairs of spinning frames on the ground floor.

1799 North Wing.

The 1799 Stock Book listed some power driven opening machines in the North Wing. It also listed two tumbling shafts, two pulleys, a drum and a gallows. The tumbling shafts were valued at only £1 each and so were much smaller than those on the main horizontal shafts. A gallows was an overhead frame to house pulleys. The power might have been taken from the end of the horizontal shaft and then to the ceiling. It is unlikely that the shaft passage was excavated at this time, though it is possible that it was built prior to the steam engine being installed.

18?? The Arkwright water frames had wooden structures and their spindles were arranged in 'heads' of four round vertical drive shafts. They would be replaced by throstles at some time. Throstles had iron frames and their rigidity allowed them to run at higher speeds. They had lengthwise horizontal drive shafts and

housed more spindles in a given floor space. The millwork might have been rearranged at this time to have one (or two) upright shafts which drove horizontal shafts suspended below the ceiling of each floor. The upright shaft(s) would normally be situated near to the waterwheel. The machines would be driven by pulleys and flat belts from the horizontal shafts.

1815+ The Waterloo wheel was installed.

Drive from 20ft bevel gear on side of wheel to 3ft bevel gear on inclined shaft (22°),
6ft bevel at top of inclined shaft to 4ft bevel on horizontal (actually rising 2°) under road,
xft bevel on horizontal to xft bevel on main horizontal in south end of 6-storey.

The South wheel might have been altered to drive the corn mill.

The original central wooden wheel would have lasted only a few years due to rot, loose joints. It would be replaced by:

Composite (wood/iron)? Would have been replaced after 25 years.

Conventional cast iron? No evidence of a gear stand to take drive.

Suspension wheel? No evidence of stone for drive pinions on loaded side.

The pit would be rebuilt.

The wheel was renamed Wellington.

There are recesses in the stonework on each side of the wheel pit. These might have been to accommodate rim gears. The edges of the recesses are very ragged compared with the rest of the masonry. Have the edges just deteriorated? Have the rim gears been modified and the recesses been enlarged to suit?

The axis centre as measured from the stone breast and as measured from the recess vary by a few inches.

18?? Probably more spindles were added and older machines replaced from time to time.

New millwork would incorporate round wrought iron shafts supported in brass bearing in cast iron housings.

1860 Steam engine and one boiler installed. Water power would be used as preference because of the cost of coal. A new horizontal shaft from the engine to the Wellington wheel would be required. If a shaft had existed in the North Wing, it would not have been able to take the power of the engine. The shaft passage in the 6-storey is walled in brick. The shaft passage in the North Wing is stone walled. Does this masonry match the engine house?

1880? A second boiler was installed. The engine might have been running full time and at a higher power. This might have been because more machinery was installed in the mill. The 1860 millwork might have handled this.

1890 Eastern Extension built. Power would have been taken from the horizontal shaft.

The Remains.

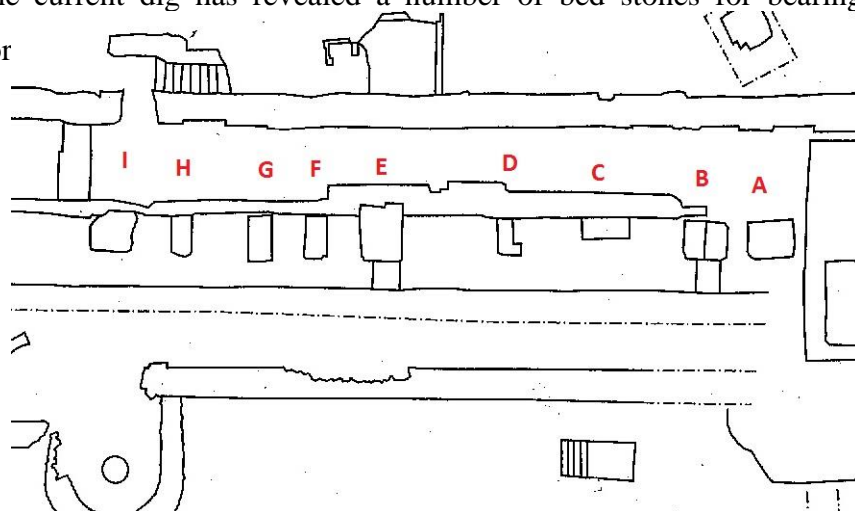
South

Wing

The UMAU dig in 2009 revealed 2 bed stones for bearings, features (037) and (041), Fig 10, by the south east corner of the South Wing. (037) is very similar to the bed stones in the shaft passage in the North Wing. I have not got a measured drawing of (037) but from scaling Fig 10 it would seem to be just a little smaller. The brick work on the adjacent walls (045), (069) looks in very good condition, especially compared with that in the shaft passage in the 6-storey north end. Perhaps (037) and (041) were installed to take power to the Eastern Extension shortly before the fire in 1892. How does the height compare with the North Shaft Passage?

Shaft Passage, 6-storey North end.

The current dig has revealed a number of bed stones for bearings for the hor



I have lettered them from right to left from the wheel pit. I have tried to relate the positions to the bays of the mill but can find no correlation. Several have multiple hole patterns. I have not yet measured out the holes and I need to spend some time mulling over the possibilities. I have seen nothing that makes me think that any go back to 1792, though the brick lined passage itself probably does.

The stone we uncovered at the end of 2015 was 'I'. It has a scoop out as if to give clearance to a bevel wheel on the horizontal shaft suggesting that it might have been for an upright shaft.



Stone I



Stone E has a recess to give clearance to a wheel. This could also be for an upright shaft.



There are several cast iron pads which so far are unexplained.
The footstep bearing for an upright shaft?
The base of a prop to support the floor above?
Neither can be right as this is directly below the horizontal shaft from the steam engine!

Waterloo Wheel.

On Sunday 9th April Tony Jones cleared off the bottom and next up foundation stones for the bearings for the eastern drive shaft from the Waterloo Wheel. Looking at the south face of the wheel pit the recess for a rim gear is clearly visible. From crude measurements it would seem that a 20ft bevel gear on the side of the waterwheel drove a 3ft bevel gear on the inclined shaft.

If the circumferential speed was $3\frac{1}{2}$ ft/sec then the wheel rotated at about 3.7rpm and the inclined shaft about 25rpm. Assuming the gears at the top were 6ft and 4ft, then the horizontal shaft rotated at 35rpm. The gear sizes at the southern main horizontal shaft are unknown but would not reduce the speed.

My latest calculation on the Goodfellow engine gave a speed of 34rpm for the northern main horizontal shaft.

On the model I assumed that an external rim gear on the Wellington Wheel drove a pinion on the main horizontal shaft. This would be about a 10:1 increase which is too

much. Therefore the main drive might have been an internal rim gear and two 3:1 pairs of gears.

The workshops were driven by an inclined shaft on the western side of the Waterloo wheel. This indicates that the waterwheel was a conventional cast iron wheel. A suspension wheel needs the drive to be taken off the loaded side.

SO/2/264 and S/2/265. Statements headed Samuel Oldknow Esq to Smith & Co Dtr, 1798

The statements are headed ‘Samuel Oldknow Esq to Smith & Co Dtr’, not ‘...Samuel Smith’ as on the internet. I had looked all over for a company trading as ‘Samuel Smith’ but could not find one. I suspected that it was Smiths’ of Griffin Foundry, Chesterfield or its subsidiary in Manchester and the documents now confirm this. I have the book *The Smiths of Chesterfield* (Philip Robinson, Chesterfield, 1957), but Grace’s guide is also helpful. The documents are statements, not bills or invoices as they cover a period from about January 1797 to May 1798 and list credits as well as debits.

Looking first at SO/2/264, the statement from Chesterfield.

I have transcribed it onto a spreadsheet (Tab 1797Smith264 on my spreadsheet MellorBook5.xlsx). This is not a true transcription as, instead of using the ditto marks, I have typed the words in full and I have introduced extra lines to make it clearer. I have used italics where I have put in extra information.

The three columns to the right of the item description on the statement are the weight of the batch in hundredweights, quarters and pounds. The next column is the price in shillings/hundredweight and the next three columns are the price in £ s d. I have then calculated the weight each and from this and the rate I have calculated the price each, as these are not always given. Ignore my next columns; they work out the prices in pence to check the arithmetic and to check that I have read the figures correctly.

All the items except the drum plate were components of the main power transmission system. The castings were priced at 15s/cwt except for the upright shafts which were priced at 25s/cwt, perhaps because they were more difficult castings. Some items were not given a weight and I assume that the price was just for machining and finishing. I have estimated the weight and cost of the material from the dimensions,

but how was this charged to Oldknow? We might expect to find all the items in the 1799 Stock Book in the 'Heavy Gearing from the New Wheel' or the 'New South End Spinning Room' (D7573 Box O 138 1799, p8, 9). I have transcribed this in a similar way to the Statement (Tab 1799 Stk Bk on my spreadsheet MellorBook5.xlsx).

Wheels

22 Mar? 1797	4	Spur	wheels,	70	cogs.
--------------	---	------	---------	----	-------

These were very heavy castings nearly half a ton each and costing £7-1s-6¾d each. If the diameter was proportional to the cube of the weight, comparing these with the 4ft wheels weighing 267lb each, then a guess at the diameter might give about 6ft 6in. With 70 cogs, the circumferential pitch would be about 3½ tpi (teeth per inch). This would be compatible with the drive from a waterwheel.

The nearest match for price in the 1799 Stock Book are 4 crown wheels at £5-14s each, two with the large wheel, one with the new wheel and one 'Gearing not in use'. (D7573 Box O 138 1799, p8, 54) Possible match, but crown not spur, not convincing. The value is ~80% cost.

30 Oct 1791	4	Wheels	Eye	4in.
-------------	---	--------	-----	------

I take the eye to be the bore. Weight each, 156lb, price each £1-0s-11d. Using the same logic, the diameter might have been about 3ft. There are no wheels in the 1799 Stock Book valued at that price, but 87 wheels between 17s and 30s. Inconclusive.

30 Dec 1797	8	Wheels	4ft	97	cogs.	267lb	and	£1-15s-10d	each.
-------------	---	--------	-----	----	-------	-------	-----	------------	-------

The circumferential pitch was 1½ tpi, not compatible with the 70-cog wheels above. A possible match in the 1799 Stock Book are the eight Flywheels in the 'Heavy gearing from the New Wheel' valued at 30s (D7573 Box O 138 1799, p8). Other possible matches are the three bevel wheels in the 2nd Card Room and six bevel wheels in the Top Card Room valued at 36s.

Segments.

There are 3 batches of segments totalling 180, each weighing 103lb and costing 13s-9½d. There is also an 'Expence in part of Wheel Segment' of £1-11s-6d. The first batch has 14 cogs and as the later ones weighed the same they were probably all the same pitch. I take these to be replaceable segments for the pit wheels of the original waterwheel. These were subject to wear as they were constantly wet and impossible to lubricate properly. If there were 8 segments on each pit wheel and the pitch was 3½

tpi then the diameter of the pit wheel was about 10ft. If more segments per wheel, a greater diameter.

There were 97 segments in the ‘Gearing not in use’ valued at 11s each (D7573 Box O 138 1799, p54). These were presumably spares. There were nearly 4 tons of ‘old segments and crown wheel’ in the smithy valued at 5s/cwt, presumably worn out (D7573 Box O 138 1799, p39). If the crown wheel weighed ½ton, then there were about 72 segments. Other wheels might also have had replaceable segments, but they would not have been interchangeable.

Shafts.

Oct 30 1797 1 Shaft Ea^{No} 2. 3. 4: 3: 6.

This I do not understand. If it was one shaft it weighed $2\frac{3}{4}$ tons and the cost calculated from the weight was £41. If it was a plain cylindrical shaft say, 16ft long, it would have been about $12\frac{3}{8}$ in diameter. There is nothing in the stock book like this. Could it be the shaft for the new waterwheel? If so, it might have been of cruciform section.

Oct 30 1797 Turning 10 Necks, at 6s each.

Necks are journal bearings or similar. Are these on the shaft above? Seems a lot for one shaft. If it was a waterwheel, one journal at each end and one seating for each flange on the pit wheel and one seating for each flange at each side of the wheel would total eight. £3 would be added to the cost.

30 Dec 1791	1	Shaft	13ft	11	in	long.
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Assuming the density of cast iron to be 0.266lb/cuin, then the shaft was 4½in square. The price calculated from the weight was £5-19s-9d. Could this be one of the tumbling shafts? Those in the 6-storey mill were valued £6-0s-10d each and those in the New South End were £7-1s-8d each (D7573 Box O 138 1799, p8).

30 Dec 1797	1	Shaft.
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No dimensions are given, but it weighed about $\frac{3}{4}$ ton and cost £10-18s. No shafts costing more than £7-1s-8d were listed in the Stock Book.

30 Dec 1797	Turning	4	Necks.	at	6s	each.
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One at each end of the above two shafts?

30 Dec 1797 1 Lyeshaft made 14ft long 5¾ Sq.

A price of 16s is given. The price of turning a neck was 6s and so a bearing at each end would have been 12s. There must have been some other work. The weight can be calculated from the dimensions as 1,477 lb and so the price of the material was about £9-17s-10½d. The shaft was altered thrice at 4s 6d making a total cost of £10-18s-4½d. Again, far more than any shaft listed in 1799.

30 Dec 1797 1 Lyeshaft 15ft 4¼ Scur.

Again, calculating the weight from the dimensions, it weighed 865lb and so the material cost was £5-15s-5d. The adding this to the machining the total was £6-11s-10d. The tumbling shafts from the Large Wheel were £6-0s-10d and from the New Wheel were £7-1s-8d, a possible match?

30 Dec 1797 1 Lyeshaft made 14 ft 9½i 6i Scur.

Similarly, the weight was ¾ton and the cost including material, machining and alteration was £12-9s-7¾d. Again, more than any shaft listed.

A check on the Tumbling Shafts in the heavy gearing in the Stock Book.

The value in the book was 50s/ft. Was this per cubic foot or per foot run?

1 cubic foot of iron weighs about 460lb = 4.1 cwt. Price of cast iron from Chesterfield was 15s/cwt. Therefore 1 cuft costs 61s. Of the right order. The figure in the stock book is therefore probably per cubic foot.

How about the oak?

30 Dec 1797 Upright Shafts.

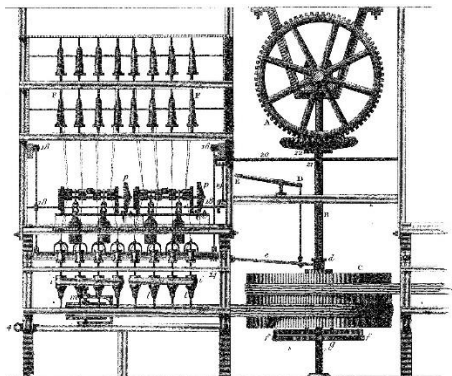
Two types were supplied, 9 bottom and 2 top, weighing 416lb and 420lb and costing £4-12s-10d and £4-13s-9d each respectively. Another 2 were 'made' at 8s each. Were these more shafts or for machining two of the previous batch? No shafts of similar price were found in the stock book, the nearest being the drum shafts.

Check on the Drum Shafts in 1799. For 3½in shafts the value was 42s. If the length was 10ft 6in then the weight was about 322lbs. There might have been collars etc., increasing the weight. In the South Wing there were eight drums shafts on the ground floor and none above (D7573 Box O 138 1799, p9). The 'top upright shafts' might have been in the 6-storey. A possible match.

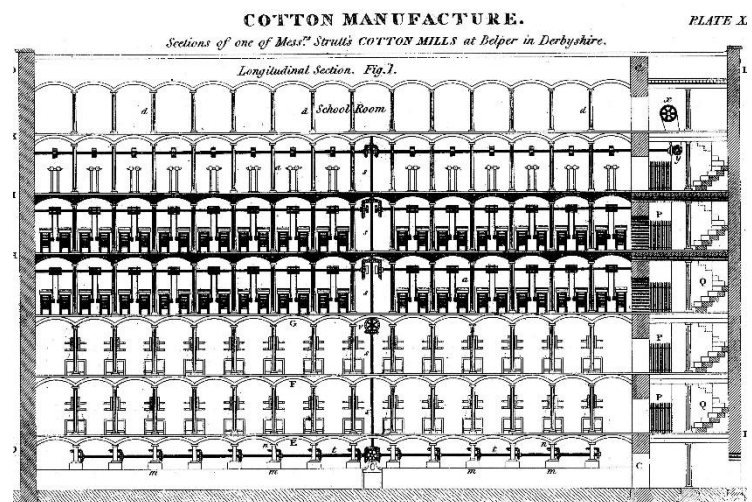
Certainly the flanges and possibly the 2¼ ton shaft, were for the New Wheel being built by Thomas Lowe, making it of 'composite' construction.

I have been contemplating on the millwork.

Just considering the 6 storey mill to begin with, I had assumed that the central waterwheel drove one or possibly two upright shafts through bevel gears. At each floor bevel gears on the upright shafts drove horizontal shafts. Bevel gears on these horizontal shafts drove drums (large pulleys) which drove the individual machines, as in the drawing of a frame at Belper. (Farey 1813, Rees)



The 1799 Stock Book that Ann Hearle recently sent me lists only 1,136 wheels, shafts, drums etc., in use. There are too few bevel wheels the above arrangement. I had a sudden thought that the spinning frames might have been driven from underneath as at Belper North Mill or The Salford Twist Co (Mr Atherton).



Belper North Mill

Farey 1814, Rees

2 spinning floors with upright shaft drive. Not same drive as frame shown above.

Peter Ewart was a millwright who worked for Boulton and Watt visiting potential customers and overseeing the erection of engines. In 1791 Ewart wrote the letter partly transcribed below to John Southern who was the drawing office manager at Boulton and Watt's Soho Manufactory. It was written shortly before Samuel Oldknow took Ewart into partnership specifically to manage the bleach works at Heaton Mersey after Thomas Oldknow's death. I do not know that Ewart had any input at Mellor, but surely he visited the place at some time.

Stockport 12th Aug 1791

Mr Southern

Dear Sir

Mr Atherton has informed me that you want to know the depth of his wells That at Manchester is 23 feet from the regulating line to the surface of the water in the well That at Liverpool cannot yet be determined upon.

He has desired me to make an estimate of ##### Millwork of that at Manchester; and I will be most obliged to you if you will as soon as (convenient) send me the size of the Engine Shaft, and I will take it as a particular favour if you will mention what size you think the other shaft should be The construction will be nearly as sketched on the next page about $\frac{1}{4}$ of the power of the Engine will be conveyed thro' the upright shaft (a) The remaining $\frac{3}{4}$ will be conveyed thro' the 12 upright shafts (d d d &c)



The upright shafts have the same velocity as the Main Horizontal Shaft- The wheels b b &c are to be about 4 feet diamr – c c c &c are the Spinning drums & e e e &c are the carding Do.- The framing for the Engine will soon be ready and I would be glad to know when the Engine Materials will be finished—Mr Shaw's Engine house...

... I got Mr Oldknows Engine set to work last week, which offers very fairly- There will soon be plenty of orders from this neighbourhood, but you will never get them executed half soon enough-

I beg to be kindly remembered to all at Soho- I hope that you will excuse this hand scrawl-

I remain

Dear

Sir

Yours

Sincerely

Peter Ewart

At Salford a horizontal main shaft drives 12 upright shafts by bevel gears. A drum on each of these shafts at each of the two spinning floors drives a pair of spinning frames. The first of the upright shafts also conveys power to the upper carding floor. The mill is 96ft long and so is of similar length to each end of our six storey mill.

Looking at the 1799 Mellor Stock Book, there are:-

Heavy Gearing from the large wheel

Page 8

2 crown wheels I assume that these take the drive from pit wheels fixed the waterwheel axle, one each side.

2 primer blocks These might house the spur wheels to transfer the motion to a long horizontal main shaft.

23 Flywheels I take these to be large bevel wheels on the main shaft

22 Counter wheels I take these to be bevel wheels on the upright shafts.

On each spinning floor there are:-

24 sets of drums shafts, drums, frames, lifters and bayonets. (The lifters and bayonets are parts of the clutch mechanism to engage the drum to the shaft.)

Pages 9-10

44 spinning frames = 22 pairs = 11 at each end.

Pages 1-3

The 6-storey has 25 bays of 7ft 10in = 195ft.

The floor joists were sited between the windows, as were the upright shafts.

The spinning frames were situated between the windows, so there were spaces for 24 pairs of frames.

There were only 22 pairs of frames. I suggest that the spare spaces were in the centre of the mill over the waterwheel.

The drive shafts on Arkwright's frames were vertical. The mill work would be re-arranged to the later usual system of horizontal drive shafts on each floor when the Arkwright frames were replaced by throstles, which had horizontal drive shafts. I doubt if we shall find much of the original millwork layout.

Neil Ormrod some time ago sent me a photo of the drive system to the grinding pans at the Etruria Bone & flint Mill.



He suggested that Mellor might have been similar, but I then did not think so. Neil, you were right!

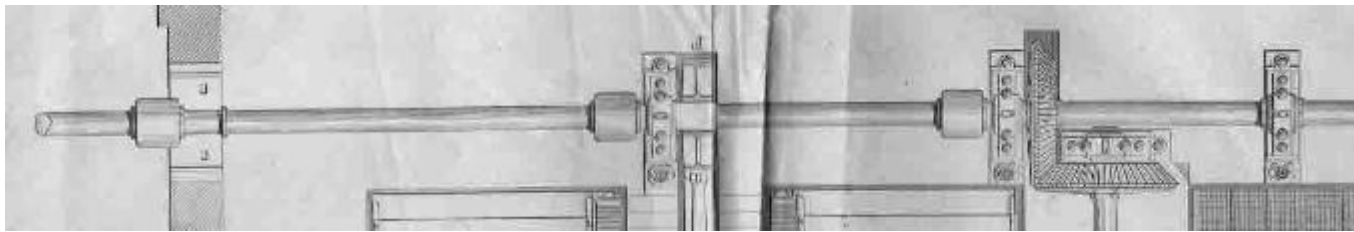
I therefore suggest that Mellor had 22 upright shafts which drove the four spinning floors through drums, each drum driving a pair of frames. The upper two floors were driven by extensions to one or more of these shafts.

The bedstones have a scoop in the eastern side of the top. I saw a shaft at Wortley Top Forge, Yorkshire, on Friday and I think ours was similar, but larger diameter. The shaft is made up of several sections, about 12ft long. At each end of each section is a claw coupling which mates with the next. Each section is supported at one end only. This arrangement would cope with minor misalignment.

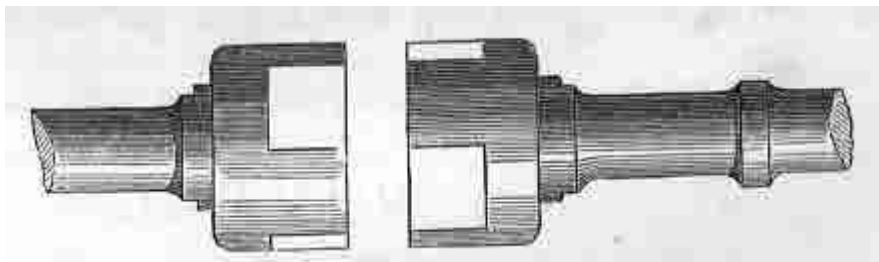




Shaft at Catrine, Fairbairn & Lillie, 1827.



Claw coupling, from Fairbairn, *Mills and Millwork*, Part 2, 1863.



There were many variations on this theme.

I also saw a tumbling shaft. This is much shorter than ours in the 6-storey shaft passage. It is cruciform in cross section whereas ours might have been square. More on this later if you really want.

