

# HOPE MILL

## MANCHESTER



*Architectural Investigation*  
Reports and Papers B/047/2002



ENGLISH HERITAGE

## CONTENTS

---

<b>SUMMARY</b>	3
<b>HISTORICAL BACKGROUND</b>	4
The Boulton and Watt Drawings	4
The early use of the mill	5
<b>BUILDINGS REPORT</b>	7
Evidence of development	9
Internal construction	9
The roof	10
The steam-power system	14
<b>NOTES</b>	16
<b>BIBLIOGRAPHY</b>	18
<b>DOCUMENTARY SOURCES</b>	19
<b>LIST OF MEDIUM FORMAT PHOTOGRAPHS</b>	22
<b>BOULTON AND WATT DRAWING 1:</b> Plan of boiler house, 1824.	
<b>BOULTON AND WATT DRAWING 2:</b> Section of boiler house, 1824.	
<b>BOULTON AND WATT DRAWING 3:</b> Section of engine house, 1824.	
<b>SURVEY DRAWING 1:</b> Plan of top floor.	

**SURVEY DRAWING 2:** Section A – A1.

**SURVEY DRAWING 3:** Section of timber roof.

**SURVEY DRAWING 4:** Assembly of iron roof apex and valley gutter.

**SURVEY DRAWING 5:** Assembly of iron roof strut housing.

**SURVEY DRAWING 6:** Iron roof parts.

Cover photograph: the north end of Hope Mill, viewed from the bank of the Ashton Canal.

## SUMMARY

---

Hope Mill was identified during the early stages of the Greater Manchester Textile Mill Survey in 1986, but its significance was not assessed until an internal inspection was carried out as part of a Listing Review of the Ancoats area by English Heritage in 2001. It was probably built in 1824 as an integrated fustian mill. The main block of the mill is intact and at the time of writing is one of the best-preserved early 19th-century textile mills in Manchester, although a variety of ancillary buildings have been demolished. In most respects it is representative of the large size, narrow plan and steam-power systems of the dozens of textile mills built in and around Manchester in the early 19th century, of which only a very small number now survive. It is of fireproof construction, with brick-vaulted ceilings supported by cast-iron beams and columns which are typical of the period, but is distinguished by the unusual survival of a fireproof cast- and wrought-iron roof. The roof is representative of an innovative type of early iron roof which is of exceptional interest. Survey and close inspection has revealed that it is a larger and more sophisticated example of the contemporary roof at nearby Beehive Mill, Ancoats (NBR 53329), and has notable similarities with other early examples in the Manchester area which do not survive.

The mill is located about three miles east of Manchester city centre, oriented on a roughly north-west to south-east axis and perpendicular to the south bank of the Ashton Canal. It is one of the most prominent structures in an imposing group of 19th-century textile mills, engineering works and related buildings overlooking both sides of the canal (Fig.1, p6). The seven-storeyed main block is set back a few metres from the canal and was built to a long, narrow plan of 20 bays. The main door is in the east elevation, in the sixth bay from the north end, and gives access to an internal fireproof staircase. The original internal engine house is located in the adjacent fifth bay and the original internal boiler house in the four north-end bays. A well-preserved integral chimney is built into the south-west elevation between the engine and boiler house, with a tapered square stack extending above the parapet. A late 19th-century single-storeyed extension to the boiler house is attached to the north-east and extends beyond the mill up to the canal bank. Other extensions were formerly attached to the south-west side, including a later engine and boiler house and a weaving shed, but all have been demolished.

## **HISTORICAL BACKGROUND**

---

Available documentary evidence suggests that Hope Mill was built in 1825 by the firm of Joseph Clarke<sup>1</sup> and Sons. Commercial directories identify the firm as cotton spinners and fustian weavers, who also occupied another premises, probably a warehouse, on York Street in Manchester city centre.<sup>2</sup> Maps of east Manchester indicate that an extensive greenfield area alongside the Ashton Canal was being developed in the 1820s as an industrial suburb with new streets, mills, foundries and terraces of worker's housing.<sup>3</sup> Hope Mill was built in the first wave of industrial development in part of the area on the south-east bank of the canal bounded by Carruthers Street, Pollard Street and Beswick Street. It was built in the centre of this block, with a contemporary mill on the adjoining site to the north east and a slightly earlier mill on Carruthers Street to the south west (not extant). Terraces of housing and related buildings were built along Pollard Street at the same time.<sup>4</sup> By the mid-19th century various other industrial and community buildings had been added nearby, and by the end of the century the Ashton Canal corridor was characterised by a dense accumulation of large steam-powered industrial buildings with extensive areas of housing for the workforce. A mid-19th century map indicates that the mill was associated with a small gasworks, formerly located opposite the southern end of the site on Pollard Street.<sup>5</sup> In the late 19th century the site immediately south-west of Hope Mill, which was formerly occupied by a shed extension of the mill, was rebuilt as the Ancoats Engineering Works, and the housing to the north-east, facing Pollard Street, was replaced by another textile mill.<sup>6</sup> In the early 20th century both Hope Mill and the Ancoats Engineering Works were occupied by the firm of John Hetherington and Sons, a major manufacturer of textile machinery which was based at the Vulcan Works further west on Pollard Street.<sup>7</sup>

### **The Boulton and Watt drawings** (see copies of 1824 drawings, attached)

In 1824 Joseph Clarke and Sons purchased a beam engine for their new mill from Boulton and Watt in Birmingham. Original drawings of this and a later engine and boilers survive in the Boulton and Watt Collection.<sup>8</sup> The first engine, which was presumably installed during the early stages of the construction of the mill, was an 80 horse power beam engine. The drawings, dated 26th November 1824, show the engine in the internal engine house with the adjoining integral chimney, but do not show the nearby internal fireproof staircase. The engine had a 24 foot diameter flywheel at the west end of the engine house and a 44 inch diameter cylinder at the east end. Other drawings of the same date show the internal boiler

house to the north of the engine house, together with a set of three 21-foot long wagon boilers with steam pipes and flues. The firing floors were at the north end of the boilers, facing openings in the end wall of the mill. The boiler house had a high ceiling, at second floor level, to accommodate tall damper pipes located at the southern ends of the boilers.<sup>9</sup> The three boilers were installed in the western two-thirds of the boiler house, next to the chimney, leaving a wide segregated space adjacent to the east wall. The three rows of columns in the boiler house were spaced asymmetrically across the mill to accommodate this arrangement of boilers.

Later drawings show alterations to the original power system. In 1828 a fourth boiler was added in the space along the east side wall of the boiler house and connected to the earlier steam pipes leading to the engine. A series of drawings dated 1831 shows the construction of a new external engine house, which was attached to the south-west side of the mill in line with the 1824 engine. This was built to power a weaving shed, which was already attached to the mill, via a horizontal shaft. The shed is probably shown (but not named) on Banck's Map of 1831, which shows the footprint of the mill extending to the west of the main block. The new engine house contained a 60 horse-power side-lever engine. The drawings indicate that the ground floor of the mill was used as a card room at that time and that an external dye house was attached to the north end of the south-west side. Another drawing dated 1833, however, indicates that the dye house was probably replaced by an external boiler house. This was designed to accommodate two additional boilers and included a nearby free-standing octagonal chimney.

### **The early use of the mill**

Fustian production was widespread in Lancashire and the West Riding of Yorkshire in the early 19th-century. It was a variety of hard-wearing cloths which usually comprised a cotton warp and a weft of wool or flax, but which could also be woven entirely from different types of cotton.<sup>10</sup> The available documentary evidence does not indicate whether Hope Mill was used for the spinning of other fibres in addition to cotton, but it does appear that the site was probably built as an integrated spinning and weaving factory. The presence of a cardroom and an attached weaving shed and dyehouse by the early 1830s suggests that the mill carried out a wide range of processes from the preparation of the raw fibre to the manufacture of the cloth. The 1824 directories list Joseph Clarke and Sons as *manufacturers* (as opposed to simply *spinners*), which usually indicates that a firm carried out weaving. This suggests that

the weaving shed was an original feature. In addition, the Boulton and Watt drawings indicate that the line shafting in the shed was probably already powered from shafting in the main block when the proposals for the new engine were drawn up. 1824 is a relatively early date for a purpose-built integrated textile mill. The addition of power loom sheds to large spinning mills, and hence a conversion to integrated working, became commonplace in Manchester from the late 1820s.<sup>11</sup>

## BUILDINGS REPORT

---

The overall scale and appearance of Hope Mill is representative of other early 19th-century textile mills in the Manchester area, although both the plan and the layout of internal features reflect the constraints of the site. The construction of the Ashton Canal enabled extensive development to the east of Manchester and was the main factor influencing the location of the mill. The adjacent streets were laid out prior to the industrial development of the canal-side sites<sup>12</sup> and influenced the plan of Hope Mill. The south end of the mill is angled to correspond to the direction of Pollard Street, resulting in an extra blind bay in the southern end of the south-west elevation. Internally, the extra space in the south-west corner has been used for the privies on each floor; most have been altered, but some tongue-and-groove panelling survives *in situ* which suggests that this was the site of the original privies. At the northern end of the mill, all the features of the steam-power system were sited in the five bays closest to the canal, which provided the essential water for the boilers and engines. The canal was also probably the means of transporting coal and possibly textile goods to and from the site. The power system is segregated from the main part of the mill to the south by a full-height cross-wall between the fifth and sixth bays from the north end. Cross-walls are another characteristic feature of early steam-powered mills, supporting the power transmission system and in some cases also ventilation ducts, hoist shafts and stair towers.



*Figure 1. Hope Mill (centre) from the north, NMR 21151-12.*

The mill is built in Flemish-bond red brick with sandstone copings and sills. The brick is typical of that used in other early 19th-century housing and industrial buildings in the Ancoats area. It was hand-made, in some cases in local “brick fields” and in others using clay which was dug from the building site itself.<sup>13</sup> The vertical-rectangular windows are of typical size and proportions, but none appear to retain their original glazing bars. Most of the windows have splayed stone lintels, typical of those seen in other contemporary fireproof mills, those to the south of the cross-wall being distinguished by a chamfer which thickens towards the centre. The two original doorways are in fourth and sixth bays of the east elevation, both of which had arched heads of rusticated voussoirs (Fig.2). The north end wall retains the four blocked wide-arched openings which formerly gave access to the firing floors of the boilers. This part of the mill, north of the cross-wall, may have formerly been used for warehousing in the floors above the boiler house and engine house. In the east elevation, most of the windows in the fifth bay from the north end have inserted timber lintels and evidence of rebuilding beneath the sills, and probably replaced taking-in doors; the top storey retains good evidence of a former powered hoist in this position (see steam-power system, below).



***Figure 2. The main entrance to the stair and hoist tower.***

Access to all the upper floors appears to have been via the internal fireproof staircase; this is located in the sixth and seventh bays from the northern end in the angle between the north-east elevation and the cross-wall (see Drawing 1). The stone staircase is half-oval in plan with landings adjacent to the side wall. It was designed to include a full-height hoist and to support a large water tank on the roof, which has been removed. The staircase is positioned alongside an original hoist shaft immediately to the north, which now contains a 20th century elevator. Several other early textile mills in the Manchester area were also built with powered hoists. The ceiling of the top landing retains two deep fish-bellied T-section cast-iron beams of early 19th-century date, indicating that the stair tower formerly supported a water tank. This was presumably for a fire-fighting system, although the stand pipe and other fittings do not survive. The parapet of

the north-east elevation is raised by approximately three feet adjacent to the stair tower, confirming the former location of the water tank.

### **Evidence of development**

At the time of writing there is some doubt about the exact sequence of construction of Hope Mill, although it appears that all parts of the main block are of roughly the same date. Tentative evidence suggests that the upper storeys of the north end of the main block may have been an early addition, or at least represent a different stage in the construction of the mill. Both side elevations include a clear straight joint between the fifth and sixth bays from the north end, extending from the parapet down to the level of the third storey. The joint corresponds to the position of the internal cross-wall, and suggests that the engine house and boiler house were built before the upper four storeys of the five end bays. In addition, the window lintels have a distinctive tapered chamfer, mentioned above, and the walls are a few inches thinner than those to the south of the cross-wall, all of which suggests that this part of the mill represents a different phase of building. Other physical evidence, however, appears to contradict this interpretation. The integral chimney in the west elevation, which is shown in the 1824 Boulton and Watt drawings (attached), is not marked by straight joints and therefore appears to be contemporary with the brickwork in the upper four storeys. If the brickwork of the chimney is original to the power system, as seems likely, the whole of the north end of the mill must be of roughly the same date. The straight joints may thus relate to the original sequence of construction, indicating that the upper four storeys to the north of the cross-wall were completed shortly after the rest of the mill.

### **Internal construction**

The walls of Hope Mill are a type of “pier and panel” construction, with splayed step-in bays separated by thicker piers which vary in depth from about 33 inches in the ground floor to about 24 inches in the upper floors (Fig.3). Walls of this type had been adopted for fireproof mills by c1820, and may be a forerunner of the use of load-bearing pilastered walls in later multi-storeyed buildings. The cast-iron columns and beams are notably similar to those of other early 19th-century fireproof mills in the Manchester area, which suggests that the ironwork of some of the extant mills might have been produced in the same foundry. The cylindrical columns are similar to those of Sedgwick Mill in the Rochdale Canal area of Ancoats, built 1818-20 (NBR 53328). They range from seven and a half inches diameter in

the ground floor to five inches in the upper storeys, and have a single hollow-chamfered ring serving as a simple capital. The columns have no bolting faces or any other fixtures associated with line shafting, although the unusually tall columns in the boiler house have a single ring about two feet below the top. Exposed parts of the beams indicate that they are of inverted T cross-section, and in the upper storeys have an eight-inch deep web with a five-inch wide parallel-sided bottom flange. The web and flange are both about three-quarters of an inch thick. The top edge of the web is horizontal except for four six-inch long sections which are raised to a height of fourteen and a half inches and contain mortices for the longitudinal wrought-iron tie-rods.<sup>14</sup> The brick ceiling vaults are sprung directly from the flanges of the beams and have been built around the tie-rods, which are only exposed near the tops of the vaults. The beams are joined above the columns with shrink rings on horizontal spigots; although no fully-exposed beam / column junction was seen, this appears to be a typical joint system for this date. Most of the floors in the mill have been replaced and in different parts of the building comprise wooden boards, cement or bitumen.



*Figure 3. A typical step-in window bay in one of the upper stories.*

### **The roof**

Hope Mill has a well-preserved double-span roof which is of timber construction in the fifteen bays south of the cross-wall and of fireproof cast- and wrought-iron construction in the five bays to the north. Presumably the north end of the mill, above the engine house and boiler house, was perceived to have a greater fire risk. The larger timber roof comprises full-width tie-beams supporting a central valley gutter flanked by king-post trusses, each with a single rank of purlins (Fig.4; Drawing 3). The trusses are an unusual asymmetrical design which may have been modified, although the main components are probably original to the building. A row of cast-iron columns supports the valley gutter, with additional columns at various points to either side supporting the tie-beams. The column arrangement has probably been altered; marks in the soffits of the tie-beams suggest that they were originally supported

by just two columns flanking the valley gutter. The inner principals, facing the valley gutter, are longer than the outer principals and support continuous skylights extending the full length of the roof. They are crudely mounted on top of the king-posts, suggesting that they may be a later modification (Fig.4). The skylights are of wired glass and are not original, but may replace earlier glazing in the same position. The king-posts are tapered with an expanded head and base, and support the outer principals with a single angled strut; the inner principals are supported by a V-shaped arrangement of struts mounted on the tie-beam.



*Figure 4. The west side of the timber roof.*

The iron roof to the north of the cross-wall is an intricate assembly which is similar to other known examples dating from between 1815 and 1824, suggesting that it is either original to Hope Mill or a very early addition (Drawings 2, 4, 5, 6).<sup>15</sup> Roofs of this type illustrate design principles which were retained on a larger scale throughout the mid-19th century, the main later developments being in the materials used, the methods of joining the components and the spans achieved.<sup>16</sup> The few surviving examples use more cast-iron components, and these are cleverly designed to enable the whole structure to be assembled using the minimum number of bolts. They indicate that the designers had a practical understanding of compression and tension in roof trusses and were applying similar principles to those used in cotemporary cast-iron floor beams. A distinctive feature of the Hope Mill roof is the cast-

iron valley gutter, which supports the trusses to either side and is thus an integral part of the roof. The principals are strengthened by a pair of angled struts and a combination of



*Figure 5. The west side of the iron roof.*

horizontal and angled tie-rods (Fig.5). The roof originally did not have purlins and the trusses were located longitudinally mainly by iron laths, most of which have been removed. It was later modified with the unusual addition of longitudinal cast-iron beams linking the bases of the angled struts, possibly to reinforce the structure after most of the laths had been removed.

The roof comprises nine pairs of trusses aligned with the five north end bays, including intermediate trusses in the centre of each bay. The valley gutter is offset to the west of the centre line of the building and is supported by a row of four columns; the gutter and the columns are roughly in-line with the columns in the boiler house in the ground floor. The pairs of trusses are thus of unequal size, those to the east having a wider span. Additional columns supporting the roof were added later (see below). The valley gutter is mounted on distinctive cast-iron Y brackets on the four original columns. The ends of these brackets project beyond the sides of the gutter to provide base plates which support both the principals and the ends of the horizontal tie-rods. The design of the base plates enables the foot of the principal to lock the horizontal tie-rods in place (Drawing 4b). The valley gutter is bolted together in sections and has been carefully designed to support the roof (Fig.6). Its underside is strengthened with longitudinal fish-bellied webs, similar to those seen in early T-section cast-iron floor beams. Base plates to support the intermediate principals



*Figure 6. Detail of valley gutter, columns and Y-brackets.*

project from the sides of the valley gutters, mid-way between the columns, and are at the same height and of identical design to those on the Y brackets. The underside of the gutter is strengthened with additional transverse webs between the projecting base plates. Similar base plates are embedded in the walls to support the outer ends of the principals and the horizontal tie-rods.

The principals are slender L-section castings which are identical in each truss and are reversed to form a half-lap joint with a single bolt at the apex. Pairs of teeth are cast onto the vertical web to locate the laths which supported the roof slates; the spacing of the laths gradually increased towards the bottom of the principals. The lower end of the vertical flange is thickened and has a tenon to fit the mortices of the base plates. The bottom flange of the principals is strengthened with triangular gussets and is wider in the centre of the span (Drawing 6c). The apex comprises an intricate casting in which the half-lap joint incorporates mortices for the angled tie-rods (Drawing 4a).



**Figure 7. Angled struts, strut housings and inserted longitudinal beams.**

The top ends of the angled struts are bolted to the webs of the principals and the lower ends have tenons which fit into a separate housing suspended by the tie-rods (Fig.7). The top ends are also shaped to locate against lugs which project from the underside of the principals. The housings at the base of the struts are rectangular cast-iron blocks containing mortices for both the struts and the horizontal and angled tie-rods. The latter are forged with T-shaped ends which engage with mortices in the apex of

the trusses and in the base plates. Where the tie-rods meet in the strut housings they overlap and have been forged with lugs on the ends which lock them in place (Drawings 5a, 5b).

Most of the laths have been removed, although in the lower parts of the roof some remain *in situ* hidden behind a hardboard cladding. They appear to be of cast-iron, but their sectional form and long-profile is not visible. The apex is flanked by slender iron battens running parallel to the laths. These appear to be of square section but are also partly hidden by a later cladding.

In what appears to be a later modification, additional cast-iron beams or purlins have been fitted to add longitudinal stability to the trusses (Drawing 5c). The beams are bolted together in sections, each about one bay long, and are of inverted T cross-section. They have clearly been designed for this purpose, incorporating square recesses to accept the base of the strut housings, and are supported by long bolts which are looped over the horizontal tie-rods. At the north end of the attic the beams are stepped upwards to clear the window heads in the end wall. They may have been added after the removal of the laths from the upper part of the roof, although the form of the castings suggests that they are unlikely to date from later than the mid-19th-century. In the wider eastern half of the roof the longitudinal beams are supported by additional columns inserted beneath the strut housings.

### **The steam-power system**

In common with most surviving steam-powered textile mills, Hope Mill retains physical evidence of a succession of power systems. Much of the structural evidence of the original power system, and some later alterations, is well-preserved and closely matches the 1824 Boulton and Watt drawings (attached). No physical evidence survives, however, of the 1831 engine and boiler house or the external weaving shed, all of which were formerly attached to the south-west elevation. Other evidence indicates that a third steam-power system was installed, probably in the mid-19th century, at the northern end of the north-east elevation.



*Figure 8. The internal boiler house.*

The original internal boiler house in the four north end bays is intact except for the brickwork associated with the boilers themselves (Fig.8). It is a rare example of a type that seems to have been in use for a brief period in the early 19th century, with a tall ceiling to accommodate the Boulton and Watt vertical damper pipes.<sup>17</sup> Blocked arched openings in the north end wall and the asymmetrical spacing of the columns confirm that the arrangement of boilers was very similar to that shown in the 1824 drawings. The west elevation contains the smaller blocked arched openings of additional former windows or ventilators. The north end of the boiler

house has blocked windows above the wide-arched boiler openings, and the east elevation retains evidence of the installation of a later steam power system (see below). Externally, the north end of the boiler house has massive cast-iron ribbed plates bolted to the brick piers between the original boiler openings.

Immediately south of the boiler house, the walls and ceiling of the original engine house survive, although wooden floors have been inserted at first and second-floor level and wide doors have been inserted into the side walls on each storey. The brick-vaulted ceiling is well-preserved, together with the iron lifting rings for the installation of the main engine components (Drawing 2). The engine beds are not accessible, but may survive beneath the concrete ground floor. Good evidence survives of an early, possibly original, upright power transmission shaft. The remains of floor traps and large cast-iron bearing boxes for the shaft survive attached to the east end of the cross-wall, facing the main rooms to the south. The largest box is at second-storey level, but it is likely that a still-larger box containing the footstep bearing at the base of the shaft was formerly located in the ground floor. Machinery in the main rooms of the mill would have been powered from line shafting driven from the upright shaft, possibly suspended from the ceiling beams, although it was not possible to ascertain the exact original arrangement of line shafting. In the top storey to the north of the cross-wall an unusual cast-iron beam survives in the south-east corner which may have been associated with a hoist mechanism for the external taking-in doors, powered from the upright shaft.

The adjacent bay to the south of the engine house contains evidence of a possible later addition to the engine. This part of the mill was altered in the 20th century, but the west end of the bay retains a 19th century brick wall incorporating H-section cast-iron columns inserted beneath the original ceiling beam to the south of the engine house. The west end of the ground floor ceiling vault has been removed and is now supported by a substantial I-section cambered beam. This created a two-storey high room which may have contained another engine, possibly connected to the original engine. The engine house wall facing this room contains part of a wide curved scrape mark, possibly made by an engine flywheel. The room now contains an inserted wooden staircase.

Another steam power system was later added to the east of the original boiler house. The third bay of the north-east elevation has been modified to support a second upright shaft. It was driven by bevel gears in a massive cast-iron box, which survives intact in the north-east

wall together with an overhead ceiling trap. The upright shaft extended up to the fifth storey, supported by heavy cast-iron beams spanning the window bays, which remain in situ along with the cast-iron floor traps. The location of the engine which powered this upright shaft is not clear. A single-storeyed gabled building has been added to the north end of the north-east elevation, enclosing the base of the upright shaft. This building comprises three phases of mid- to late-19th century date, with an intact timber roof topped by a ventilation louvre. The gutter where the roof adjoins the mill is supported by substantial cast-iron columns with bolting faces for a horizontal shaft at the same level as the base of the upright shaft; an engine may have been located either in the external building or inside the original boiler house. The north end of the external building includes a pair of blocked wide-arched openings overlooking the canal, suggesting that this end of the building might have functioned as a boiler house. A closer physical inspection of Hope Mill may reveal more precise details of the development of the power system.

## NOTES

---

<sup>1</sup> Most of the documentary sources spell Clarke with an “e”, although in some cases the name is spelt Clark. The site is identified as “Hope Mill” in the index to the Boulton and Watt drawings, which suggests that it is the original name.

<sup>2</sup> See attached notes on documentary sources.

<sup>3</sup> A map published 1824-5 shows the site before the mill was built: A New Plan of Manchester and Salford, *Pigot and Dean’s Directory of Manchester and Salford*, 1824-5.

<sup>4</sup> Banck’s Map of Manchester and Salford. Pollard Street is named Ashton Street on this map.

<sup>5</sup> Named *Hope Mills Gas Works* on O.S. 1:1056, 1850, Manchester Sheet 30, surveyed 1849.

<sup>6</sup> O.S. 1:2,500, Lancashire, sheet CIV, 7, published 1921.

<sup>7</sup> Hope Mill is illustrated in advertisements for John Hetherington and Sons, along with other Ancoats mills occupied by the firm, dating from the early to mid-20th century. See Hetherington catalogues at Manchester Central Library, ref 677.2.5 HE9.

<sup>8</sup> Portfolios 492 and 1041, Boulton and Watt Collection, Birmingham City Archives.

<sup>9</sup> The vertical damper pipes were an early method of regulating the steam pressure in the boiler. A float in the pipe was raised or lowered by the level of water in the boiler and adjusted the damper

---

plates in the flues via a system of chains and pulleys. This varied the draft through the flue, the temperature of the furnace and hence the steam pressure in the boiler. Dickinson and Jenkins, p238-9.

<sup>10</sup> Cossons, p38-41.

<sup>11</sup> Williams, p76.

<sup>12</sup> The street pattern, shown on maps of the early 1820s, was laid out on greenfield sites before any building took place, in a similar sequence of development to that which took place in the Rochdale Canal part of Ancoats from the 1780s.

<sup>13</sup> The deeds to Sedgwick Mill, Ancoats (NBR 53328), for example, specified the use of clay for building bricks which was obtained from the site. "Brick Fields" are marked on early to mid-19th-century maps of the east Manchester area.

<sup>14</sup> The horizontal web may be unusual. In other known fireproof mills of this period the top edge of the web is not horizontal and is deeper in the central part of the beam than at the ends.

<sup>15</sup> The best-known example is the 1824 roof at Beehive Mill. In addition, the Boulton and Watt Collection contains detailed 1815 drawings of an almost identical type of roof construction; Portfolio 449, Messrs Birley and Hornby, Feb. 1815. This was designed for Chorlton New Mill, Cambridge Street, Manchester, but does not survive.

<sup>16</sup> For the later development of iron roofs see Drysdale Dempsey.

<sup>17</sup> The only other recorded example was at Havelock Mill, Manchester, which had an inserted concrete first floor and has since been demolished (NBR 53293).

## **BIBLIOGRAPHY**

---

Bancks, 1831, *Map of Manchester and Salford*.

Boulton and Watt Collection, Birmingham City Archives, Central Library, Birmingham.

Cossons, Neil (ed.), 1972, *Rees' Manufacturing Industry (1819-20)*, Vol 3.

Dickinson, H.W. and Jenkins, R., 1919, *James Watt and the Steam Engine*.

Drysdale Dempsey, G., 1850, *Examples of Iron Roofs, from 20 to 150 feet in Span*, British Library.

Williams, M., with Farnie, D.A., 1992, *Cotton Mills in Greater Manchester*.