Information Sheet 1

Sir Richard Arkwright

Early Life

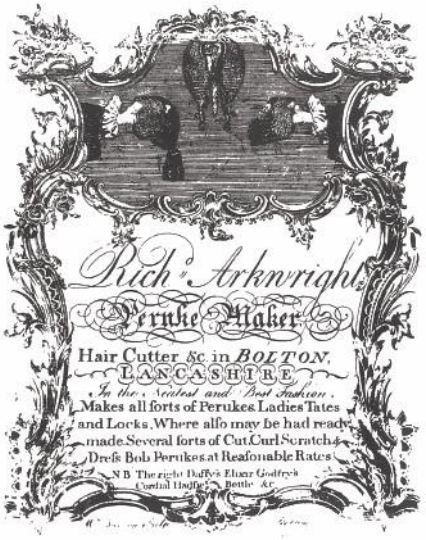
Richard Arkwright was born into a large, working class family in Preston, one of thirteen children. His brothers and sisters attended Blue Coat Board School, but Arkwright is thought to have been taught to read and write by relatives. As an apprentice Barber, Arkwright began learning his trade and later owned his own Peruke (wig-making) business. One of his first inventions was a waterproof colour dye for wigs.

Arkwright's Water Frame

Working with a clockmaker John Kay and inventor Thomas Highs, Arkwright developed the water frame machine. After trying many times to find a solution, Arkwright made two important contributions, spacing the rollers so that the cotton would not snap and adding weights to the rollers so that the cotton yarn was even. The water frame could make stronger threads of different thicknesses and produce larger quantities than other machines. It was too large to be spun by hand but could operated by unskilled labour if powered by water.

First Mill © Derbyshire Archaeological Society

Second Mill © Derbyshire Archaeological Society



Richard Arkwright's trade plate as a barber and peruke maker in Bolton.

Why did Arkwright build Cromford Mills?

Arkwright was a businessman and inventor, interested in new ideas and making money. The demand for spun cotton was increasing and Arkwright's machine could work seven times as fast as hand operated spinning.

Arkwright's first cotton mill, in Hockley Nottinghamshire was near to a mill owned by James Hargreaves (the inventor of the Spinning Jenny, 1764). Arkwright needed to raise more funds and in 1770 partnered with Jedidiah Strutt, inventor of the Derby Rib machine and Samuel Need, a business man. They raised enough money to build a horse powered mill but in 1771 they made a decision to also build the water powered mill at Cromford.

Cromford was a suitable site because it offered flowing water for Arkwright to power many machines at once. It was also away from city rioters who were against the use of new workplace machines. Cromford Mills became an important example of the new factory system; different processes including preparing, spinning, storing the cotton happened in one place and people moved from working inside the home to a factory workplace. Although the cotton yarn was spun by machines the weaving was still done by hand. Once spun, the cotton would have been sold on or taken home where men would make cloth using hand operated weaving looms. It would then be brought back to the factory for sale.

Arkwright's invention and factory system was so successful that people paid him money to use his designs and set up their own businesses. His mill inventions and designs spread to Scotland, Europe (including Cromford, Germany) and America.

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Sir Richard Arkwright

Sir Richard Arkwright by Joseph Wight of Derby

Arkwright's Family Life

Arkwright married Patience Holt the daughter of a schoolmaster in March 1755. They had a son in December 1755 named Richard. Patience died in October 1756 and four and a half years later Arkwright married Margaret Biggins. A daughter Susan was born in December 1961.

Margaret left Arkwright in early 1770s for being too absorbed in his work. After his death Arkwright's son Richard Arkwright (Junior) inherited his business and most of his wealth.

Evidence

Arkwright appears to have been an astute and guarded business man protecting his plans, ambitions, ideas and assets. Archaeological studies and other evidence including contemporary newspapers, magazines, diaries, artworks, maps and records have been important in providing evidence about Arkwright's life and the working of the Mills.

Summary

- Richard Arkwright was born into a large working class family.
- He began his working life as a barber and wig-maker.
- The first mill at Cromford was built in 1771.
- Cromford was chosen as a site because it offered flowing water for Arkwright to power his machines.
- It was chosen as a site because it offered flowing water for Arkwright to power many machines at once.
- In Arkwright's factory design the preparing, spinning, storing the cotton happened in one place. The cotton yarn was spun by the water frame machines.
- Weaving was done by hand.
- Arkwright's invention and factory system was so successful that people paid him money to use his designs. His mill inventions and designs spead to Scotland, Europe (including Cromford, Germany) and America

Information Sheet 2

Life at Work and Home

Where did people work before the mills were built?

Before the mills were built the main industries in and around Cromford in the mid to late eighteenth century would have been lead mining and farming. Women would have spun cotton yarn in their homes using spinning wheels.

Why did Arkwright choose to build a mill at Cromford?

Cromford had a constant flowing water supply that did not freeze. The water was supplied by lead mines that were drained by a sough. It was channeled beneath the ground through a hill and into an overground stream. It was this stream that Arkwright used. He also built ponds, water channels and an aqueduct; some of his work can still be seen in and around the village today.

It was also far enough away from other inventors looking for ideas and machine wreckers, people who attacked new machines in workplaces.

What was it like to work at Cromford Mills?

Arkwright's factory was designed efficiently to produce large qualities of spun cotton. Children and adults worked outside of the home to set hours and timed breaks to maintain the machines during the day and sometimes at night.

Information provided by Richard Arkwright (Junior) describes some of the working conditions and employment of men, women and children. Hours of work were from 6am until 7pm in summer and 7am until 8pm in winter. One hour was allowed for dinner. Breakfast was served at 8.30 am in summer and tea at 4pm. Unlike many other mills Cromford Mills did not take on parish apprentices (pauper children without family to look after them). Cromford workers received half their wages if they were ill but were also fined if they broke rules such as being later for work.

Where did workers live?

When Arkwright developed his mills he built cottages with small allotments for his workers and their families. Houses were three storeys high and better than homes or living spaces found in mills in cities.

How did working conditions at Cromford Mills compare to other mills?

Working conditions varied greatly in the 18th and 19th century. Generally cotton mills were very dusty, workers were prone to coughs, sore and itchy eyes and risk of machine accidents was high. There is evidence of how bad conditions were at other mills, including workers being exposed to dangerous and dusty conditions with uncomfortable temperatures either too cold or uncomfotably warm. The temperature at Cromford Mill was around 60 – 65 degrees Fahrenheit and unlike many other mills the air flow was managed to help reduce the dusty conditions.

Information Sheet 2

Life at Work and Home, 18th & 19th Century

How old were the children who worked in the mills?

Before 1806 children as young as seven were employed at the Cromford Mills. Roles would have included piecing, clearing and sorting the cotton, replacing bobbins, greasing and minding the machine. From 1806 Cromford stopped taking children under the age of 10 years. There was a general expectation that they should learn to read before beginning work at the mill although this may not always have been checked. Boys were paid more than girls.

In other mills children had to work from a young age, for example in Lancashire mills, children as young as five and six were employed working 14 hour days in cool conditions with inefficient air flow and poor quality food. In 1802 the government stated that apprentice pauper children were not allowed to work more than 12 hours a day and after 1803 they were not allowed to work at night between 9pm and 6am.

What was it like to live in Cromford after the mills were built?

After the workers cottages were built, Arkwright constructed The Black Dog Inn (later the Greyhound Inn) and a Market area. Festivals and celebrations were held in the village for the workers and general public. The Derby Mercury of 19th September 1776 reported that, at Cromford there was an annual festival of candlelight, 500 workmen and children led by a band and a boy working on a weavers loom paraded from the mills round the village, watched by a huge gathering. They returned to the mill for a feast of buns, ale, nuts and fruit followed by music and dancing. Workers also wrote a song about Arkwright to the tune of the Roast Beef of Old England.

Crime and Punishment

In the eighteenth century local watchman, constables and courts dealt with incidents of crime. During 1790 Arkwright oversaw the conversion of a cottage into the Village Lock Up (jail). Two cell rooms were created downstairs. The story of John Thompson exemplifies how it was used. In 1806 he was imprisoned in the village Lock-Up whilst awaiting trial at Nottingham for stealing cloth from a canal barge. Following a guilty verdict he was transported to Australia for seven years, leaving his wife and children behind.

Summary

- Arkwright built cottages with allotments for workers, a pub, market area and lock up.
- When the Mills first opened children as young as 7 were employed.
- From 1806 children had to be 10 years old before they could start work at the Mills.
- Children worked the machines and on carding, sorting cotton.
- Festivals and celebrations were organised for workers.
- Mills were often cold, dusty places with poor air conditions and quality of food.
- Cromford working conditions were better compared to other mills.
- Cromford did not employ apprentices.
- Before the mills were built women would have spun cotton yarn on spinning wheels at home.

Information Sheet 3

Mill Construction and Water Power

When were the Mills built?

The first mill was built in 1771, it was five storeys high. A second mill was built in 1776, 120 feet in length, seven storeys high with the capacity to make double the amount of cotton yarn than the first. To achieve the extra power needed the second mill used water from Bronsall Brook and Cromford Sough and a large double wheel set into a deep pit underneath the mill.

To accommodate the new mill, older buildings were demolished and changes were made to the flow of water. Water was channeled underground away from the second mill's big wheel to the River Derwent. A corn mill downstream of the first mill was demolished and rebuilt upstream in 1780, by a local land owner. A lead smelting mill on the River Derwent downstream from Cromford Bridge would have stopped or reduced production due to the changes Arkwright made to the water flow.

How and where did the water flow?

Water flowed to the first mill through a wooden launder onto a water wheel. In 1786 this was heightened and a new bigger waterwheel was used. In 1821 the wooden aqueduct that bridged mill road was replaced with a cast iron piece.

There were three watercourses: the Brook flowed beneath the first mill, another ran past the Weavers Workshop building and the first watercourse ran through a wooden aqueduct constructed in 1771. At the mill basin, the weir to the east of the bridge filtered excess water through two routes, one underground to the canal feeder arm (this was built in 1790s), another close to the surface near the second mill, flowing under parkland to the River Derwent. The water that travels through the mill basin would have travelled into the waterwheel pit under the second mill, through a stone arched culvert, (underground drain) under Cromford meadows and out into an open ditch until it joined the river where it reached water level.

Why does the mill have so many windows and a bell?

Mills were built with many windows to reduce the need for artificial light and to help control temperature and humidity. The sash design of the first mill was just becoming popular in middle class homes in this area of Derbyshire. Fixed windows with single opening panes are believed to have appeared with the introduction of a new heating system that would have needed careful control of air circulation to work properly.

On some of the buildings facing the road there are no windows at the lower levels. This may be a way of protecting the building and the contents or may have been for other reasons. In cities rioters had targeted factories and broken machinery.

A mill bell would have hung in the cupola, a small structure on top of the building, (it became a standard feature for mills across the UK). The bell can be seen at Cromford Mills and is dated 1771. The bell would have sounded at the start and the end of the day.

Information Sheet 3

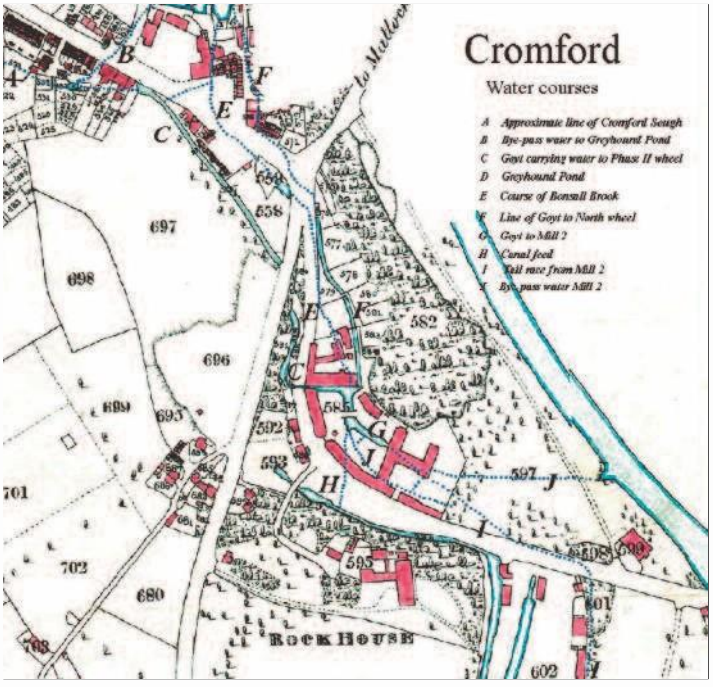
Mill Construction and Water Power

How were the mills heated?

In 1785/6 a vented warm air heating system was put in. Fireplaces were added at each floor to draw warm air through the rooms from the heating vents in the heating tower. Joseph Wright's picture Cromford Mills by Day, c1795 shows the heating tower and a chimney. The temperature was said to be between 60 and 65 degree Fahrenheit.

Summary

- The first Mill was five storeys and the secomd Mill was seven storeys high.
- The Mills used water from Cromford Sough and Bronsall Brook. The water flowed from the Mills into the River Derwent and to Cromford Canal.
- Arkwright built aqueducts and underground tunnels to control the flow of the water.
- The water flowing through the double wheel under the second mill powered twice as much machinery that the single wheel on the first mill.
- In the 1780s a warm air heating system controlled the temperature of the first and second mills.



Information Sheet 4

Transport

Roads

Images of the site before and after construction of the Mills show that Arkwright rerouted the road. In general roads were described as being very rough and difficult to use. Below is a quote from Monthly Magazine 1804:

'The usual method of making or mending roads in stoney countries is a great nuisance to the traveller. It consists in breaking stones taken out of the neighbouring quarries into brick sized pieces, and spreading them over the roads. With what pain and difficulty a poor horse drags a carriage over such a track.'

Railway

The High Peak Railway opened in 1831 to transport goods from the canal. Carriages were powered by static steam engines on inclines and horses on the flat. The first locomotive was purchased for the line in 1833. The railway was initially a link in the canal network and did not link to the main line until the 1850s when it opened as a passenger line.

Canal

Arkwright invested time and money into the development and promotion of the canal, aspiring to use the canal to make money from transporting and trading limestone and minerals. He initially gained from his involvement because the wharf was developed on his land at Rock House and he accepted money to accommodate the canal. Arkwright also agreed to the mills supplying the canal with water at weekends.

The canal was important to the growth of the Derwent Valley before the roads were developed and the High Peak Railway built. Canal wharf had two warehouses, a counting house, two cottages, stables and smaller workshops.

Summary

- All the materials needed to build and operate the mill would have been delivered by road
- Rural roads were in poor condition at the time the mill was built.
- Arkwright re-routed the road to make way for the second mill
- The canal was built in the 1790s, opening in 1794
- The railway at Cromford opened in 1831