

# Sir Richard Arkwright

## Arkwright's early life

Richard Arkwright was born in Preston into a large family, one of thirteen children. He was not thought to be educated in school but to have attended evening classes or taught to read and write by family members. His older siblings attended Bluecoat Charity School, Preston.

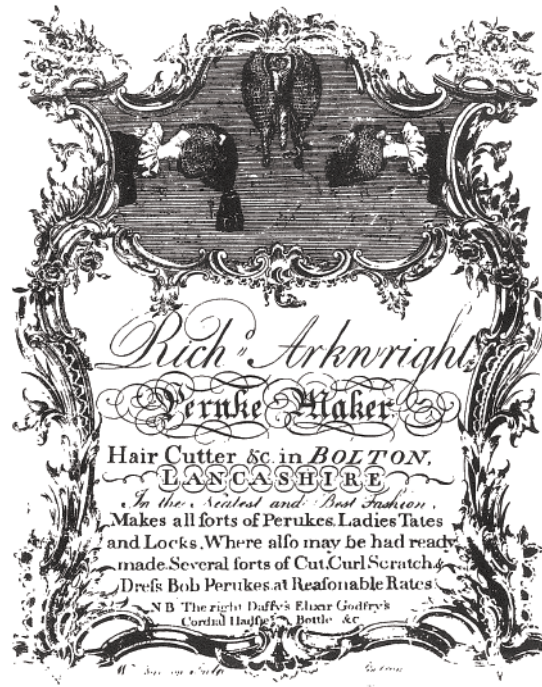
Arkwright began his working life as an apprentice to a barber, quickly progressing to wig making and later owned a Peruke making business in Bolton, successfully developing a waterproof dye for wigs. In 1762 to 1764 Arkwright was the licenced owner of The Black Boy pub in Bolton.

## Arkwright's Water Spinning Frame

Before Arkwright's development of the water frame, other inventors had built mills and machines for spinning.

Lewis Paul, a physician and son of a French refugee developed a device for spinning, similar to John Kay's flying shuttle for weaving. Paul commissioned the building of animal and possibly water powered mills in different places across the Midlands. However, they were not sustainable for many reasons including management and machine efficiency. It is likely that knowledge of these roller-spinning machines and mills was widely shared.

In the 1760s Arkwright worked with clockmaker, John Kay and inventor, Thomas Highs (Hayes) to build a new spinning machine. The partnership only lasted a few years; although Highs and Kay made their contributions it was Arkwright who completed the machine and obtained the patent. He successfully made the device work by the effective spacing of rollers to draw out the cotton and weighting the upper rollers with the lower rollers to maintain an even yarn. Pairs of rollers were made to turn at different speeds, each succeeding pair turning faster. This produced stronger yarn at different thicknesses, at much greater volumes. Initially the original machines were the size of two chairs but they were eventually scaled up for use in the factory. They required little skill to operate, unlike Hargreaves' spinning jenny invented in 1764.



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

## Arkwright's Business Developments

When Arkwright moved to Nottingham he partnered with John Smalley from Preston and two Liverpool men, David Thornley and brother-in-law watchmaker Henry Brown. On 14 May 1768 they became partners for two years and in 1769 found a site for a mill in Hockley, Nottingham close to James Hargreaves' mill. After two years the project needed more funding and in search of new investors Arkwright formed a partnership with Jedidiah Strutt and Samuel Need. The money was used to commission the building of the horse powered Nottingham mill, then in 1771 to build the mill at Cromford.

Arkwright's waterframe invention, mill design and factory production model brought all processes together in one place and was so successful that other mills were built using his plans and designs. In 1783 Johann Gottfried Brugelmann commissioned the first water powered cotton spinning mill using Arkwright's designs near Ratingen in Germany and called it Cromford. More mills were built by different investors in Scotland and the United States including Pawtucket, New England. Arkwright also invested in mills in Derbyshire and Lancashire as well as having interests in other businesses around the country.

A portrait of Sir Richard Arkwright painted in 1790 by Joseph Wright of Derby captures Arkwright as a self-made man, an industrialist and inventor. The rollers that made his fortune are seen on the table by his left arm.

# Sir Richard Arkwright



Sir Richard Arkwright by Joseph Wight of Derby  
© Derby Museum and Art Gallery

## Arkwright's Family Life

Arkwright married Patience Holt the daughter of a schoolmaster in March 1755, they had a son in December 1755 also 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 1761 and another daughter Ellen in 1764 but she died in infancy. Margaret left Arkwright in the early 1770s. Richard Arkwright Junior inherited the mill businesses and also became a Banker.

## Evidence

Arkwright appears to have been an astute and guarded business man protecting his plans, ambitions, ideas and assets. Archaeological studies and other evidence such as 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

- Arkwright's water frame invention, mill design and factory production model was so successful that other mills across Europe and in the USA were built using his plans and designs
- Arkwright successfully made the spinning water frame work by the effective spacing and weighting the rollers to maintain an even yarn.
- Unlike Hargreaves spinning jenny it could be operated by unskilled workers
- Arkwright's factory model brought all processes together in one place, preparing, weaving, spinning

## QUESTIONS

- How was Arkwright perceived by his contemporaries?
- What do the portraits of and writings Arkwright tell us about his character and attitude towards work?
- When in history was Arkwright well regarded and most criticised?

# The Location of Cromford Mills

Cromford may at first seem to be an unusual place for the mill site, as it is not located that near to trading places such as Nottingham and Lancashire. The rural location was possibly an advantage for developing and refining production processes away from busy cities and other industrialists. Although transport routes may not have been that established Cromford did offer an important source of energy, flowing water that was steady, reliable and constant throughout the year.

When Arkwright arrived the industries were mainly lead mining and agriculture. The lead mines were drained by a sough that channelled water beneath the ground through the hill and into an overground stream. It was this energy source, that Arkwright used and adapted as needed, constructing ponds, sluices, underground culverts and an aqueduct; some of his work can still be seen in and around village today.

## Signing of the Lease for Cromford Mills

The ambitions of Arkwright and his partners are evidenced in the lease. On 1st August 1771 Richard Arkwright and his partners John Smalley, Samuel Need and Jedidiah Strutt signed the lease to water rights and land, an annual rent £14, from the land owner Richard Nall:

*'All that river, stream or brook, called Bonsall Brook in Cromford together with the stream of water running from Cromford Sough into Bonsall Brook with full liberty to divert, turn, and carry the water down the south side of the highway in Cromford and under or over it; and also all that piece of ground lying between Bonsall Brook and the intended new cut, extending from the turnpike road leading to Matlock Bath... to erect and build...one or more mills for spinning, winding or throwing silk, worsted cotton, linen or other materials, and also water wheels, warehouses, smithies etc; banks, dams, goits, shuttles and other conveniences.'*

## QUESTIONS

- When Arkwright and his partners made their decision to build a mill at Cromford what did they need to consider?
- Who did Arkwright work with and how did he work with them to develop his mills?



First Mill © Derbyshire Archaeological Society



Second Mill © Derbyshire Archaeological Society



Image of a model of Cromford Mills



# 18th and 19th Century Life at Work and Home

## Changes to Working Lives

Before the mills were constructed Cromford was a small village with a few houses, a corn mill and mines. The main industries in and around Cromford would have been lead mining and farming. Prior to manufacturing cotton in the mills women would have made cotton yarn in their homes using spinning wheels. In the 18th century cotton was typically woven with linen to make calico but towards the end of the century, around 1774, the duty on cotton was reduced and so could compete on equal terms with other materials such as wool.

Arkwright's invention made high quality spun cotton at different thicknesses and strengths in greater quantities. His new factory system enhanced the speed of production; processes were brought together in one place outside the home and a less skilled and lower paid workers could operate the machinery. This change threatened skilled workers who could not compete with the pace of production and so riots against these industrial changes occurred in cities.



## Homes and Wages

There were believed to have been about 200 workers employed in the first mill. Soon after the construction of the first mill homes were built for the workers. The cottages were three storeys high with small allotments and offered a better standard of accommodation than workers homes in cities. In the early 1780s a Barracks building was constructed onsite for single men who lived too far away to travel each day. All workers received some benefits such as sick pay at half their wages and gifts as incentives and rewards for their hard work, but they were also fined for breaking the rules, including late attendance at work and neglecting their duties.

## Working Conditions

Working conditions varied greatly in the 18th and 19th century. The information provided by Richard Arkwright (Junior) in the 'Minutes of Evidence Before the Select Committee on State of Children in Manufactories' 1816 describes some of the working conditions and employment of men, women and children at Cromford Mills.

Hours of work were six in the morning until seven in the evening in summer and seven until eight in winter with one hour for dinner. Breakfast was served at 8.30 am in summer and tea at 4pm. Jobs were mainly unskilled and the roles for children would have included sorting and cleaning the cotton, maintaining the machines, repairing broken yarn and replacing bobbins. Boys were paid more than girls.

Atypical to many other work places, Cromford Mills did not take on parish apprentices (pauper children without family to look after them). Before 1806 children as young as seven were employed at Cromford mills. By comparison in Manchester mills children as young as five and six and one as young as three were reported as being employed, working 14 hour days in poor conditions with inefficient ventilation and low quality cheap food. From 1806 Cromford stopped taking in children under the age of 10 years. They were also expected to learn to read before beginning work at the mill.

## Health and Morals of Apprentices Act

To address some of the poor working conditions in the workplace Sir Robert Peel's Health and Morals of Apprentices Act was passed in 1802. Peel was concerned about the working conditions of apprentices following an outbreak of malignant fever in one of his mills in 1784. A copy of the Act was to be put in every mill or workshop and visits were to be made by clergymen or magistrates to ensure it was being carried out. The Act applied to mills/workshops having three or more apprentices where 20 or more people worked. Employment of apprentices was prohibited to more than 12 hours a day. From 1 June 1803 night work between 9pm and 6am was forbidden. Other aspects of the act related to sanitary conditions, education, welfare and religious instruction.

# 18th and 19th Century Life at Work and Home

## Leisure, Festivals and Celebrations

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 workers and the general public. The Derby Mercury, 19th September 1776 reported an annual festival of candlelight at Cromford with 500 workmen and children led by a band and a boy working on a weavers loom. They paraded from the mills round the village, watched by a huge gathering returning 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. In 1806 John Thompson 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

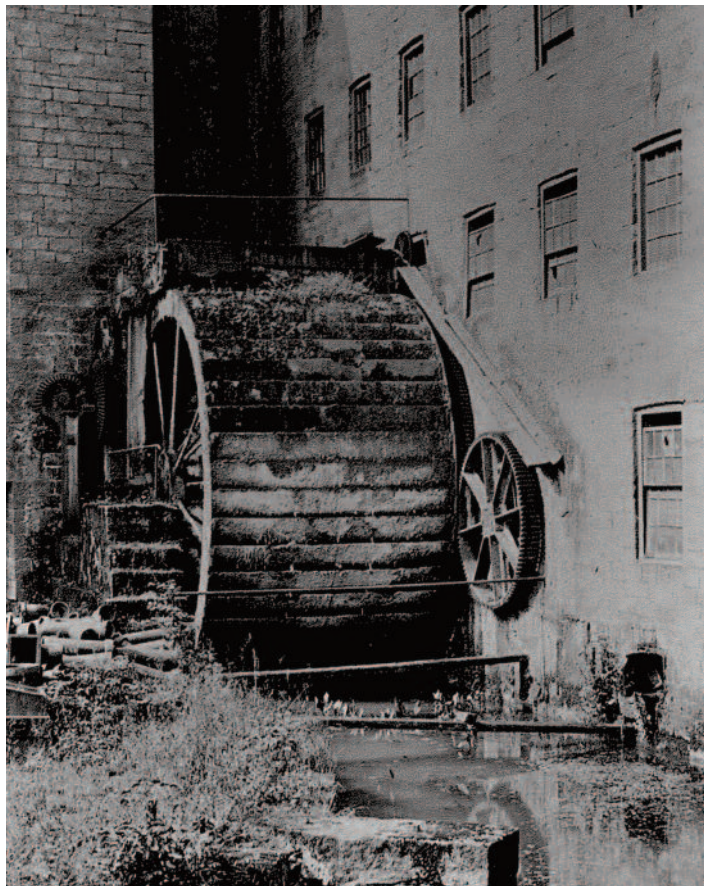
- Arkwright employed adults and children in different roles in the factory. Children as young as seven could start work at Cromford Mills but from 1806 they had to be 10.
- To address some of the poor working conditions in the workplace Sir Robert Peel's Health and Morals of Apprentices Act was passed in 1802. Atypical to many other work places, Cromford Mills did not take on parish apprentices
- Conditions at Cromford appear to be generally better compared to other mills.
- Arkwright built workers cottages, a pub, market area and village lock up
- Celebrations, festivals and incentives were used to motivate workers
- Cromford Mills sought large families amongst others to work at the mills but did not employ apprentices.

## QUESTIONS

- What is typical about Cromford Mills compared to other mills and what is different?  
Why do you think this was?
- What did Arkwright do to protect his mills?  
What was he guarding against?
- How did working conditions change over the 19th century and what was the role of parliament in contributing to change?



# Mill Construction and Water Power



© Derbyshire Archaeological Society

The first mill was the first building constructed on site in 1771, originally it was five storeys high. The second mill was built in 1776, downstream of the first mill. Newspaper descriptions and images confirm these dates.

When the second mill was constructed it was 120 feet in length, seven storeys high with nearly double the production capacity of the first. To achieve the extra power needed the second mill drew water from Bronsall Brook and Cromford Sough, channelling it towards a double wheel set into a purpose built deep pit underneath the building. The pit was lower than the water level of the river and so water was channelled underground nearly half a mile to a place where it levelled with the River Derwent. Before 1776 the tail water of the first mill and Bronsall Brook had powered a lead smelting mill situated on the River Derwent further up from Cromford Bridge. When the second mill was constructed it is thought this mill's function would have been very reduced or stopped altogether. Baxters Corn Mill, downstream of the first mill and mentioned in the lease of 1771, was also demolished to make way for the second mill.

## Water Courses

Water was initially delivered to the first mill through a wooden launder, in 1786 this was heightened. It may be that a new waterwheel was also installed at this time. In 1821 the wooden aqueduct that bridged mill road was replaced with a cast iron piece.

There were three watercourses, one ran through an aqueduct that was constructed in 1771 at a lower level and raised to a higher level in 1786. Another, Bronsall Brook, ran beneath building 19 and (building 18). A third watercourse (now dry) ran past the Weavers Workshop building. The weir to the east of the bridge filters excess water through two routes, one underground beneath buildings 15 and 14 to the canal feeder arm, another close to the surface between building 14 and 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.





# Mill Construction and Water Power

## Design of the Mills

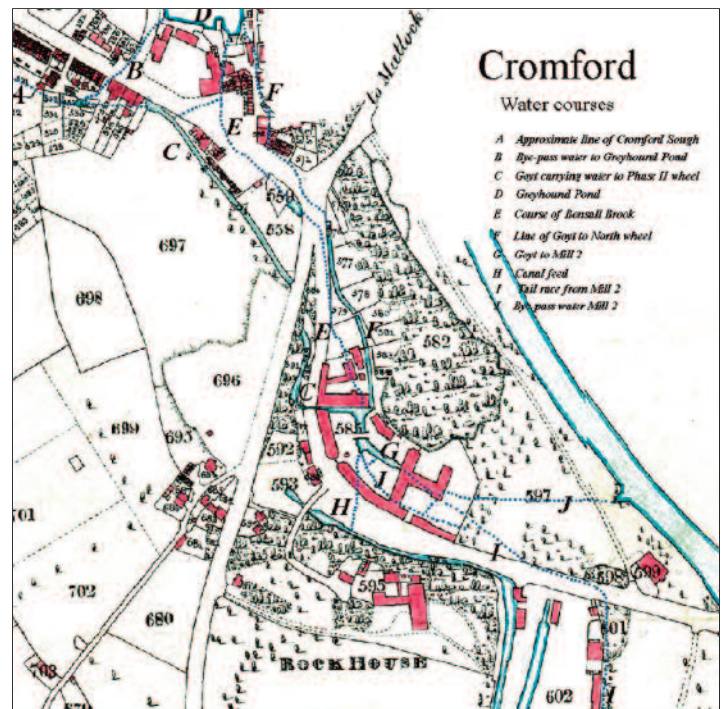
The mills would have been constructed of sandstone, wooden beams and slate roofs. Buildings had many windows to reduce a need for artificial light and to help regulate temperature and humidity. Sash designs found in the first mill were just becoming popular in middle class domestic settings in this area of Derbyshire. Fixed windows with single opening panes were believed to be linked to the introduction of a new heating system that would have required careful control of air circulation to work efficiently.

A cupola, a small structure on top of the mill buildings, would have housed the mill bell, which is currently on display at Cromford Mills and is dated 1771. Illustrations of the mills vary in depicting the location of the cupola and bell. In 1790 the first mill was reroofed, the change in the location of the bell may also have occurred around this time.



## SUMMARY

- The mill used water from Cromford Sough and Bronsall Brook. Water flowed from the Mills into the River Derwent and 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 than the single wheel on the first mill.
- In the 1780s a warm air heating system was installed to control the temperature in the Mills



## Heating

In 1785/6 the mill ground floor was raised and a vented warm air heating system was introduced. Fireplaces were added at each floor level to draw warm air through the rooms from the heating vents located in the heating tower that had been added onto the building close to the original mill and the extension. Chimneys are depicted in illustrations and artworks made before the construction of the heating tower. Joseph Wright's work *Cromford Mills by Day* c1795 shows the heating tower and a chimney.

# Transport and Roads



## Canal

Arkwright invested time and money into the promotion and delivery of the canal. He was interested in the money he could make from the transportation and trade of limestone and minerals. The plans for the Wharf show that it would have been located across the gardens of Rock House, Arkwright's home before he built Willersley Castle. Not only did he invest in the canal but he was offered money to accommodate the canal on his land. A condition of the construction was that water from Cromford Mills was to be supplied to the canal at weekends.

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

## Roads

The roads are described as being very rough at the time the mills were operating. Turnpike roads were privately owned and users would have had to pay a toll fee.

Monthly Magazine 1804 describes the road conditions:

*'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 masses not much less than the common brick, and spreading them over the line of the roads. It may be conceived with what pain and difficulty a poor horse drags a carriage over such a track.'*

Images comparing Cromford Mills site before and after construction of the second mill show that Arkwright rerouted the road to accommodate his plans.

## Railway

The railway at Cromford 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.

## SUMMARY

- Arkwright re-routed the road to build the second mill.
- The canal was built in the 1790s, opening in 1794 to transport commodities
- The railway at Cromford opened in 1831 to link trade routes
- Rural roads were in poor condition at the time the mills were built.
- The railway passenger line did not open at Cromford until 1850s.



# The Cotton Trade

## Where did the cotton come from?

London was the main port for cotton until 1795 specialising in Levant and South American types of cotton. The source of cotton for Cromford Mills is not currently known. The Strutts in Derbyshire purchased most of their cotton from London until 1803. Distribution was good in the spring, summer and autumn but not in winter due to weather conditions.



## How was cotton distributed?

Importers dealt with a range of items including cotton. They took the cotton through customs, stored it in warehouses, settled insurance premiums and arranged for the cotton to be sold. Importers charged commission for their services (about 1.5 – 2.5 %). Cotton was mainly sold through a network of selling and buying brokers.

Selling brokers sold to the dealers. Brokers were important from 1790s onwards, having warehouses at the port and knowledge of markets and trade. They also had large stocks of cotton of different types bought from a range of shippers, classified and stored so that it was available at short notice and when supply was poor. Brokers also advised spinners of alternative sources.

Dealers linked the port to the cotton towns, buying cotton from the importers and storing it in their warehouses. The cotton was sold to the spinners by public auction. Dealers were independent from the importers and the spinner and dealt in other commodities too.

## Cotton and Slave Labour

The cotton trade was one of many that benefited from slavery and the exploitation of men, women and children. The majority of cotton at the end of the 18th century is said to have been transported from plantations in the West Indies that were farmed by African slaves.

Although mill owners may not have had direct links with the slave trade, due to the chain of supply, they may have indirectly gained from their exploitation in pricing and transportation of cotton. In 1787 a committee for the abolition of the slave trade was formed which led to the abolition of the slave trade in 1807. Fair and ethical trading remains a contemporary issue. At what cost are some cheap goods and commodities available today?

