THE ARKWRIGHT COTTON MILL AT BAKEWELL.

By Robert Thornhill.

RICHARD ARKWRIGHT built one of his early cotton mills at Bakewell, and it is now possible to give some information about its size and its waterworks. Arkwright's first water-powered cotton mill, opened at Cromford in 1771, was worked not, as one might suppose, by the River Derwent but by a stream of drainage water from near-by leadmines. An early reference to these mills is found in Bray's *Sketch of a Tour into Derbyshire and Yorkshire*; in the preface to the first edition, written in November 1777, Bray says:

> "A little stream . . . comes from Bonsall . . . turning a mill for spinning cotton, invented by one Mr. Arkwright, who . . . carries on the business with great advantage to himself and the neighbourhood. It employs about 200 persons, chiefly children; and to make the most of the term for which the patent was granted, they work by turns, night and day. Another mill, as large as the first, is building here, new houses are rising round it, and every thing wears the face of industry and cheerfulness. A third is begun at Bakewell . . .".

In the second edition, February 1783, Bray records that "A third is built at Bakewell", so it appears that the Bakewell cotton mill was either the second or third of Arkwright's to be put into operation in Derbyshire. It was certainly the first to obtain power from a river as both Cromford mills depended on a relatively small stream.

In looking for a site for another water-powered mill, Arkwright could hardly have found one more suitable than that at Bakewell. Here was the River Wye, which could readily be harnessed, with a road on one side and a flat area on the other where a mill and a reservoir could be built; furthermore part of the former river course was available as a tailrace. Although the building of a mill and the construction of a reservoir, some five or six acres

in extent, on the outskirts of a country town must have aroused considerable interest, the only contemporary record so far found is that of a local historian, geologist and marble worker, White Watson, who stated in his *Observations on Bakewell: Beginning on the 31st of May 1774*:[1]

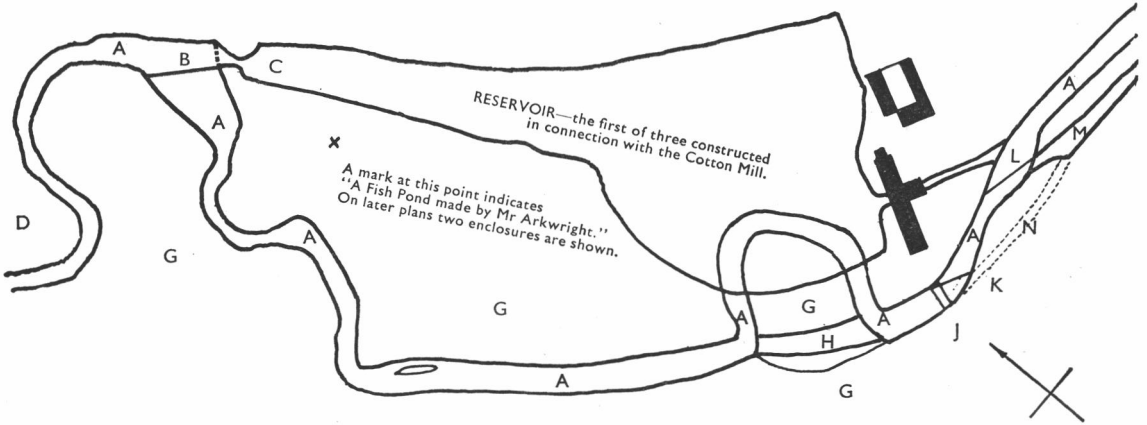
> "In 1777 the Cotton Mill was begun, when wages were raised immediately, and hands came from Manchester, introducing good-natured girls here, to whom the town was a stranger".

From investigations into the history of the mill extending over many years, it had been possible to form a general idea of its size and situation and of the manner in which the river was harnessed, but documentary evidence was lacking until the discovery of important Arkwright papers during 1959.

The record of the cotton mill begins on 6 November 1777 when Richard Arkwright obtained a lease from Philip Gell of Hopton of land at Great and Little Lumford and at Holme Bank in the parishes of Bakewell and Longstone. The actual lease is not available but subsequent documents show that it was to operate from 25 March 1778 for a period of fifty years and that the area of the property was about 53½ acres. Of this some 20 acres covered the mill area which extended from Holme Bridge, on the outskirts of Bakewell, to Crackendale, rather more than half-way to Ashford-in-the-Water. Since 1898 the site has been owned and occupied by a firm engaged in the manufacture of electric storage batteries. Their offices, occupying the Bakewell side of the main building, are in the position of the original mill.

The cotton mill was a long narrow building, 30 ft. wide and 186 ft. long, and water from a reservoir was conveyed under it to operate a water-wheel evidently on the Bakewell side. The mill and reservoir are shown on the accompanying plan (Fig. 7), which has been prepared from one contained in a lease of 1786 following the settlement of a dispute between the fourth Duke of Rutland and Richard Arkwright the younger over fishing and other rights. It is of particular interest as it shows the

[1] *D.A.J.*, XI (1889), 160.



A. Ancient course of the River Wye.
B. Weir erected by Arkwright.
C. The "New Cut" made by Arkwright.
D. Duke of Devonshire's land.
G. Lands of Philip Gell Esq.
H. "New Cut" made by Arkwright.
J. "A new bridge lately erected by Mr Arkwright."
K. "A Weir made by the Duke of Rutland's Tenant to the Corn Mill in the Year 1766 . . ."
L. "The ancient Weir for conducting the water to the Corn Mill immemorially used previous to the year 1766."
M. "The ancient Corn Mill Dam."
N. "The Corn Mill stream made in 1766 now filled up."

BAKEWELL OPEN FIELDS

PLAN OF 1786

FIG. 7. The site of Bakewell Mill, 1786.

ancient course of the river and the changes made in it at different times. Alterations were made to the river in order to obtain water-power for operating the new cotton mill. At the same time it was necessary to maintain an adequate supply of water to the corn mill at Bakewell, an ancient right of the Lord of the Manor, the Duke of Rutland. The course of the river was changed in three places and weirs constructed to divert the flow of water as required. Originally the river made a wide sweep to the north as shown in the top left-hand corner of the plan, the area inside the loop being known as Little Lumford and that between the river and mill as Great Lumford. It was towards the top of the loop that a cut was made and a weir built to divert water into a reservoir. Natural features favoured the construction of a reservoir at this point as Holme Bank, a wooded hill, formed the whole of one side, whilst only a relatively low embankment was required round the remainder, as the area of rather more than five acres to be enclosed fell only slightly towards the site of the mill. One difficulty, however, was that the river made another detour extending into the area required for the reservoir; to overcome this, the course of the river was straightened. The ground within the former bend is now mostly built over. When trenches were cut in 1959 for foundations for a new store, river gravel was found in two places indicating the previous course of the river.

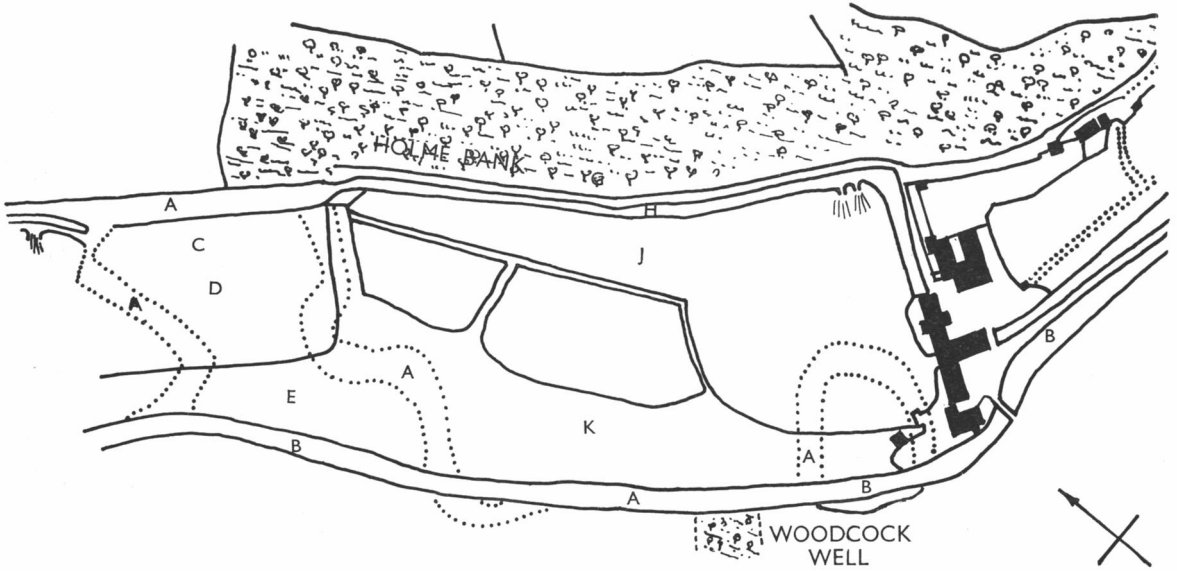
The bridge over the river was built by Arkwright, and as this was no doubt one of the first operations it may be dated 1778. From here the river continued through what is now the tailrace. Just before it there was a weir, which diverted water into the "Ancient Corn Mill Dam"; part of this dam is now the main course of the river adjacent to the trunk road. An earlier alteration was made in 1766 when the Duke of Rutland's tenant of Bakewell corn mill made a cut from near the position of the later bridge to a point 80 yds. downstream, in order to provide a straight channel for water entering the corn mill dam. This is now part of the main stream.

For nearly fifty years an undershot type of water-wheel or wheels provided motive power for the cotton mill, but

in 1827 a high breast-type wheel made by Hewes and Wren of Manchester was installed. This was of a new design, more efficient and of large size, measuring 25 ft. in diameter and 18 ft. wide. Round the circumference of the wheel was a series of buckets or troughs that were filled with water as the wheel rotated. Power was derived from the weight of water in the buckets turning the wheel, each bucket being capable of holding water weighing nearly half a ton. There were seventy buckets in all, and under normal working conditions the total weight of water in the buckets was about 10¾ tons. This heavy weight would have necessitated a very massive structure if the power had been transmitted through the spokes and axle as with the undershot type of wheel. To avoid this a series of teeth was arranged round the inner circumference or shroud of the wheel to engage a pinion situated at a point just below that at which water entered the buckets. In this way the weight of water in the buckets was applied more or less directly to the heavy pinion wheel, which in turn operated the shafting in the mill.

The 1827 water-wheel and a somewhat smaller one, installed in 1852, were in use until 1955 when a serious breakdown occurred necessitating their removal. The wheels were then replaced with a modern turbine. The smaller water-wheel (Plate III) was made by Kirkland and Son of Mansfield in 1852. It was 21 ft. in diameter and 7 ft. wide, and like the 1827 wheel it was of the high breast-type, water being conveyed to it through the trough shown in the illustration, which partially obscures the view of the larger wheel. To obtain maximum power from the high breast-type wheel, it was necessary for water to be delivered to it at about a 2 o'clock position. To do this a new reservoir had to be constructed capable of providing a supply of water at a higher level than had been required for the early undershot wheel.

The reservoir adjoined the original one and like it was constructed so that Holme Bank formed one side. To convey water from it to the new wheel a goit was made through the first reservoir by building a substantial embankment to form one side and using Holme Bank for the other, except for the final length where it turned



A. The ancient course of the River Wye.
B. New river course.
C. The plan is marked "Reeds" at this point.
D. "Duke of Devonshire's Reservoir."
E. "Little Lumford. Duke of Devonshire's Land."
G. "Border of Land north of the Guite – 5 yards wide."
H. "Cotton Mill new Gait."
J. "The Reservoir."
K. "Great Lumford."

PLAN OF 1836

FIG. 8. The site of Bakewell Mill, 1836.

at right angles to the hill. It would be necessary to keep the mill in operation whilst the new wheel was being installed and the reservoir and goit constructed, but with the site chosen no serious difficulty should have been experienced. Provision was made for maintaining a supply of water in the low-level reservoir from the goit by the two outlets shown from it in the top right-hand corner of the 1836 plan (Fig. 8). When the property was purchased by the present owners, there was a sluice, or the remains of one, in the position indicated; as some leakage was taking place, it was cemented over. The new reservoir was rectangular in shape at the lower end; it covered not only the site of the present one, but also a large portion of what is now a willow bed. Altogether three reservoirs were constructed for the cotton mill, and it would be the second of these which burst about 1880. In the willow bed is a small mound surmounted by a few fir trees that may be a remnant of the embankment which gave way, as it appears to be in the position of the corner of the second reservoir.

No plans or building records of the first cotton mill appear to have survived, but from photographs of the two sides of the mill taken after the fire of 1868 a plan has been made showing the approximate size and position of the buildings. Careful measurements have also been made from the small drawings on the deeds and the information thus obtained checked with known facts as they exist today. The view from the upstream side of the mill (Plate IV*a*) shows the large arch under which water passed to the wheel at the other side of the building. In the foreground are the remains of the first reservoir and possibly part of the embankment. Between the two tall narrow structures can be seen a portion of the 1827 wheel, whilst immediately to the right of the chimney, screening the lower part of the tree, there is a trace of the 1852 wheel. The building shown in the foreground was a long narrow one extending from a point 36 ft. to the left of the tall structure to the extreme right of the picture, the overall dimensions being 186 ft. long and 30 ft. wide. This was probably the original mill built in 1778.

In confirmation of this is the fact that the 1836 plan

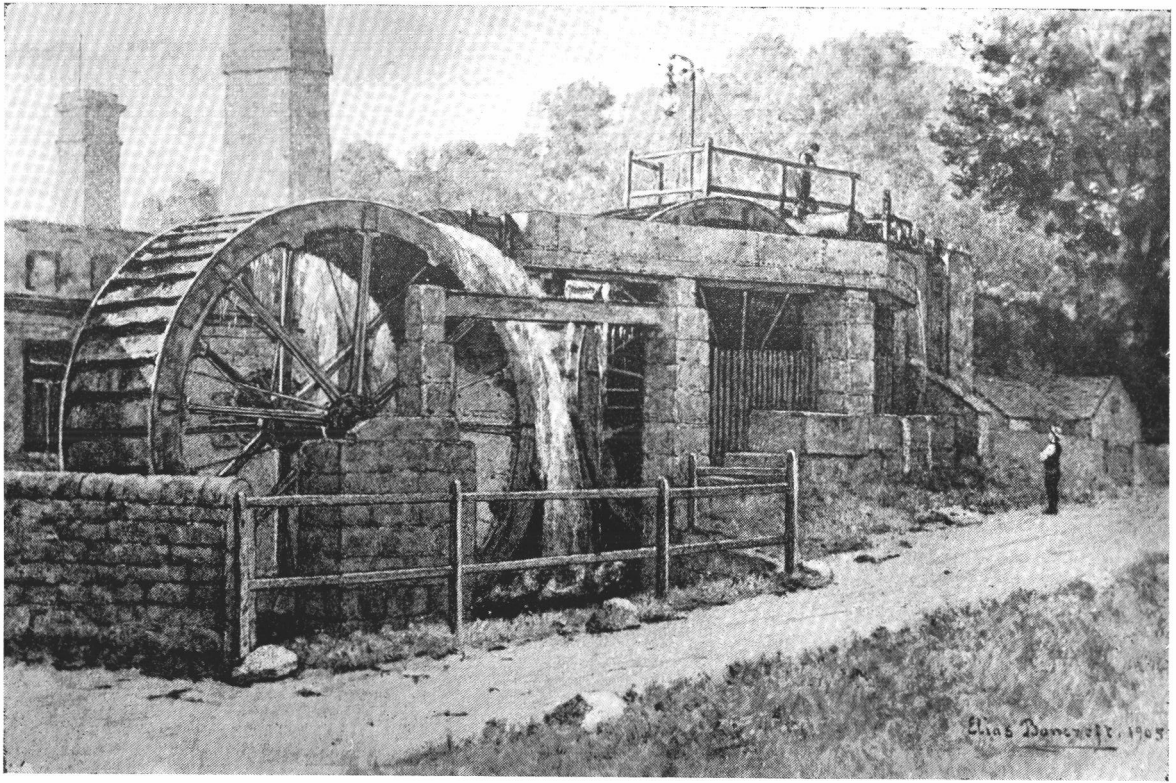


PLATE III. Bakewell Mill Water Wheels in 1905.

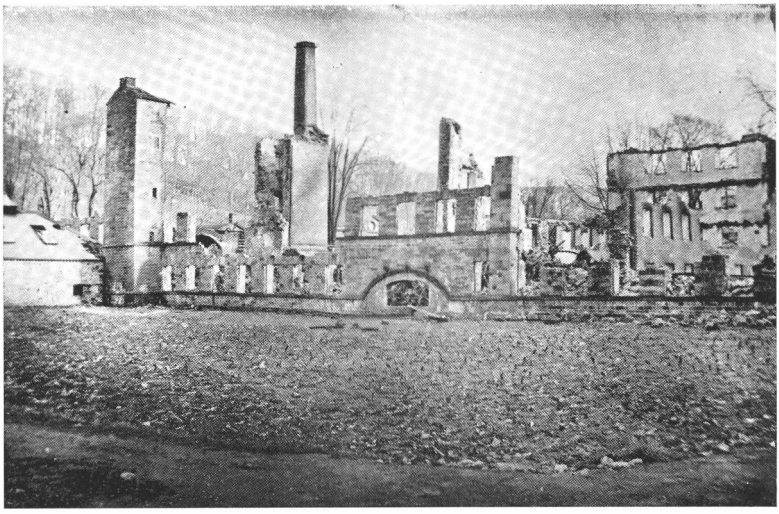


PLATE IVa. Bakewell Mill — view from upstream after the fire in 1868.

PLATE IVb. Bakewell Mill — view from downstream after the fire in 1868.

shows a building of the same dimensions occupying exactly the same position as on the plan of 1786. Also the two tall structures and the extension on the other side of the mill had been added to an existing building. There is little, if any, evidence of bonding where the buildings met and, if for any reason the original had to be rebuilt, it is unlikely that it would have been replaced with one of exactly the same size at a time when extra accommodation was required. The tall structure on the left probably contained stairs; its survival after the fire was no doubt due to its relatively small size making it self-supporting. The building on the right enclosed the lower part of the chimney.

Over the tailrace an extension, 60 ft. long by 36 ft. wide, was added at right angles to the original mill (Plate IV*b*). This was of simpler construction, without a string course and with plain rectangular lintels over the windows, instead of tapered stone blocks with a large keystone as used in the long portion of the mill. This design of head can be seen on the building adjacent to the river and road, which is now the oldest part of the premises, possibly built prior to 1799 and certainly existing in 1824. These remarks apply to the two-thirds of the building nearest to the bridge; some time after 1847, an addition was made, which apart from the colour of the slates matches the remainder of the building very well. After the fire, half of the present single-storey mill was built. This portion extended from just beyond the two water-wheels to the window adjacent to the projecting office block.

This account of work in connection with the cotton mill at Bakewell has to a large degree been made possible through the kindness of Mr. T. S. Wragg, Keeper of the Devonshire Collections, in allowing access to the Arkwright documents and for permission to publish plans of the site based on those in the deeds at Chatsworth. To Miss M. H. Mackenzie who calendared these papers, to Professor G. R. Potter for a copy of the calendar, to Mr. R. Hayhurst who prepared drawings for the illustrations and to others for their help, the writer expresses his thanks.