

new works was to make, which, moreover, were required in the mill in numbers greater than the heavier and bulkier machines comprising the earlier part of the process, the making of which was to remain at the original Hartford Works. (This allocation of the machines was, basically, to continue until 1947).

In Hartford New Works the disposition of the work areas, machine tools and the arrangement of the lineshafting system for driving them accorded with the best possible practice of the day – no doubt, Elijah Hibbert's experience as a millwright had come into play. Hoists (lifts), passageways and stairways were positioned in the most efficient locations and care had been taken in arranging the lighting of the buildings, as much skylighting as possible had been used. To administer, the Works was organised into departments, which, apart from the foundry, fell into two main categories, first those in which the various manufacturing operations (planing, shaping, milling, drilling, turning, polishing etc.) were performed on the host of parts which comprised the product machines and, second, those in which the fitters constructed the product machines. A foreman was placed in charge of each of the departments whose duty it was to superintend the workforce, at his disposal, and to ensure the work placed in his department was completed punctually and accurately. At the time of opening, the conception that was Hartford New Works led to it being acclaimed a showpiece engineering factory.

At this juncture, it might help if the simplest outline is given of the cotton spinning process, as it was, at the time the allocation of the product machines was made to the two works.

The first machines in the sequence opened and cleaned the cotton, taken from the bales in which it had arrived at the mill. The last machine, in this group (Scutcher), assembled the tufts of cotton, to which the hard pressed mass from the bales had been reduced, into a manageable rolled sheet (lap) for feeding to the next machine in the sequence which was the carding machine (Card).

The Card unrolled the sheet and fed the tufts onto the revolving cylinders, it contained, the surfaces of which were covered with wire points. Set close to the cylinder surfaces were other members of the machine, some of these also covered with wire points, others were equipped with knife-like edges. The combing and striking action thus caused on the tufts tore them apart allowing finer foreign impurities to fall out and, coincidentally, the fibres to be arranged to lie in a less tangled relationship. The machine assembled the fibres into a strand (siver) which it delivered into a cylindrical can.

Manufacture of the foregoing machines was to remain at the original Hartford Works, at Greenacres moor. Although the Card was

required in the mill in considerable numbers it included some heavy parts and, moreover, the cylinders, one of which was large, required foundry facilities alien to those which had been installed at the new works, at Werneth.

After the Card, the process was devoted to rendering the fibres in the strand more parallel, enhancing the regularity of the thickness of the strand and progressively reducing the thickness of the strand to that at which it was to be spun. These aims were achieved by passing the strand, which had issued from the previous operation, through a series of pairs of rollers, each pair revolving at a speed faster than that of the previous pair. (This was the essence of Arkwright's invention, though his patent was contested on the grounds that he only harnessed a concept seen earlier by others). The machines which performed this part of the sequence were those which had been allocated to the new works.

The first machine (Drawframe) concentrated on making the fibres in the strand much more parallel and the strand, itself, much more regular in thickness. Normally, it did not reduce the thickness of the strand since a grouping of the strands from the Card (usually six in number) was passed through the pairs of rollers, the speeds of which were set in a ratio to draw the (six) individual strands into a single strand of thickness equal to that of the individual strands (doubling and drafting). The improved strand was, again, delivered into a cylindrical can. The operation was repeated according to the degree the fibres were to be rendered parallel and the degree of regularity required in the thickness of the strand.

The next series of machines – the Speedframes – continued the processes of doubling and drafting but the ratio of the speeds of the pairs of rollers was set such that the issuing strand was reduced to a thickness less than that of the strands fed into the machines and nearer to the thickness the yarn was to be. The strand (Slubbing or Roving) produced on these machines was wound onto a bobbin, rotated on a spindle. The strand was fed to the first machine in the series (Slubber) from the cylindrical can produced at the Drawframe, subsequent machines, in the series, received the strand from the bobbin produced on the preceding machine.

The bobbin from the final machine in the preceding series (Rovingframe) was placed on the spinning machine (Mule). This machine, too, was equipped with rollers which, in fact, imparted the greatest amount of reduction in thickness to the strand to obtain the desired thickness (count) of the yarn. The yarn was formed as the strand received twist from the spindle onto which it was wound into a package (cop).

So perfect were the original inventions the process is little changed, in its essential elements, today.