V

ARKWRIGHT AND THE SPINNING-JENNY

1732–1792

ALL the great English inventors have sprung from families of small means, and have had to work for their living. Richard Arkwright, born at Preston, in Lancashire, December 23, 1732, was no exception to this rule. He was the youngest of thirteen children, and his parents were as poor as the proverbial church mice. He had no real education, only such as he could pick up by chance, but he made the most of such chances as came his way. He was apprenticed to a barber at Bolton, and later took up that business for himself. It was an occupation in which he would be apt to glean much gossip and many stray scraps of information, but little that would tend to broaden his mind. Perhaps he realized this for himself, and concluded that the hair-dressing line was not to be his destiny, for when he was in the neighborhood of twenty-eight years of age he retired from his barber-shop, and became a traveling dealer in hair and dyes. This would at least allow him to see something more of the world.

His prospects at this new trade were good. He had come upon a new method of dyeing hair and preparing it to be made into wigs. Wigs were the fashion, and Arkwright had an excellent process, and was an ener-

getic and resourceful dealer. He saw something of the country world of England, the men and women in it, what they wanted, and what they needed. Doubtless his inventive mind was already revolving improvements for them. The dealer in dyes and wigs was a shrewd and canny man. Carlyle had this to say concerning him and his progress: "Nevertheless, in stropping of razors, in shaving of dirty beards, and the contradictions and confusions attendant thereon, the man had notions in that rough head of his! Spindles, shuttles, wheels, and contrivances, plying ideally within the same; rather hopeless-looking, which, however, he did at last bring to bear. Not without difficulty."

There is always a strain of romance, or at least adventure, in the life of the itinerant pedlar, something of the free-footedness of the gypsy, and something of the acumen of those Eastern traders who traveled in caravans from the Orient. But doubtless we see the charm more clearly than the traveler himself. It may have been, and most likely was, a workaday job for Richard Arkwright. But consider the romance that underlay it! This country vendor of hair was to become one of the world's great inventors, and to kneel before his sovereign for the accolade that was to make him knight. Figaro of Seville, famed as he was, was none superior to the Lancashire barber.

He traveled much through South Lancashire and Cheshire, and there he came in daily contact with the cotton-spinners. A weaver of great ingenuity and tireless purpose, James Hargreaves, had invented what was known as a spinning-jenny, an arrangement by which

many spindles, fastened in a wooden frame, would work together by the turning of a fly-wheel. This machine could do the work of many spinners, and in a much shorter time. The rovings of cotton went under a bar-clasp that took the place of the spinner's finger and thumb. This bar-clasp could be moved backward and forward on a rod as the spinner's hand would do when stretching the thread and winding it on. It had a precision of action that resulted in a much greater regularity in the spun thread than by the earlier process. It was a very ingenious device, and Hargreaves deserved the greatest credit for the skill with which he solved the problem

But the spinners did not take kindly to this improvement. When they discovered that Hargreaves could do more spinning with less work with his machine, and could supply his own loom with all the woof that was needed instead of keeping three or four spinners employed, they grew highly indignant. They did not realize that the demand for cotton cloth was far greater than the supply, and that they could all be profitably employed operating the spinning-jenny. That panic which has so often come over people when they learn of a new device entering their field of action struck the cotton-spinners, and Hargreaves was regarded as a foe rather than a friend. Hargreaves was driven from Lancashire to Nottingham, and many of his larger jennies were broken by mobs. A few of the smaller machines were saved, but the people's mind was very evident.

Hargreaves' improvement on the old-fashioned

spinning-wheel dates from 1767, though he himself, it is said, had first used such a machine in 1764. Two men, Wyatt and Paul, of Birmingham, had earlier built a machine to spin stronger yarn than that usually used, but their machine had shown many defects, and they had abandoned its use. Arkwright knew of Hargreaves' jenny, but not of the other machine, and as he came upon none in use in his travels he cannot be held to have been under any obligations to this earlier device.

The manufacture of cotton goods was in a primitive state in England. Pure cotton fabrics could not be made, and the fustians that were produced had a warp of linen yarn in them, due to the fact that no way was known by which cotton yarn of sufficient strength could be spun. Arkwright soon learned these difficulties that arose from the absence of cotton warp and the deficiency of cotton weft, and his alert mind commenced to wonder whether he could not so improve on Hargreaves' jenny as to overcome these difficulties. He was not a skilled mechanic himself, and so, when he decided to take up the subject, he employed a clock-maker, named Kay, to help him. Realizing the hostility to any improvement on the part of the cotton-spinners, he gave out that he was engaged in building a machine to solve the world-old problem of perpetual motion.

Under this cloak he worked, and soon found that his new occupation was vastly more interesting than that of dealer in wigs had been. He was a shrewd man, and therefore, when he withdrew from that trade in 1767, it

is probable that he foresaw that he was on the track of something better. His idea was that cotton could be spun by rollers, and he said that this thought occurred to him as he happened to watch a red-hot iron bar lengthened out by passing between two rollers. But the iron would necessarily have to be drawn out in such a process, while the cotton wool could be indefinitely packed together. It would have to be taken hold of, and forcibly stretched as it passed through the pair of rollers, if it were to be drawn out, and not merely compressed. His solution of this problem was a machine that had two pairs of rollers, which were called drawing-rollers, the first pair of which revolved slowly in contact with each other, while the second pair revolved more rapidly in a similar way. One roller of each pair was covered with leather, and the other was fluted lengthwise. The two were pressed together by means of weights. In this manner the adhesion of the cotton wool was safely secured, and there was no chance of the rollers slipping around without drawing it in. The cotton passed through the two pairs of rollers, and its extension depended entirely on the difference in the velocity of the revolutions of the two pairs. When the proper fineness had been obtained in this way, the cotton, as it passed from the second pair of rollers, was twisted into a firm strong thread by spindles attached to the frame.

Arkwright realized that he must have assistance in order to put his machines on the market. He applied to a Mr. Atherton, and the latter, although he considered the venture a hazardous one, sent him two work-

Sir Richard Arkwright

men to help in building his first machine. When this was finished Arkwright went with it to Preston, and there set up his spinning-frame and began to use it in a room of the house that belonged to the Free Grammar School. His experiments convinced him of its success. Then he thought how he could best introduce his machine with least risk of rousing the popular fury. John Smalley, a liquor merchant and painter, had helped him build his machine, and after consultation, the two men decided to take the spinning-jenny to Nottingham, which lay in the heart of the frame-work stocking trade.

Arkwright's great opportunity lay in the fact that the manufacture of cotton hosiery had hitherto had to be carried on on a limited scale, owing to the difficulty of obtaining yarn that was sufficiently strong for the stocking-frames that were then used. At first he and John Smalley were associated with the Messrs. Wright, Nottingham bankers, but these bankers, figuring on the experience that had befallen the inventors of other spinning machines, soon withdrew their aid. But Arkwright was more fortunate in his next step. Samuel Need, a Nottingham manufacturer of stockings, and his partner, Jedediah Strutt, of Derby, who had himself invented a device for making ribbed stockings, became interested in his machine, tested it carefully, and with the experience they had already gained as practical manufacturers, decided in its favor. It was their approval that started Arkwright on the road to fortune.

Arkwright took out his first patent in 1769, the same year that Watt patented his steam-engine with a

separate condenser. A little later, with his partners Need and Strutt, he built a very complete factory at Cromford, on the Derwent River. He had already shown his power of originating and perfecting a working machine, now he showed an additional ability for organizing a great manufactory, and improving and adding new devices to his original model. This was the test of his strength, and perhaps the most wonderful part of his character. Many men have come upon new ideas, and many have sent them forth to improve the world's work, but only a few have developed them, day in and day out, until they stand forth as a finished achievement. That is the gauge, the test that has proved the inventor. Not Watt's first innovations on the stationary steam-engine, nor Stephenson's building of his original locomotive, nor Arkwright's discovery that rollers could be used to draw the cotton, but the years of trial and improvement Watt spent at Birmingham, and Stephenson in his shops at Killingworth, and Arkwright in his factory at Cromford, have made the three men famous in history. They were the years of patience and perseverance, which must come in the life of every great inventor to test his strength.

The country people about Cromford came to see Arkwright's machines, and wonder at them, and sometimes to buy a dozen pairs of stockings that had been made of Arkwright's yarn. But the big Manchester manufacturers refused to trade with him. The fine water-twist that was being spun on his spinning-frames was perfectly adapted to be used as warp, and would have supplied the demand for genuine cotton goods,

which otherwise had to be imported from India. But, though they needed his yarn, the manufacturers would not buy it from him, and he was forced to find some way of using his large output himself. First he used it to manufacture stockings, and then, in 1773, to make, for the first time in England, fabrics entirely of cotton. This was the turning point in England's trade in cotton goods. Heretofore she had not been able to meet the demands of her own people, now she was to commence a campaign that was ultimately to send her cloth to the farthest ends of the earth.

His powers of resistance were to be still further tested. An act was passed, based on the assumption that the English spinners could never compete with the fine Indian handiwork, that a duty of sixpence a yard should be levied on all calicoes, which were a variety of cotton goods originally imported from Calicut, in India. In addition, the sale of printed calicoes was forbidden. The customs officers immediately began to levy the duty on the products of Arkwright's mills, claiming that the goods were in reality calicoes, although they were made in England. It followed that merchants who had ordered goods from the Cromford Mill cancelled their orders, rather than pay the duty, and again Arkwright found his cottons piling up on his hands.

The act was too unfair to stand, and after a time was repealed. Cotton and all mixed fabrics were taxed threepence per yard, and the prohibition on printed cotton goods was withdrawn. The opposition of rival manufacturers could not in the nature of things long re-

tard what was to become one of the nation's main industries.

He took out his second patent in 1775, and it embraced almost the entire field of cloth manufacture. It contained innumerable devices that he had worked out during the years he had been experimenting at his factory. It covered "carding, drawing, and roving machines for use in preparing silk, cotton, flax, and wool for spinning." The man who had been a vendor of wigs had now revolutionized the whole spinning world. He had taught men and women to work at his machines, instead of in the old way of individual hand labor, he had organized a great business, and was showing the world that more could be accomplished by the division of labor and its control by one mind than could ever have resulted from individual initiative. In this way he was taking a most vital part in the progress of those new economic ideas that were dawning into consciousness toward the close of the eighteenth century.

It is so easy to see the successful result, so difficult to appreciate the trials that have been undergone. We look at the great picture and we admire the genius of the artist, but how rarely we realize the no less wonderful patience, the no less wonderful struggle that underlies what we see. The creator has not wrought easily, that is certain; and his greatness consists in what he has overcome.

Arkwright was ill with asthma during many of the years when he was fighting for his fortune, and time and again it seemed as if his strength must fail before

the task he had undertaken. But he was a great fighter, and so he won through. His workmen were offered bribes to leave his service, and teach his methods to rivals, his patents were infringed, right and left there was warfare, and he was fighting a score of enemies single-handed.

In 1781 he had to bring suit against Colonel Mordaunt, and eight other manufacturers, for infringing his patent. The influence of all the Lancashire cotton-spinners was aligned against his claims. They could not deny the fact that he had invented the spinning-jenny, but they said that the specifications of his patent were not sufficiently clear. The court upheld this contention, and declared the patent invalid. Arkwright withdrew the other suits he had started, and wrote and published his "Case," in order to set forth to the world the truth of his claims.

In 1785 he brought his case again into court, and this time Lord Loughborough ruled that his patent was valid. On account of this conflict of decisions the matter was referred to the Court of King's Bench. Here a Lancashire man named Highs, who had constructed a double jenny to work fifty-six spindles in 1770, was declared by Arkwright's opponents to be the real inventor. It was said that Arkwright had stolen this man's ideas. On such evidence Arkwright's claims were denied, and his patent overruled. This was the species of constant warfare with which he had to occupy himself.

Manchester had fought against the spinning-frame for years, but it was to receive the chief fruits of its

success. Arkwright built a mill there in 1780, and it prospered exceedingly, in spite of the fact that he no longer had the protection of his patents. He was such a good business man, such a splendid organizer, that he could overcome his enemies without that help, and in time he built up a fortune.

When he had started his first mill at Nottingham Arkwright had been obliged to use horse-power, and it was owing to the expense of such a system that he had soon moved to Cromford, where he could obtain water-power from the Derwent River. It was this that gave his yarn the name of water-twist. But in his Manchester Mill he made use of a hydraulic wheel, supplied with water by a single-stroke atmospheric steam-engine. Later Boulton and Watt's engines were installed, and with the most profitable results. As a result of these improvements the imports of cotton wool, which had averaged less than 5,000,000 pounds a year in the five years from 1771 to 1775, rose to an average of more than 25,000,000 pounds in the five years ending with 1790. England began to export cotton goods in 1781, which was sufficient evidence that the manufacture of such goods was proceeding more rapidly than the home demand for them. This was due largely to Arkwright's invention, to his building up of factories on new methods, and to the great help furnished to all machinery by the steam-engines of James Watt.

This is the romance of the dealer in wigs and dyes. He had won fame and fortune, and a powerful position in his country. In 1786 he was appointed High

Sheriff in Derbyshire, and the same year was knighted by George III. He died at Cromford in 1792.

His personality was strong, aggressive, dominating. Nothing could turn him from his course when he had made up his mind in regard to it. He was determined to make a fortune out of cotton-spinning, and he did, in spite of the loss of his patents, and the rivals who were always pursuing him. He stands high as inventor, and quite as high as one of the makers of modern commercial England.