

WEAVING.—No. II.

A BRIEF ACCOUNT OF ITS HISTORY.—(Concluded.)

In 1760 the "drop box" was invented by Robert Kay, a son of John Kaye, by means of which several shuttles, with different coloured weft, could be used in the fly loom, and this system is still in use both in hand and power looms.

By the invention of the fly shuttle, and the addition of the "tappet shaft" to the narrow goods, or Dutch loom, a great step had been made towards the application of motive power to weaving. The spinners could not supply yarn in sufficient quantity to keep the looms at work. In addition to this increased demand for yarn, the hosiery trade required further supplies, in consequence of the invention of the rib hosiery frame by Jedediah Strutt, and other modifications of the Lee stocking frame. This increased demand led to the grand series of inventions used in the spinning of cotton.

When it was found that the cotton spinners were able to supply all the requirements of the weavers, and there appeared to be a probability that the weavers would be unable to use the yarn as fast as it was spun, it became apparent that an advancement was requisite in the process of weaving.

This was first accomplished by Dr. Edmund Cartwright, of Hollander House, Kent, who obtained his first patent for a power loom in 1785. The circumstances which led him to apply himself to the invention of a new mode of weaving are best related by himself, in his well-known letter to Mr. Bannatyne, as follows:

"Happening to be at Matlock in the summer of 1784 I fell in company with some gentlemen of Manchester, when the conversation turned on Arkwright's spinning machinery. One of the company observed, that as soon as Arkwright's patent expired so many mills would be erected, and so much cotton spun, that hands never could be found to weave it. To this observation I replied that Arkwright must then set his wits to work to invent a weaving mill. This brought on a conversation on the subject, in which the Manchester gentlemen unanimously agreed that the thing was impracticable; and in defence of their opinion they adduced arguments which I certainly was incompetent to answer, or even to comprehend, being totally ignorant of the subject, having never at any time seen a person weave. I controverted, however, the impracticability of the thing by remarking that there had lately been exhibited in London an automaton figure which played at chess. 'Now you will not assert, gentlemen,' said I, 'that it is more difficult to construct a machine that shall weave, than one which shall make all the variety of moves which are required in that complicated game.'

"Some little time afterwards a particular circumstance recalling this conversation to my mind, it struck me that, as in plain weaving, according to the conception I then had of the business, there could only be three movements, which were to follow each other in succession, there would be little difficulty in producing and repeating them. Full of

these ideas I immediately employed a carpenter and smith to carry them into effect. As soon as the machine was finished, I got a weaver to put in the warp, which was of such materials as sail-cloth is usually made of. To my great delight a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to anything mechanical, either in theory or practice, nor had even seen a loom at work, or knew anything of its construction, you will readily suppose that my first loom was a most rude piece of machinery. The warp was placed perpendicularly, the reed fell with the weight of at least half a hundred-weight, and the springs which threw the shuttle were strong enough to throw a Congreve rocket. In short, it required the strength of two powerful men to work the machine at a slow rate, and only for a short time. Conceiving, in my great simplicity, that I had accomplished all that was required, I then secured what I thought a most valuable property by a patent—4th of April, 1785. This being done, I then condescended to see how other people wove; and you will guess my astonishment, when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw I made a loom, in its general principles nearly as they are now made. But it was not till the year 1787 that I completed my invention, when I took out my last weaving patent, August 1st in that year."

Dr. Cartwright took out four patents for weaving, namely, in 1785, 1787, 1788, and 1792. He established a mill at Doncaster in 1785, for weaving and spinning, but was compelled to abandon it in 1793, after expending 30,000*l.* in the enterprise. As a compensation for the great loss he had sustained in endeavouring to introduce the power loom, a grant of 10,000*l.* was allowed him in 1809 by the Government.

But although Cartwright was unsuccessful in his undertaking, the subject was of too great importance to be neglected. Other inventors took it up with more or less success, and every detail which had proved obstructive to the doctor were ultimately cleared away, and it has at the present time become one of the most perfect machines used for manufacturing purposes.

A very important step was made in 1804 in weaving cotton goods. Previous to that time the requisite dressing or sizing of the warp was performed in the loom, and it necessitated frequent stoppings and delay to the weaving. This was obviated by William Radcliffe, of Stockport, who invented a dressing machine, by means of which the warp was prepared in a far more satisfactory manner, before it was put in the loom, thus adding greatly to the productive power of the latter. The dressing machine has also undergone repeated improvements, and has now arrived at great perfection.

In 1770 a patent was obtained by Mr. Crawford, a London merchant, for a new mode of doubling, or winding two or more threads together, as customary in silk throwing. The operation required the stoppage of the machine on the breakage or exhaustion of any one of the threads. Doubling had formerly been done by means of the common hand wheel, and the winder or doubler had no difficulty in keeping the threads perfectly arranged as they passed between the finger and thumb. Mr. Crawford effected the same thing by passing each separate thread through the eye of a small wire lever, and when the thread broke, the lever, which had been supported by the thread, fell upon a larger lever, which was thereby thrown into such a position as to come into contact with the bobbin upon which the threads were wound, and to stop it until the broken thread was replaced. Since that time the principle of this contrivance has been of frequent use, particularly so in the weft stop motion of looms, and in warping machines, and in other similar cases.

Before the introduction of the Jacquard machine, which we have next to notice, the weaving of figured fabrics was accomplished by means of the draw loom, which was probably introduced into England at the same time that damasks were introduced, viz., in 1567, as before mentioned, this mode of weaving being also known as damask weaving, and consisted of a compound harness, the ingenious arrangement of which we shall hereafter describe. The draw loom takes its name from the circumstance that the necessary cords to form the pattern had to be "drawn" for the purpose of raising the warp threads for the passage of the shuttle. This operation was originally done by an assistant to the weaver, who was called the "draw boy."

It had long been felt desirous to dispense with the boy, not only on account of his presence being often required when he was absent, but because it was believed that mistakes, through drawing wrong cords, might sometimes be avoided. Consequently various descriptions of "draw boys" were devised, the action of which we intend to illustrate.

The draw loom was not only cumbersome, and entailed a vast amount of labour in the arrangement of the harness, but it was limited in extent. The time had arrived when some more efficient means of producing figured fabrics were necessary, and these means were supplied by the Jacquard machine.

Joseph Marie Jacquard was born at Lyons on the 7th of July, 1752. His parents were employed in some operations connected with weaving. At twelve he was put to a bookbinder, then to type-founding, and cutlery. At the death of his parents he had left to him a small property, which enabled him to commence figure weaving, but he was unsuccessful, and lost all. After he was married he occupied himself with schemes relating to cutlery, type-founding, and weaving. In 1792 he joined the Revolutionists, and on his return, in the following year, he and his son assisted in the defence of Lyons against the Army of Convention.

He first turned his attention to the machine which now bears his name in 1790. At first he did not succeed, but in 1801 he had completed it, and it was exhibited in the National Exposition, Paris, when he received the reward of a bronze medal for the invention. Although he had a patent for the machine, he made little by it, but Napoleon granted him a pension of 60*l.* (1500 francs), and the right to a premium of 2*l.* for each machine sold.

In the introduction of the machine he met with the greatest opposition. His machines were pulled down and destroyed, and the model publicly burned. A "Conseil des Prud'hommes" also opposed him. But, after some years had passed, the machine proved to be of the greatest value, and on the spot where the model was burned a statue to Jacquard now stands. He died August the 7th, 1834.

Dr. Ure, in his account of the introduction of the Jacquard machine, says, "He undertook to do by a simple mechanism, what had been attempted, in vain, by a very complicated one, and taking as his pattern a model machine of Vaucanson, he produced the famous Jacquard loom." It is thus admitted that Jacquard had a foundation for his invention, but it is not stated to what extent.

It is generally taken as granted that he invented the application of perforated cards, and this, the very life of the invention, is always associated with the name of Jacquard. Whether he was the inventor of any one of the parts forming the principle upon which the merits of the loom depend may be seen by referring to the "Report on the Paris Exhibition of 1855," Part II., page 150, "On Machinery and Woven Fabrics," by the Reverend R. Willis, who states that M. Marin, Professeur de la Theorie des Fabrications, at Lyons, exhibited a series of nine models, showing the development of the Jacquard loom. These models went to prove that M. Bonchon, in 1725, employed a *band of pierced paper* pressed by a hand bar against a row of horizontal wires, so as to push forward those which happened to lie opposite the blank spaces, and thus bring loops at the lower extremity of vertical wires in connexion with a comb-like rack below, &c.

In 1728 M. Falcon substituted a chain of cards, and a square prism (known as the cylinder) in lieu of the band of paper of Bouchon. In 1746, Vaucanson suppressed altogether the cumbrous tail cards of the draw loom, and made the loom completely self-acting, by placing the pierced paper or card upon the surface of a large pierced cylinder, which travelled backwards and forwards at each stroke, and revolving through a small angle by ratchet work. He also invented the rising and falling griffe, and thus brought the machine very nearly resembling the actual Jacquard.

Mr. Willis adds: "The merit of Jacquard is not, therefore, that of an inventor, but of an experienced workman, who, by combining together the best parts of the machines of his predecessors in the same line, succeeds for the first time in obtaining an arrangement sufficiently practical to be generally employed."

The Jacquard was probably introduced into England about the year 1810. Harding, in his History of Tiverton, speaks of its introduction there about 1812. Gilroy states, in his "Art of Weaving,"

that it was smuggled into England by Mr. Stephen Wilson, silk manufacturer, of London, but does not mention the date. Mr. James records, in his "History of the Worsteds Manufactures," that Mr. J. Ackroyd introduced the Jacquard into Halifax, in 1827, and bought it of Mr. Sago, Manchester. It was introduced into Horton, Bradford, in 1832, and Mr. Dracup commenced making such looms there in the following year. Mr. Thomas Ackroyd, of Horton, first applied the Jacquard to the power loom in the neighbourhood of Bradford.

Within the last thirty years the Jacquard apparatus has undergone numerous modifications, not only to make it more efficient, but to adapt it to particular descriptions of weaving. It has also been successfully applied to the lace frame, and to several purposes apart from weaving, such as musical instruments, to punching machines for punching wrought-iron plates used in the construction of girders, and to type-setting machines. To increase the speed of the apparatus, and to make it more adapted to the power loom, rising and falling motions have been given to the bottom board of the machine, as well as the griffe, and the double action principle for increasing speed is gradually working its way. A great improvement has also been made by working the card cylinder by a connexion which can be detached, which not only operates advantageously for the action of the griffe on the hooks, but enables the weaver to reverse the cards or "pull back" with ease and certainty. Even electricity has been applied for operating upon the needles, but this idea, although workable, can scarcely be considered in any other light than as a novelty.

Since the power loom became thoroughly established (although its establishment was not, unfortunately, attained without the greatest opposition from the weavers, and without giving rise to much trouble and distress), the improvements in it have been so great and varied, that we can at present merely indicate their nature. In the loom itself the take-up motion and weft stop motion have been much improved. Shedding motions, for the production of small patterns, have been very numerous, and many of them very ingenious. Circular and drop boxes have also received great attention, in order to adapt them to the increased speed of the loom, which is now at least twice as fast as in the early days of power loom weaving. These boxes are for the purpose of weaving checks, or goods which require different coloured, or different kinds of, weft.

Swivel, carpet, velvet, and other descriptions of looms have also received great improvements, and new kinds of looms have been introduced, such as shuttleless, pneumatic, and other descriptions, which have met with more or less success.

In like manner in the manufacture of machines for reed making and heald making, as well as in some other requisites for the loom, as in dressing and warping, a very considerable amount of ingenuity has been shown.

We intend, hereafter, to lay before our readers not only some examples of the most approved machines in use, but as far as possible to describe the purposes for which they are intended, and other matters of interest connected with weaving.