

## WEAVING.—No. XIV.

## JACQUARD APPARATUS—INTRODUCTION.

In the previous articles we have endeavoured to show the general principles of weaving as practised before the introduction of the Jacquard and other automatic machines. At that time the loom consisted of a complicated mass of cords, levers, and pulleys, which had to be compactly united or arranged together to produce the desired pattern or cloth to be woven. Every new design required a fresh arrangement, which often entailed a great amount of labour.

By dividing the peculiarities of the old system of weaving into distinct classes, as we have done, a better and more definite idea of the principles could be shown. Still, each of those classes were capable of many modifications. For instance, in the second class the changes shown were made by operating upon the divisions of the levers and headles, one set of levers operating upon the others, but this plan could be modified by one set of leashes operating upon another set of leashes, which latter set governed the warp.

In the third class modifications were made in combining two or more harnesses together, to work separately or collectively, &c.

But whatever advantage that might arise from these modifications, they have been more or less applied to the Jacquard loom, and will be more easily illustrated in connexion therewith than in the old system of weaving.

The Jacquard machine, since its introduction into England, has also undergone numerous modifications to adapt it to various descriptions of looms. Still all of them are based upon the same principle, viz., the use of perforated paper or cards or other equivalents.

In our second article we mentioned, on the authority given, that the inventor of the application of perforated plates to weaving purposes was a M. Bonchon, who so early as 1725 made use of "perforated paper pressed by a hand bar against a row of needles or horizontal wires, so as to push forward those that happened to be opposite the blank spaces, and thus bring loops at the lower extremity of vertical wires in connexion with a comb-like rack below. This being depressed by hand, pulled down the selected wires and with them the tail cords of the draw loom to which they were connected." (Report on the Paris Exhibition 1857, by Rev. R. Willis).

This process is the very life, as we have before stated, of the Jacquard apparatus, and it may be simply illustrated by Fig. 127, which represents the tail cords of the ordinary draw loom, as already described, and S the leashes connected to the tail cords. The simple cords are kept in tension by the lingoes or weights at the bottom of the leashes, which are shown at *s*; by this means they are kept in a vertical position. In a box or frame D are placed a number of horizontal wires or needles, each having an eye, made by turning a loop in the wire, in their centres. The ends of the wires protrude a short distance through the front, or needle board of the frame, and one of the simple cords is passed through the eye of each needle. Below the needles a knot or a bead is tied upon each of the cords, and opposite to these knots a comb bar is fixed to a frame G, which can be depressed by means of a treadle, as shown.

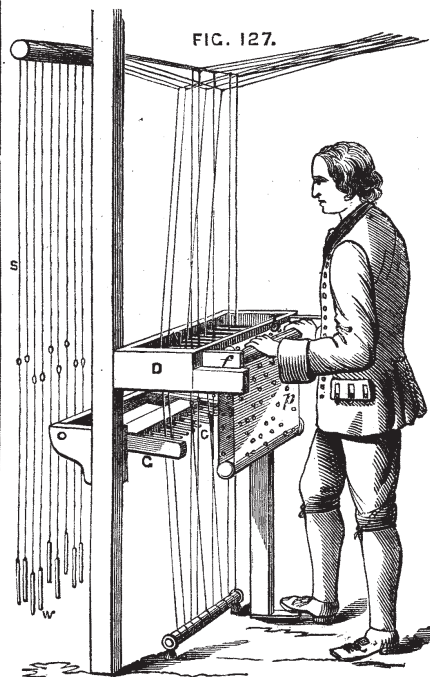
Now if a band of paper *p* be placed upon a roller *b*, and fixed into a frame *f*, and be pressed against the points of the needles that protrude through the front board of the box D, it will force back all the needles in the frame, and cause the knots or beads upon the simple cords to come into contact with the teeth of the comb. By depressing the comb all the cords will be drawn downwards, for the knots or beads are made too large to pass between the teeth of the comb, consequently all the warp threads will be raised. But by perforating the paper, and placing it upon a perforated cylinder, then wherever there is a hole in the paper opposite to a needle that needle remains stationary and is not affected, but if the paper has a blank space instead, then it will force back the needle and bring the knot on the simple cord into contact with the comb, by which it will be lowered, and the warp thread raised.

Thus any desired arrangement of design can be effected by corresponding perforations, and the extent of pattern is bounded only by the number of needles and the length of the band of paper. After the cords have been lowered they recover their normal position on the paper being removed, and

the cylinder being turned so as to present another series of perforations the operation is repeated, each row of holes representing one drawing of the cords.

Fig. 127 does not exactly correspond to the description given by Professor Willis, but the action is in every respect the same, and can make little difference in the machine excepting in rendering it in a more simple form.

The invention of Bonchon was brought to comparative perfection about the year 1745 by the celebrated mechanician Vaucanson. He at once dispensed with the tail cords and simple of the draw loom, and placed the perforated paper and cylinder on the top of the loom, in the place of the pulley box, and it is in this position that the Jacquard still remains.



Before entering further into the subject we will give an account of the introduction of the Jacquard machine into England, as given in evidence before a committee of the House of Lords on the silk trade in 1823, by Mr. W. Hale and Mr. Stephen Wilson, also an account of its invention given by Dr. Bowring (afterwards Sir John Bowring) before a committee of the House of Commons in 1831-32.

Before a Lords' Committee on the silk trade (vol. xiii., 1823) evidence was given by Mr. W. Hale a manufacturer of Spitalfields, to the effect that:

"In making a tour through Switzerland and Italy in 1816, with my family, I was the first individual who saw it (the Jacquard loom). I communicated it to other manufacturers, and Mr. Stephen Wilson, after a time, went over and saw the loom and has got a patent for it.

"Is that improvement which Mr. Wilson introduced into the country in general use?—No.

"Is it confined to his own manufactory?—I am not aware that it is in use in any other manufactory but his own, but not in Spitalfields. I am told they have improved upon it in Manchester or Macclesfield, but I am not aware that a single piece of goods has been made by it. Mr. Wilson, I think, has got two or three of the looms at Streatham, there may be more. It is a very great improvement, and I was very anxious to get it over, that the manufacturers generally, not myself, might take the advantage of it, and I did take measures to get another person to bring it over, not knowing that Mr. Wilson had succeeded, when I found he had got a patent for it."

Mr. Stephen Wilson before the same committee gave the following evidence:

"Here are a number of works that have been made with it; this shawl has 1200 cords. I never knew a loom of that number of cords in Spitalfields. Here is another shawl with 600 cords. The weaver does all himself. It is also adapted to damasks, which is one of the heaviest kinds of work. Generally they are drawn every four shoots, but this is drawn every shoot, which makes it more difficult

work. This pattern is three yards long, but it can be made of any length whatever.

"I have now a pattern on with 7000 leashes. If I am not too sanguine my idea of this machinery is that it is of as much consequence to the silk manufacture of this country as Arkwright's machine was to the cotton, and that it will supersede a great deal of the machines now in use."

From the evidence given before the committee of 1832-33 it was stated by David Smith, a weaver of Coventry, that the first Jacquard machine used there was in 1823, and Mr. S. Cox stated it to be in 1824.

Before the committee of 1831-32, Dr. Bowring, in the reply to the question "Do you know the history of the Jacquard machine?" gave the following interesting evidence:

"The introduction and history of the Jacquard mechanism is certainly one of the most interesting and one of the most instructive facts connected with the silk manufacture. I was extremely desirous, having seen the beauty of the machine and the simplicity of its operations, of some conversation with its inventor, and accompanied by a number of gentlemen, I went to visit Jacquard, and was very much gratified at hearing from him a history of its invention, which is now generally recognised as one of extreme importance and value.

"He told me he was originally a straw hat manufacturer; his attention had never been turned to mechanical topics till the Peace of Amiens opened the communication of France with England; at the same time an extract from an English newspaper fell into his hands, in which it was stated that a society here offered a premium to any man who should weave a net by machinery. He told me that his thoughts were thus turned upon this subject, which, by the way, if there had been any interruption to intercourse would never have taken place; he did produce a net, which he threw aside for some time, and afterwards gave it to a friend as a matter of indifference. The net by some means or other got into the hands of the authorities, and was sent to Paris. When some time had passed and Jacquard had completely forgotten his production, he was sent for by the prefect, who said, 'You have directed your attention to the weaving of nets by machinery.' He did not immediately recollect it, but the net was produced to him, and that called it to his mind. The prefect said, 'I require you to make the machine which led to this result.' He asked three weeks for its completion, and brought it to the prefect, and desired him to strike with his foot, by which a mesh was added to the net. It was sent to Paris and an order came for his arrest. It was in Buonaparte's time, when things were done in a rash and very arbitrary way. He found himself under the keeping of a gendarme, and was not allowed to go home to provide himself with the necessaries for his journey.

"He was required at Paris, in the Conservatory of Arts, to produce the machine in the presence of inspectors, which he did.

"He was introduced to Buonaparte and to Carnot, who said to him with a menace of incredulity, 'Are you the man who pretends to do that which God Almighty cannot do, to tie a knot in a stretched string?' He produced the machine and showed its operation. This was Jacquard's first mechanical experiment. He was afterwards called in to examine a loom on which 20 or 30 thousand francs had been expended for the production of articles for the use of Buonaparte.

"He offered to do that by a simple machine which they were attempting to do by a very complicated one, and improving upon a model by Vaucanson he produced the mechanism which bears his name. He returned to his native town, a pension of 1000 crowns having been granted to him; but so violent was the opposition made to the introduction of his machine that he had three times the greatest difficulty of escaping with his life.

"The Conseil des Prud'hommes, who are the conservators, *ex-officio*, of the interests of the Lyonnese trade, broke up his machine in the public place; the iron (to use his own expression) was sold for iron and the wood for wood, and he, its inventor, was delivered over to universal ignominy. It was only when the French were beginning to feel the effect of foreign competition that they were forced to employ this machine, which led to such great improvement in their manufacture, and, as everybody knows, it is now extensively employed through the whole of the manufacturing districts of France."

When this statement is compared with the

account given by Dr. Cartwright of the invention of the power loom (see Article II.) a marked difference appears. Dr. Cartwright's is a full and circumstantial account, and carries with it an unmistakable evidence of fact. But the account given by Jacquard dwells more upon the netting machine, and seems to avoid the real question at issue. He acknowledges the invention of Vaucanson, but after the subject has had fair consideration scarcely any other result can be arrived at than that given by Professor Willis, already quoted, viz., that Jacquard "must not rank as an inventor, but as a talented workman who has been able to carry out practically the inventions of others."