HAND-LOOM WEAVING; THE JACQUARD LOOM.

Fig. 128.

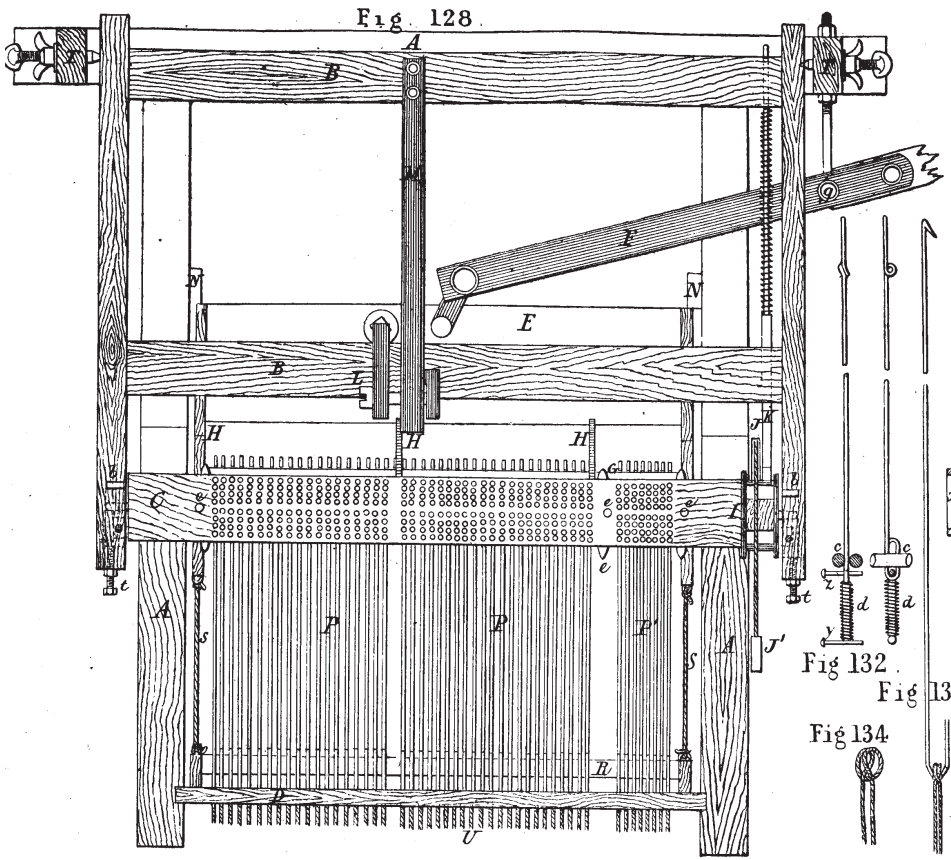

Fig 132.

Fig 133.

Fig 134.

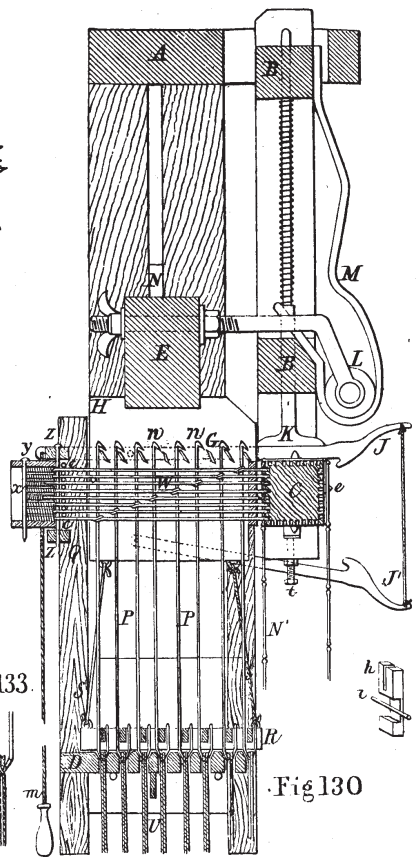

Fig 130.

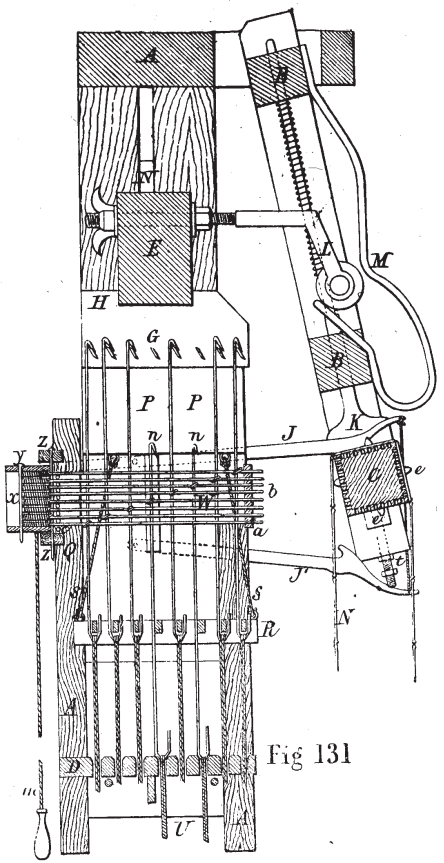

Fig 131.

WEAVING.—No. XV.

THE JACQUARD LOOM.

THERE is, perhaps, no machine more simple in its construction than the Jacquard machine, and when it is considered that it is almost unlimited in its extent and power—far beyond the compass of any other machine—it well deserves the high estimation in which it has, since its general introduction, been held. So simple, indeed, is it in its details that it will be the best course to describe the machine itself and its mode of application before any other class of automatic machine is explained. By doing so the principles of the most elaborate figured weaving may be readily shown, as well as the advantages and disadvantages of the machine in its operation, which have led to a great variety of modifications of more or less merit in order to adapt the Jacquard apparatus to the power loom. The various descriptions of shedding motions, or machines for weaving small figures, will, also, be rendered clear and their actions understood, and by the aid of simple diagrams the principles of different looms will be far more easily explained than by any other means.

The Jacquard machine is simply a frame containing a number of wire hooks, which are connected direct to the healds of the loom. These hooks are raised according to the pattern to be woven—the pattern being first transferred from the design paper to the cards which operate upon the hooks through the medium of needles. We have at present only to show how the hooks are arranged, and how they are operated upon by the cards. The effect they have upon the warp is either in a simple or direct manner, or by a combined action, similar to that already shown in the draw loom, illustrated by Figs. 112 to 115, page 337 *ante*, and which will be explained afterwards.

Jacquard machines are made of various sizes and descriptions. Some contain only a few hooks, but the usual number is 300, 400, 600, and 900. The machines with 300 needles and hooks are used on power looms for weaving figured stuff goods, and the higher numbers are used on hand looms for weaving figured silks. Sometimes two or more machines are employed on one loom, and may be worked in various ways. We purpose now to describe an ordinary 400-needle machine—such as is in common use in silk hand-loom weaving—and afterwards to show the various ways in which it is usually applied for the production of figured silks. Machines intended for hand-loom weaving are usually made of wood, but for power looms iron is used.

Fig. 128 represents a front elevation of what is known as a 400-needle Jacquard—although it may be observed that there are more than that number of needles in it. Figs. 130 and 131 represent transverse sections, showing the parts in different positions. The letters in each figure relate to the same parts. The frame consists of the two ends, and the top piece A A A. The perforated board D, on which the hooks P P rest, is the bottom board, and not only constitutes a substantial part of the frame, but forms the guide for the neck cords U, which pass through it from the hooks to the healds or leashes of the loom. The hooks are held in position by the needles W W, which have eyes in them for the hooks to pass through, as may be observed, also, in Fig. 132, which shows a needle in two positions, viz., in plan and in elevation. The needles have a loop at one end, which allows of the pin *z* being inserted. The loops being passed between the strong wires *c c*, are held firmly, but with sufficient play for longitudinal motion to press against the spiral springs *d d*. The opposite ends of the needles pro-

trude about ¼ in. through the needle-board *b*, Fig. 131. It is against this end of the needle that the cards N act; these cards turning upon the prism C, or cylinder, as it is technically called.

The hooks being passed through the needles—each hook having a separate one—it follows that when the points of the needles are pushed backwards the hook is also pushed. Where there is a perforation in the cards the needle is not pushed, but it passes through the card into the perforated cylinder, as may be seen in cylinder C, Fig. 130, where some needles have passed through the card, and the remainder have been pressed backwards against the springs.

Immediately above the hooks there is a sliding block, E, shown in section in Figs. 130 and 131, and in elevation in Fig. 128. In the latter figure a lever F is shown attached, with its fulcrum at *y*, suspended from a bolt secured to the cap A. From the block E, the plates H are suspended, and through these plates the bars G, made of strong hoop iron with feather edges, are passed. This portion of the machine is called the griffe, or griff, and its purpose is to raise the hooks. On referring to Fig 130 the two needles which have been pushed backwards by the card, as shown, have also pushed back the corresponding hooks *n n*, consequently these hooks have been pushed away from the griffe bars above, and upon raising the griffe these hooks will remain stationary, while all the others are raised, as shown in Fig. 131. If a blank card, therefore, be pressed against the whole 400 needles they would all be pushed back, and none of the hooks would come in contact with the griffe bars; on the other hand wherever a perforation was made opposite to a needle, then the corresponding hook would be raised. This is, really, all that is required from the machine, viz., to lift any of the hooks that may be required for each pick of the weft or passage of the shuttle.

By placing the needles in tiers, as well as in rows, great compactness is obtained, and it is certainly very remarkable that this excellent contrivance should have been invented so far back as 1728 (as before related), and have remained nearly a century without any practical result.

The details of the machine may now be described. The small spiral springs (made of thin brass wire), are enclosed in a "spring box," shown in section at *x*, Figs. 130 and 131. The perforations pass completely through the wood, and the spring is held in the hole by means of the pin *y*. By removing one of these pins any of the springs in the corresponding tier may be taken out and replaced. Of course there is a separate pin for each vertical row of needles.

Not only can any one spring be taken out in case of any defect arising to it, but the whole spring box can be removed, for it is completely independent of the needles, as may be seen in the figures. The needles themselves are secured separately, as already stated, by means of the pins *z* and the wires *c*, which are inserted into a frame Q, as shown, and it is in this frame that the spring box is fixed.

It is of importance that the needles be kept with the eyes in correct position, otherwise, on the raising of the hooks, they would be liable to rub against the side of the eye, and "jam," thereby causing them to be bent. This bending would cause the hook to be thrown out of its perpendicular, and the result would be that on the lowering the griffe the bars would probably drop upon the top of the hook, and considerable damage would be rapidly done, if not immediately detected. Sometimes the needles wear out and break, consequently an easy method of replacing them is required. The weaver, notwithstanding the complicated mass, can readily replace them by withdrawing the pin *z*. To keep the hooks in position a wooden grate R R is made to fit into the lower bend of the hook, as shown, and this grate ascends with the hooks—for it is suspended from the griffe by the cords S S at each corner of the grate. Those hooks, which are not raised, remain in position on the bottom board, from the circumstance that the upper part of the holes upon which the hooks rest are hollowed out for the hooks to fit according to their proper position.

The "neck" cords attached to the hooks are not fastened on by a knot, but the cord is made into a double hitch, as shown in Fig. 134. If this were not so, the constant and rapid fall of the griffe and hooks would very quickly cut the knotty projections through.

This kind of fastening has also the advantage of being easily made, and in case one of the two cords were to break the other would still remain secure upon the hook.

The griffe has not only to raise the hooks as already explained, but it has attached to it a pulley L, which is made to slide in a curved or S bar, which is fixed to the frame or batten, in which the card cylinder turns. When the griffe is raised the pulley also ascends, and as it comes into contact with the concave part of the S iron it causes the cylinder to be thrown out from the machine or from the needles. During this motion the lantern upon the end of the cylinder, as will be hereafter described, coming into contact with the hook J, causes it to turn. There have been various other contrivances used instead of the S iron for the same purpose, such as knee-joint motions, which will be referred to hereafter, but for hand-loom purposes the simple S bar answers every purpose.