

LOOM

Loom [M. Eng. *lome* < O. Eng. *gelōma*, tool, implement, instrument]: a machine for weaving textile fabrics. The two sets of threads or fibers of which a fabric may be composed are known as warp and filling; the set running throughout the length is the warp, and those threads extending from side to side, and interlacing with it, the filling, or weft. The interlacing of these two sets of threads is called WEAVING (*q. v.*). This art is so ancient that its beginning can not be traced.

To Dr. Edmund Cartwright, of Manchester, England, belongs the merit and honor of originating and producing the first practical power-loom, from which the present looms have developed. This invention, the patents for which were issued Apr. 4, 1785, and Nov. 13, 1788, has proved one of the greatest in textile manufacture. Cartwright recognized that there were "three movements which were to follow each other in succession," and he arranged his power-loom to produce these movements in proper order and time.

Three Movements.—The first separates the threads of the warp longitudinally into two sets, leaving a space through which to pass the weft; the second passes this filling through that space; the third presses the thread of filling up against the one preceding it.

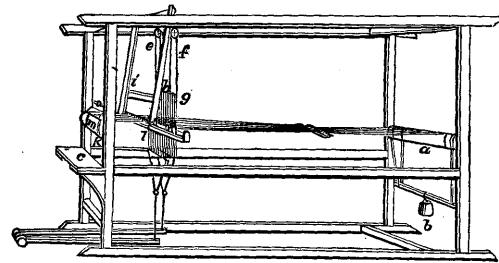


FIG. 1.—Hand-loom.

Plain Loom.—The plain loom is built for producing the simplest fabrics, and is capable of but two movements for the warp-threads; it may be for weaving with but one color

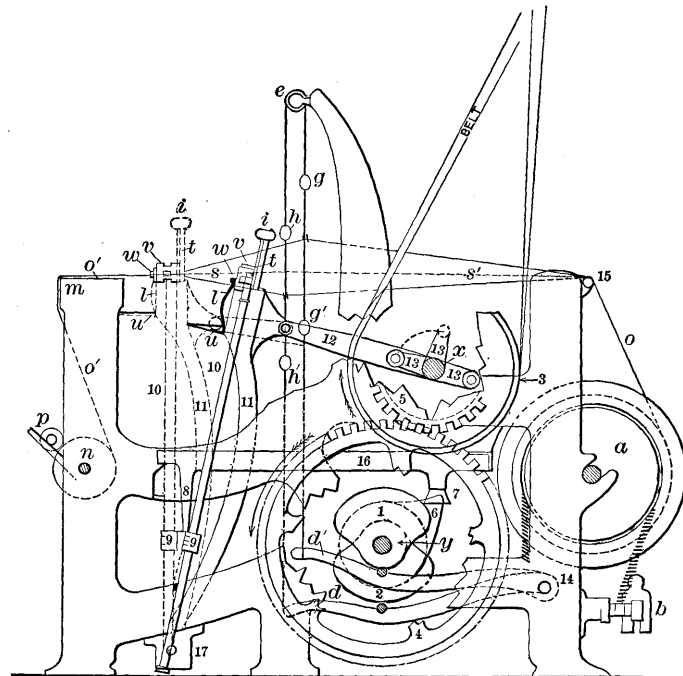


FIG. 2.—End view of a modern plain power-loom.

of filling, or for as many as six colors. Fig. 1 gives a representation of a hand-loom for plain weaving. Fig. 2 is the

end view of a modern plain power-loom. A comparison of the two designs will show similarity in the essential movements.

Construction and Operation.—The plain power-loom is usually built with two parallel horizontal shafts extending across the loom-frame from end to end, one above, *x*, and a little back of the other, *y*. The upper shaft is in most cases the driving-shaft, and has a pulley, 3, at one end. This shaft is geared, 4-5, to the lower shaft in such a manner that two revolutions of the former must be made to one of the latter. The threads of the warp *o* are arranged, wound upon the warp-beam *a*, and passed through the eyes of the harness *h h' g g'*, also through the reed *l*, before coming to the loom. Each harness, after the warp has been placed in the loom, is fastened to certain straps which pass over an elevated roller, *e*; also connected with one of two levers below, *d d'*; these levers are each in contact with revolving cams, 1, 2, so placed on the lower shaft that, as the shaft revolves, one cam depresses the lever in contact with it, and the lever in contact with the other is allowed to rise. These cams, as aforesaid, being connected directly with the loom-harness, and indirectly with each other by the straps passing over the top roller *e*, cause the harness which they control to work simultaneously and in the same direction with them. The threads of the warp, being some on one harness and some on the other, usually alternating, are separated as the harnesses are brought into different relative positions, and a space formed between the two sets of warp-threads; this space, *s*, is called the shed, and is produced by the first of the three recognized movements. Through this shed the shuttle containing the weft is passed, leaving a strand of the weft in its path, and the second movement is complete. In most power-looms the shuttle is thrown across the loom, through the shed, on the shuttle-race, from a shuttle-box at one end to one at the opposite end by a lever, 10, hinged at or near the floor, 17, and called a picker-stick. This picker-stick is usually propelled by the quick stroke of a cam, 6, on the lower shaft against the arm, 7, of a short rocker-shaft, 16, placed at right angles to the cam-shaft and in a horizontal plane several inches above it; a second arm, 8, on this rocker-shaft is connected by a short rod and strap, 9, to the picker-stick. The action of the cam on the rocker-shaft throws the picker-stick toward the fabric, and at the same time the shuttle through the shed previously formed.

The third movement, the beating up of the filling-thread, is accomplished by the quick stroke of the lathe, *l*—that part of the loom which holds the reed—which is connected with a crank, 13, on the driving or the upper of the two shafts; as the shaft revolves the lathe receives a reciprocating motion, and, being connected with and movable on a rocker-arm, 17, at the lower part of the loom-frame, swings in a small arc, the chord of which would be twice the length of the crank before mentioned. As the lathe is propelled forward the filling-thread is beaten up against that part of the fabric already produced.

The continued repetition of these three movements is the process of weaving complete.

Hand-loom.—The hand-loom (Fig. 1) in principle is the same as the power-loom, but the harnesses are controlled by the action of the weaver's feet on the treadles; the shuttle is propelled by the hand, and the stroke of the lathe or batten, usually hung from an elevated stand, is also made by hand. Great skill is required with such a machine to produce fine textures, yet some of the most delicate fabrics are manufactured by hand-loom weavers.

Fancy Loom.—Looms which may have more harness capacity than a cam-loom would allow of, used for weaving fancy patterns, are called fancy looms. The cam-loom may be used with a limited number of harnesses—from two to five, and occasionally with more. The fancy loom has often as many as thirty-six harnesses, the twenty to twenty-four harness looms being most in use aside from the plain looms. The looms have a "head-motion," so called, or a "head," which is composed of a revolving shaft over which passes a pattern-chain, so built that each bar of the chain will control the harness for one entrance of the filling; also certain lifting or vibrating bars which raise or lower the harness, the harness being connected to certain pieces of the mechanism which are brought into contact with one or the other of the bars by rolls on the pattern-chain. These rolls may be so placed on the bar of chain that any of the individual harnesses may be raised; wherever no roll is placed on the chain the harness will lower. Thus the chains may be built to raise or lower any of the harnesses and in any order.

Box-motion.—The shuttle-boxes of the power-loom are placed at each end of the lathe, and may be one box at each end, one box at one end with from two to six at the opposite, or with from two to four boxes at each end. For one color of filling one box at each end is used; with several colors, each is placed in a different box, which may be called when needed by the action of rolls placed on a chain similar to the pattern-chain, on certain fingers which in turn engage the mechanism for raising or lowering the boxes.

Jacquard Machine.—This machine is used for such designs as are so extensive that a sufficient number of harnesses could not be placed in the loom to produce the patterns. It is simply a "head," which controls the shed, and may be applied to almost any make of loom. The machine consists of a set of knives, *a, a'* (Fig. 3), called a "griffe,"

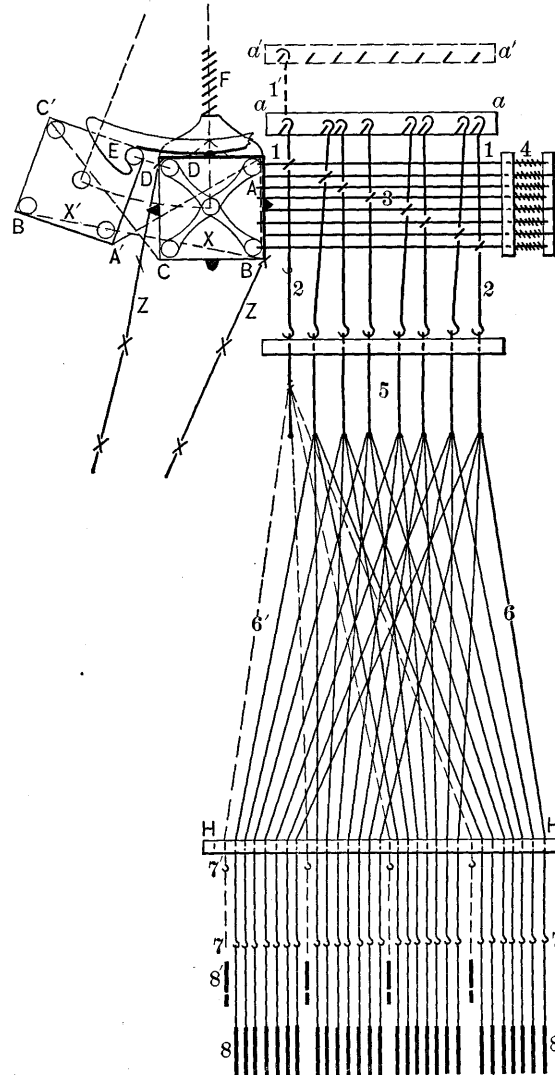


FIG. 3.—Jacquard machine.

capable of being raised and lowered; a set of perpendicular hooks, 1-2, in connection with and governed by a set of horizontal needles, 3, these hooks having attached to them the leash-strings 6, 6', mail 7, 7', and lingo 8, 8'—the mail being the eye through which the warp-thread is passed, the lingo the weight which draws down the leash. The pattern is controlled by a set of pattern-cards, *Z, Z*, fastened together, which pass over an intermittently revolving, perforated cylinder, *X, X*. This cylinder swings in a small arc, and presses against the needles, 3. Whenever a hook is to be raised a hole cut in the pattern-card allows the needle to enter the perforation in the cylinder, also the hook 1 to be engaged by the knives as they lift. The card, when no hole is cut, will press against the needle, throwing the hook which it

governs back until the knives lift. The raising of a hook raises also all the leash-strings connected with it, which may be from one to half a dozen. A machine may have from 100 to 1,200 hooks, and each hook may be worked independently of the others.

This machine was originated by Joseph Marie Jacquard, a native of Lyons, France, born in July, 1752. He first came into prominence by perfecting a machine for making fish-nets, for which he received 3,000 francs and a gold medal offered by the Society of Arts, London, and with this came an engagement in the Conservatoire des Arts, Paris. Here he had opportunity to study the inventions for weaving-machinery already made. Bouchon in 1725, Falcon in 1728, and Vaucanson in 1745 had each improved on the looms then in use, but none of their inventions, while in some respects similar to what Jacquard produced, proved practical. "He was an experienced workman, combining the best parts of the machines of his predecessors in the same line, and succeeded as the first person to obtain an arrangement sufficiently practical to be employed." There was great opposition to the introduction of his machine as a labor-saving device, and many of them were broken up. The model from which the others were made was destroyed in the square where his statue has since been erected. It is said that 30,000 Jacquard machines were in operation in his native city at the time of his death, 1834.

Draw-loom.—This was the nearest approach to the Jacquard up to the nineteenth century, but required two persons to attend it. The pattern was governed by a boy, who raised the warp-threads by "drawing" certain strings attached to the various groups of leash-cords. William Cheape patented a mechanical "draw-boy" in 1779, but the loom was superseded by Jacquard's invention.

Loom-harness.—This is usually a skeleton frame, on which are placed wire heddles with eyes at the center for the warp-threads. Cotton-harness, used mostly on the plain or cam looms, consist of two parallel rods on which is a series of cotton heddles. The frame or rods, with the attached heddles, constitute a harness.

Loom-reed.—The reeds are two parallel strips, into which are inserted at right angles thin strips of flattened wire; these are spaced equally, and the reed is numbered according to the number of spaces per inch. The reed not only beats up the filling, but keeps the warp-threads of the various textures at the required number to the inch.

See Ashenhurst, *Weaving and Designing for Textile Fabrics*; Alexander Brown, *Practical Treatise of the Construction of the Power-loom*; Porselt's *Jacquard Machine Analyzed and Explained*; also Patent Office reports.

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