

UNITED STATES PATENT OFFICE.

GEORGE JOHNSTONE, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN KNITTING-MACHINE.

Specification forming part of Letters Patent No. **107,381**, dated September 13, 1870.

I, GEORGE JOHNSTONE, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain Improvements in Knitting-Machines, of which the following is a specification:

Nature and Object of my Invention.

My invention relates to certain improvements in knitting-machines in which the operations of the needles and threads are regulated by jacquard apparatus; and my invention consists of certain devices, fully described hereafter, for facilitating the operations of the different parts of the machine.

Description of the Accompanying Drawing.

Figure 1 is a perspective view of a Lamb knitting-machine with my improvement; Fig. 2, a view of one of the sets of cams for operating the needles; Fig. 3, a view illustrating the manner in which the needles are raised by the jacquard apparatus to bring them under the control of the cams; Fig. 4, a detached sectional view, also illustrating the operation of the jacquard; Fig. 5, a transverse section of the upper portion of the machine, showing the manner of feeding the yarn; Fig. 6, a detached view of a device for drawing down and preventing the puckering of the work at the needles; and Fig. 7, a view of a modified form of needle.

General Description.

A represents the stationary frame of the machine, which consists mainly of end pieces *a a* and of inclined side pieces or needle-beds *b* and *b'*, which approach each other toward the top, but are situated at a sufficient distance apart to permit the fabric, as it is knitted, to pass downward between them.

The single-ended latch-needles *c*, with which the machine is provided, are arranged to slide in rows of parallel grooves formed in the needle-beds, as best observed in Fig. 1, and the lower end of each needle is bent outward at right angles to the shank, so as to form a projection, *c'*, which may be operated in such a manner as to raise and lower the needles by the cams of a sliding carriage, B, which is arranged to reciprocate upon the upper portion of the frame. The construction and operation

of these cams (shown in Figs. 2 and 3) will be fully described hereafter.

A jacquard apparatus may be adapted to the above-described machine, for the purpose of rendering it entirely automatic as regards the operation of the needles and the feeding of different-colored yarns to the same, and the devices employed are, in the present instance, as follows:

The spindle of a square axis, F, arranged beneath the needle-bed *b*, is hung to vibrating arms *d d*, which have their fulcrums at points *e* on the opposite end pieces *a a* of the stationary frame. The arms *d* are vibrated in such a manner as to raise and lower the axis by the power which drives the machine, and the said axis is turned, in any suitable manner, to the extent of a quarter of a revolution each time the arms are depressed.

The axis is precisely similar to those used in the jacquards of looms, it being perforated with a number of holes, and having studs *g* at the opposite ends of each of its faces for passing into corresponding openings of the pattern-cards H, which are arranged in an endless chain, as usual, and are carried around by the axis as the latter is rotated.

The bent ends of the needles *c* rest upon rods *i*, equal in number to the needles, which are arranged to slide upon the bed *b*, their lower ends extending below the under edge of the latter, as shown in Figs. 1 and 4.

The pattern-cards H are arranged to act directly upon and lift these sliding rods when the axis F is raised, the said cards being perfectly plain, so that they may lift the rods uniformly, or having projections *j*, so that a portion of the rods may be raised to a greater extent than the others, or being punctured to correspond with the openings in the axis, so that other of the rods may remain undisturbed; but, as this depends entirely upon the pattern which it is desired to form, the cards are varied as required.

As the needles rest upon the upper ends of the sliding rods *i*, the upward motion of the latter must necessarily be imparted to them, so that, when these rods are lifted, all or a portion of the needles will be raised to a point where they may be operated upon by the cams of the reciprocating carriage B.

Although I prefer to use these sliding rods *i*, it is not absolutely necessary that they should be employed, as the needles might be lengthened out, as shown in Fig. 7, so as to be controlled directly by the cards.

The cams are of the peculiar character shown in Fig. 2. Each set consists of inclined surfaces *k* and *k*¹, of a V-shaped or double inclined surface, *k*², of two inclined arms, *l* and *m*, adjacent to the inclined surface *k*, and of similar inclined cams *l*¹ and *m*¹, adjacent to the surface *k*¹.

The cams *m* and *m*¹ are set lower than the cams *l* and *l*¹, and the lower end of each is beveled upward toward the said cams *l* and *l*¹.

The operation of these cams upon the needles, which are raised by the cards through the medium of the rods *i*, is illustrated in Fig. 3. In this case the set of needles marked 1 remain undisturbed, and are not brought into action, as their rods *i* enter the punctures in the card. The set marked 2, however, are raised by the plain portion of the card to such a height that when the cams are moved forward in the direction of the arrow the bent ends of the said needles shall enter the space between the cams *m* and *l*, and be elevated by the same to the position indicated by dotted lines, or to such a height above the line *xx*, which represents the upper edge of the needle-bed, that the yarn shall turn back the latches and be retained upon the same, so that as the carriage continues to move forward and the needles are drawn downward on the under side of the cam *m*¹, the said yarn shall also be drawn downward by the hooks of the needles in order to form the desired loops.

The set of needles marked 3 are elevated to a still greater height by the projection *j* on the card, so that they may enter the space above the cam *l* and be elevated by the same to the position indicated by dotted lines, which permits the stitch to slip over or beneath the latches, so that when these needles are drawn downward by the cam *m*¹ the said stitches shall raise the latches and pass over the same without being caught by the hooked ends of the needles. In this way the character of the web is determined, and when the motion of the carriage is reversed the cams *m*¹ and *l*¹ operate the needles raised by the next card in a corresponding manner, and this is repeated and continued until the pattern determined by the card is completed.

The object in beveling the lower ends of the cams *m* and *m*¹ is to prevent these cams from accidentally raising the needles which are not to be brought into play.

The needles at the opposite side of the machine on the bed *b*¹ are controlled by a jacquard in precisely the same manner as those of the bed *b*.

The yarn is fed to the needles, in an ordinary Lamb machine, by a single slide hung to a stationary frame and operated by the reciprocating carriage, so that when yarns of dif-

ferent colors have to be used, the thread must be broken off and retied whenever a change of color is required.

I use the same method of feeding in the present instance, but employ as many slides as there are colors required, and attach these slides to a vibrating bar so controlled by the jacquard that any one of them can be instantly brought into play and its yarn fed to the needles without requiring any breaking off and tying or other tedious manipulation of the threads.

The vibrating bar *K*, to which the slides *p* are attached, is hung to arms *q q* of the stationary frame, and is arranged to be turned in one direction by a system of levers, *r*, controlled by the cards of the jacquard at one side of the machine, and in the opposite direction by a similar arrangement of levers, *r*¹, controlled by the cards of the jacquard at the opposite side of the machine.

The slides *p*, of which there may be any desired number, have pendent arms *p*¹, which are turned in the arc of a circle on the vibration of the bar *K* by the jacquards, so that any one of the said arms may be brought into the path of a pusher-rod, *t*, of the reciprocating carriage, and operated by the same, and by a counter-rod, *t*¹, until the bar is again vibrated by the jacquards, in order to feed a different-colored yarn to the needles.

In order to draw down the work from the needles and prevent the puckering of the same, I employ a number of weighted sliding rods, *v v*, Fig. 6, hooked at their upper ends, so as to catch into the fabric. These rods are merely reciprocated by a bar, *S*, having a double-inclined lug, *w*, and which is struck, at its opposite ends, alternately by arms *y y* of the carriage *B*, and thus caused to reciprocate with the latter.

The application of the above improvements to a Lamb knitting-machine renders the bringing of the needles into play and their subsequent operation entirely automatic, so that the machine, either enlarged or not, can be driven by power with much greater speed and accuracy than by hand, and as the pattern, as well as the color of the yarn employed, is determined by the cards, the character of the work, whether tubular or flat, can be varied to an almost unlimited extent.

Claims.

1. The pattern-card consisting of a perforated plate, to which are secured projections *j*, as set forth.
2. The combination of the reciprocating pattern-cards, or their equivalents, having two or more rests, which elevate the needles to different degrees, and sliding cams having two or more inclined needle-operating edges, to which the needles are directed by the action of the pattern-cards, as specified.
3. The vibrating bar *K*, operated by the jacquards through mechanism substantially as

described, and carrying two or more thread-guides, which, by the movement of the bar K, are brought separately into a position to be moved longitudinally by a sliding bar, *t*, or other device operating with like effect.

4. A series of weighted hooks, *v*, operated independently of each other by a reciprocating bar, S, or its equivalent, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE JOHNSTONE.

Witnesses:

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