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I. W. Lamb.

Straight Knitting Mach.

No. 50,369. Patented Oct. 10, 1865.

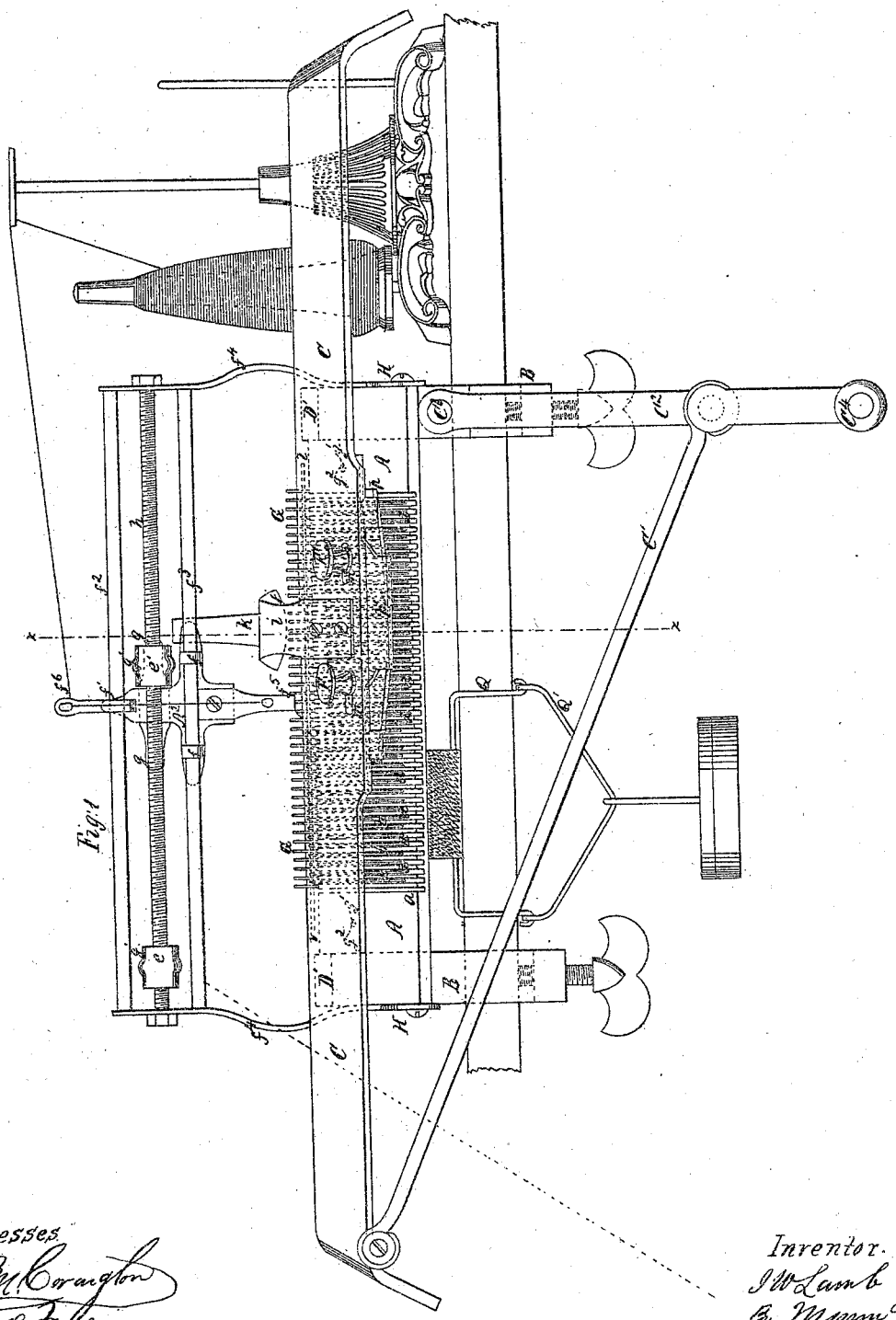

Fig. 1

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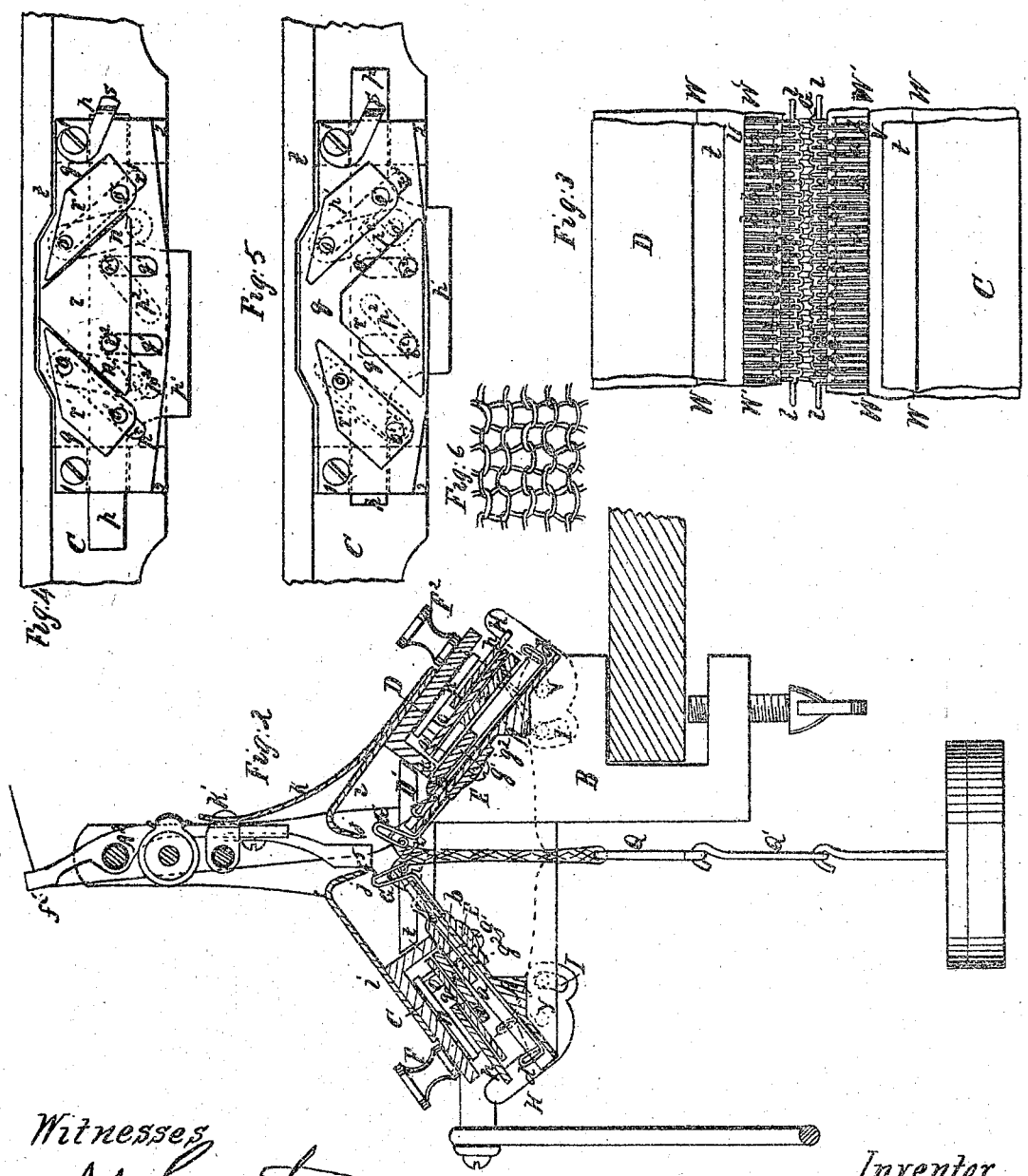

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UNITED STATES PATENT OFFICE.

ISAAC W. LAMB, OF ROCHESTER, NEW YORK.

IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. **50,369**, dated October 10, 1865.

To all whom it may concern:

Be it known that I, ISAAC W. LAMB, of Rochester, Monroe county, State of New York, have invented a new and useful Improvement in Knitting-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings forming part of this specification, in which—

Figure 1 is a front elevation of a knitting-machine made according to my invention. Fig. 2 is an elevation of a cross-section taken on the line *x* of Fig. 1. Fig. 3 is a plan view of a portion of the sliding carriage and needle-plates. Fig. 4 is an under-side view of that portion of one side of the sliding carriage which carries the cams for operating the needles, the cams being seen here in the positions they take when drawn up out of the way of the butts of those needles which are in use. Fig. 5 is a view of the same parts as seen in Fig. 4, the cams having been brought down so as to engage the butts of the needles in use. Fig. 6 shows a piece of knitted fabric.

Similar letters of reference indicate like parts.

This invention relates more particularly to that class of knitting-machines represented in the Letters Patent granted to me September 15, 1863, having two rows of needles, and also to machines having straight frames and only one row of needles. Without enumerating here all the particular devices embraced therein, it is sufficient to say that one part of the invention relates to the construction of the cams for operating the needles, and to the manner of operating such cams. Another part relates to the manner of regulating the length of the loops. Another relates to the manner of supporting the sliding carriage. Another relates to the manner of constructing the jacks. Another relates to the manner of driving the sliding carriage. Another relates to the construction and operation of the yarn guide or carrier and to means for driving it. Another relates to a novel construction of latch-openers. Another relates to means for connecting suitable weights to the work.

A A′ are two flat needle-plates, inclined toward each other, as seen in Fig. 2, their upper edges being separated far enough to permit the operation of knitting to take place without obstruction from the plates, and to allow the fabric produced to hang down between them. They are firmly secured to a suitable bed, B, or they may form a part of it by being cast therewith in one piece. The bed B is so made in this example as that it can be attached below the needle-plates to the edge of a table. It may be made, however, so as to be supported on suitable standards.

The needle-grooves *a a* extend entirely across the plates, and are open above and below, so that the needles can be readily withdrawn therefrom at pleasure when the retaining-plates U are raised.

The needles here represented are of the kind known as "latch-needles," but with slight modifications, which will suggest themselves to persons skilled in the art of making knitting-machines, needles with flexible beards can be used in connection with my invention. The lower ends of the needles have butts *d*, which reach forth from the grooves *a* above the face of the needle-plates, so as to enable the needles to be operated by the cams thereinafter mentioned. The needles are retained in their grooves by means of plates U U, one for each of the needle-plates A A′, the said plates U being flush with the needle-plates along their lower edges, W, (see Fig. 3,) but being higher than the faces of said needle-plates along their upper edges, W′, because the upper parts of said needle-plates A A′ are cut down a distance equal to the thickness of the retaining-plates U; moreover, the upper parts of the retaining-plates U are beveled off so as to be brought to a fine or thin edge. These plates U serve to hold the needles in place, and also to close their latches when they are pulled down out of the path of the operating cams, as hereinafter explained.

G G designate two rows of bent wires, whose shanks are secured respectively in plates E E, one of which is fastened beneath each needle-plate by means of screws which pass through slots in said plates E and hold them to the needle-plates. These slots are elongated in a direction transverse to the length of the plates E, so that the latter can be adjusted to different heights and the bent wires of one row thus be made to approach or recede from those of

the other row. These wires are bent in such a manner that their bent portions rise nearly at right angles to the planes of the needle-plates respectively.

l l designate rods, which are fixed in horizontal positions within the bent parts of the wires, for the purpose of supporting them, the ends of the wires being clasped about the rods so as to form eyes, through which the rods pass, as seen in the sectional view, Fig. 2, for the purpose of sustaining them. The wires and rods are not soldered to each other, nor are the wires so tightly clasped about the rods as to prevent the wires from moving on them laterally when a knot is passing between the wires or any strain comes on them from other causes. The bent wires G fulfill the office of jacks, and they are placed opposite to the spaces between the grooves of the needle-plates. The needles in their reciprocations pass between adjacent jacks and above the rods *l*, so that they are supported vertically by the rods and laterally by the jacks. This construction of the jacks enables me to reduce the size of the grooves of the needle-plates at their upper edges, so that the hooks of the needles need not be drawn entirely within the grooves, nor the loops be drawn into the same, the said jacks serving to support the loops at the sides of the needles in a manner similar to the common way of supporting them by ridges between the needle-grooves during the drawing of the loops, and the loops simply being drawn by the needles between the jacks instead of being drawn into the needle-grooves; and since there is more room between the jacks than in the needle-grooves, and since the needles in being drawn back to cast off the loops are drawn back of the upper or inner portion of the jacks before the former loops are cast, so that there is nothing between the needles at the point where the loop is thrown off each, it follows that coarser yarn may be used with the needles at a given distance apart, and a large number of needles may be used in the machine, and the machine need not be any wider than the finished work is to be. These jacks enable either coarse or fine yarn to be used equally well in the same machine, and also permit the large or uneven places in yarn to pass without difficulty; and they are much better than flat plates, even though such plates are elastic, because they occupy no room where the loops are cast. The jacks may be made of metallic plates by punching such plates out to the required form, instead of being made of wire, as here shown. They may be used in all kinds of knitting-machines where sliding needles are used, whether a single or double row or series of needles are used.

By making the grooves *a* run entirely across the needle-plates I am enabled to throw any number of needles out of operation for narrowing and to bring them back into operation for widening without removing them from the machine, the needle being meanwhile kept in the grooves by the plates U. When any needle is to be removed for any purpose or new needles are to be put in the machine it is only necessary to loosen the gibs which hold the sliding carriage to the bed B, so as to allow the plates U, one or both, to be raised a little distance, so as to permit the latch and hook of the needles to pass beneath. For this purpose I fasten the plates U to the needle-plates by means of smooth pins g', fitting into holes g^2, made in the bearing-plates U, on which pins the said plates U can be moved when it is desired to raise them off the needle-plates. The pins may be made to project from the plates U, fitting in holes in the needle or foundation-plates, if desired.

f^4 f^4 are standards rising from either end of the bed of the machine, supporting two guide-rods, f^2 f^2, and also a screw-threaded rod, *b*, which is placed midway between the guide-rods. The rod *b* carries two nuts, *e e'*, which are free to travel thereon. Each of these nuts has an enlargement at the middle of its length extending all around it.

A^2 is the yarn-conductor. It is supported upon the guide-rods by means of eyes *f f f'*, through which the rods are passed.

g g are the arms of a spring made fast to the back of the yarn-conductor, the said arms extending each way therefrom in a horizontal direction at the level of the nuts *e e'*. When the yarn-conductor is pushed toward the right its side strikes against the nut *e'*, and at the same time one of its arms *g* springs over and embraces the ridge *g'* of said nut, and the yarn-conductor is thereby held steady until its movement toward the left takes place. When it is moved against the nut *e* it is held stationary in like manner by the other arm *g*.

C D designate a sliding carriage, longer than the bed B and the needle-plates. It is composed of two plates connected at their ends so as to form one frame, their upper sides being parallel with the needle-plates, and their inner or front sides, *t t*, extending downward at right angles therewith and resting upon the bearing-plates U, on which they slide horizontally. The frame is retained in place by locking-pieces or gibs D' D', one at either end of the bed B, which are screwed down to their places, their ends serving as guides along which the front sides, *t t*, of the frame move.

K is a stiff spring-dog, secured to the part D of the frame and extending forward and upward against the back of the yarn-guide, which it moves to and fro by means of two shoulders, K' K', one of which is seen in Fig. 2. These shoulders are placed behind the guiding-eyes *f f*, and the spring-dog being forced by its own elasticity against the yarn-guide, it follows that when the sliding carriage is moved toward the left the dog will pass along the back of the yarn-guide until it strikes the shoulder K' on that side, when the spring-arm *g* will be drawn out of engagement with the

nut e' and the yarn-guide will be carried up to the nut e, whose ridge g' will engage the spring-arm on that side and hold the yarn-guide stationary against reaction; the dog K meanwhile will be carried over the shoulder and past the nut e, by reason of the continued movement of the carriage, its elasticity allowing it to yield sufficiently to ride over the shoulder when the yarn-guide is stopped by the nut. On the return movement of the carriage the dog slides over the shoulder it engaged last, whose outer side is inclined so that the dog will not move the yarn-guide, and moves along until it strikes the face of the other shoulder on the right-hand side of the yarn-guide, when it carries the latter along until it reaches the nut e'. The yarn-guide is again stopped and held stationary, as before, while the dog K is forced past the shoulder, as before. The nuts e e' are to be placed on the screw-threaded rod in such positions and at such distances apart as will enable the yarn-guide to pass in both directions beyond the outermost of the needles which are in operation—say to the distance of half an inch beyond them on each side.

The letters i i designate latch-openers consisting of flat plates fixed to the inclined sides of the frame-carriage C D, their inner ends, j j, being bent downward at right angles to the rest of the plates, and curved as seen in Fig. 1, where that one which is fixed to the part C of the frame is shown. They are so located that their greatest convexities are just in advance of the yarn-guide, whose lowest part, f^5, when the machine is in operation, is found between the latch-openers, but at that end which is hindermost. The driving-dog K is bolted to the frame upon the back of that one of the latch-openers which is on the same side of the frame, and therefore, since at each change of direction of the motion of the carriage the driving-dog advances along the back of the yarn-guide until it meets the opposing shoulder, the latch-openers are carried past the foot f^5 of the yarn-guide before the latter begins its return movement. The yarn passes through an eye in the top f^6 of the yarn-guide, and thence through an eye in its foot f^5, as seen in Fig. 2. Each side of the sliding frame carries a system of cams, which will be next described. They are the same for each side of the frame, and therefore a description of those on the side C will answer for both. Figs. 4 and 5 represent one set of these cams in two different positions. They are placed on the under side of the frame below the front side, t, thereof, and are attached to and sustained by a fixed plate, q, which is secured at 1 1 to ribs 2 2, formed on the under side of the part C.

q' q' are transverse slots in the plate q, which receive pins r^2 r^2, extending from a V-shaped cam, r, on the plate q. The pins r^2 r^2 also pass through the diagonal slots p^2 p^2, made in a sliding plate, p, placed beneath the fixed plate q, as shown in the drawings, but above the plate as it sets in the machine. The ends of said sliding plate are confined against the plate q in recesses sunk in the ribs 2 2, in which recesses they are guided in the reciprocating movements of the plate p. Friction is made on one end of the sliding plate by means of a spring, S, which is secured in place by one of the screw-bolts 1. The pins r^2 r^2 terminate on the upper side of the sliding plate (the upper side as that plate lies when in the machine) in buttons or heads, (not seen in the drawings,) which serve to hold the V-shaped cam in place. The sliding plate p has no transverse motion, but only a longitudinal movement, which is effected by means of its lower edge, p', which projects below the fixed plate q and below the part C of the frame. The ends of the projection p' come in contact with the adjustable stops H H, which are so placed on the ends of the bed B as to be capable of motion about their pivots V, curved slots I, formed on their inner or lower ends, receiving set-screws, (seen in dotted outline in Fig. 2,) by means of which the stops are set either in or out of the path of the part p' of the sliding plate. When the stops are turned up in its path the sliding plate will be moved to and fro, and it will in turn cause the pins r^2 r^2 to be moved either up or down in the slots p^2 p^2, and so cause them, and consequently the V-shaped cam, to be moved transversely up or down in the slots q' of the fixed plate. When this cam is moved upward it will pass above the butts of the needles, and when it is moved downward it will be in the line of engagement with them. r' r' are side cams, adjustably secured to the fixed plate q by means of pins O O projecting from the upper ends of the cams through diagonal slots r^3 r^3 cut in the plate q. Pins O′ O′ projecting from the lower ends of said cams also enter the diagonal slots on the lower side of the sliding plate, the object being to keep the faces of these cams always parallel with the opposite faces of the cam r. The pins O O′ are far enough apart to permit the shifter or sliding plate p to pass between them.

The slots r^3 may extend from the place of the pin O to that of the pin O′, or they may be interrupted and not continuous where they are covered by the plate p, providing they extend far enough above and below the said plate p to allow the pins to move the distances required for the adjustments of the cams. The upper ends of the pins O′ O′ do not pass quite through the slots r^3, being intended only for guides, but the upper ends of the pins O pass through them and are connected to links n n, which extend downward across the sliding plate or shifter p, their lower ends being controlled by thumb-screws F F, whose shanks pass through longitudinal slots m m and are connected to the links. The effect of this construction is, that when the thumb-screws are moved toward each other the cams r' are

moved upward, and when the thumb-screws are moved away from each other the cams are moved downward.

The upper sides of the cam r present a salient angle, and the inner sides of the cams r' present a corresponding hollow or re-entering angle, and the space between them forms an inverted V-shaped passage for the butts d of the needles to travel in, so that the said cam r, on striking those butts which are in its path, will first move the needles they belong to upward to the top of the passage, and the cam r' will then draw them downward. When the cam r has been carried upward, as seen in Fig. 4, it is rendered inoperative, and the sliding-frame moves over the needle-plates without producing any movement of the needles, but when it has been drawn down, as in Fig. 5, it engages the butts of whatever needles are in its path, and operates them as above explained.

The slots p^2 are so arranged that when the projection p, which may properly be called the "shifter," in moving toward the right strikes the stop H the passage between the cams r r' will be opened by the descent of the cam r. When, on moving toward the left, the shifter-plates strike the stop H on that side the said passage will be closed. This operation is the same on either side of the machine. By this action upon the cams I am enabled to knit on the two rows of needles in alternation, the stops H at the end of the bed B on each side of the machine being set so that the cams r on opposite sides will operate in alternation.

Q designates a wire setter, made with hooks on its ends to receive the hooked ends of a bent wire, Q', upon which latter weights are hung for distending the fabric and clearing the machine of it as it is produced. The wire setter Q is dropped down between the latch-openers upon the work when it is set up, and its hooks are then engaged to the hooks of the other wire, as seen in Fig. 1, both rows of needles being operated together in setting up the work, forming a net-work between the rows. This machine may be operated with both rows of needles alternately, so as to produce circular knitting; or the knitting may proceed on one row back and forth, and then on the opposite row back and forth; or it may proceed on only one row continuously.

The sliding frame is reciprocated by means of a crank, C^2, whose shaft C^3 is placed in the bed B at the right-hand end of the machine. A connecting-rod, C', pivoted to the left-hand end of the sliding-frame, is connected to the middle of the crank-arm in such a manner as that the crank-arm can turn in the eye of the rod. C^4 is the handle of the crank. The machine may also be fitted to be operated by a treadle or by power.

The length of the loops is determined by the position of the side cams, r' r'. When they are in their highest positions the work will be closely knitted; when they are in their lowest position the fabric will be loosely knitted; and their positions are to be changed by means of the thumb-screws which operate the links n, according to the character or closeness of the texture to be knit.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The employment, in a knitting-machine having two rows of needles operating alternately, of shifters p p, having suitable bearings and one or more oblique slots, p^2 p^2, in combination with the pins r^2 and transverse slots q' in the cam-box, for the purpose of shifting the V-shaped cams to produce the alternation in the operation of the two rows of needles, substantially as herein described.

2. The combination of the shifters p p, having projections p' p', with suitable stops, H, to effect the movement of the shifters, as needed, in order to change the V-shaped cams, substantially as herein set forth.

3. The adjustable stops H, so secured as to allow of their being placed either in position to combine with the projections p' of the shifters, and thus change the V-shaped cams, or in position to allow the shifters to pass them without changing them, so as to permit of changes in the machine simply by the change of the stops, substantially as described.

4. The outside cam-pieces, r' r', when they are made either one or both adjustable in the line of the side of the V-shaped cam, so that when either of the outside cams shall be adjusted to regulate the length of the loops the parallelism between the sides of the V-shaped cam r and the inside surfaces of both outside cams, r' r', shall always be preserved by the change of the shifters, as described.

5. The manner of regulating the length of the loops by means of the link n, slot m, and the thumb-screws, substantially as described.

6. The friction-spring s, to prevent the changing of the shifters before they come against the stops H, as described.

7. The plate U U over the needles, when the same perform the double office of retaining the needles in their grooves and also form the lower rests or bearings for the sliding frame, as described.

8. The manner of fastening the plates U U in place by means of pins g' g' and holes g^2 g^2, whether the pins are stationary in the foundation or in the plates, so long as the plates are held down to the needles by the sliding frame, so as to permit the needles to be readily removed by simply loosing the bearings or gibs D' to allow the sliding frame to be raised, substantially as herein described.

9. Making the inner edge of the plates U, which plates perform the functions stated in clause seventh of the claim, beveling or sharp on the upper side, as described, for the purpose of turning over the needle-latches when the needles are drawn down to be out of working position.

10. Having the lower ends of the wire jacks

G all firmly attached to the plates E, in combination with the small rods *l*, passing through the eyes in the upper portions of the jacks, substantially as described.

11. Making the jack-plate E adjustable out and in, so as to have the opening between the two rows of jacks wide or narrow, as desired.

12. The attachment of the crank c^2 by suitable shaft and bearings to the foundation of the machine by means of a connecting-rod, c', attached at one end to the crank and at the other to the sliding frame, substantially as described, whether the machine be in all respects similar to this or otherwise, so long as there be a sliding frame moving over two alternately-operating rows of needles, substantially as herein described.

13. A detached yarn-carrier having an adjustable movement to conform to any desired width of fabric to be knit, in combination with a sliding frame having a uniform distance of movement, substantially as described.

14. Operating the yarn guide or carrier by means of the driving-spring K on the sliding frame working on the inclined surfaces and stops of the yarn-carrier, in combination with the friction-spring *g*, substantially as herein described, for the purpose of taking hold and letting go of the yarn-carrier, as described.

15. A knife or sharp edged latch opener or guard that takes the latches from the top of the hooks of the needles without entering the barbs of the needles, whether the edge of such latch-opener is nearly straight and the movement of the needles opens the latches or whether the needles are stationary while an inclined knife-edge opens the latches.

16. The combination of the two latch-openers, constructed as shown, with the yarn-carrier, when the same are so arranged as to permit the yarn-carrier to pass between the latch-openers, as described.

17. The bent wire Q or its equivalent, to drop down on the yarn in setting up work on the machine, so as to permit a weight to be attached to the same under the machine by means of the bent wire Q′ or other suitable connection, substantially as described.

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