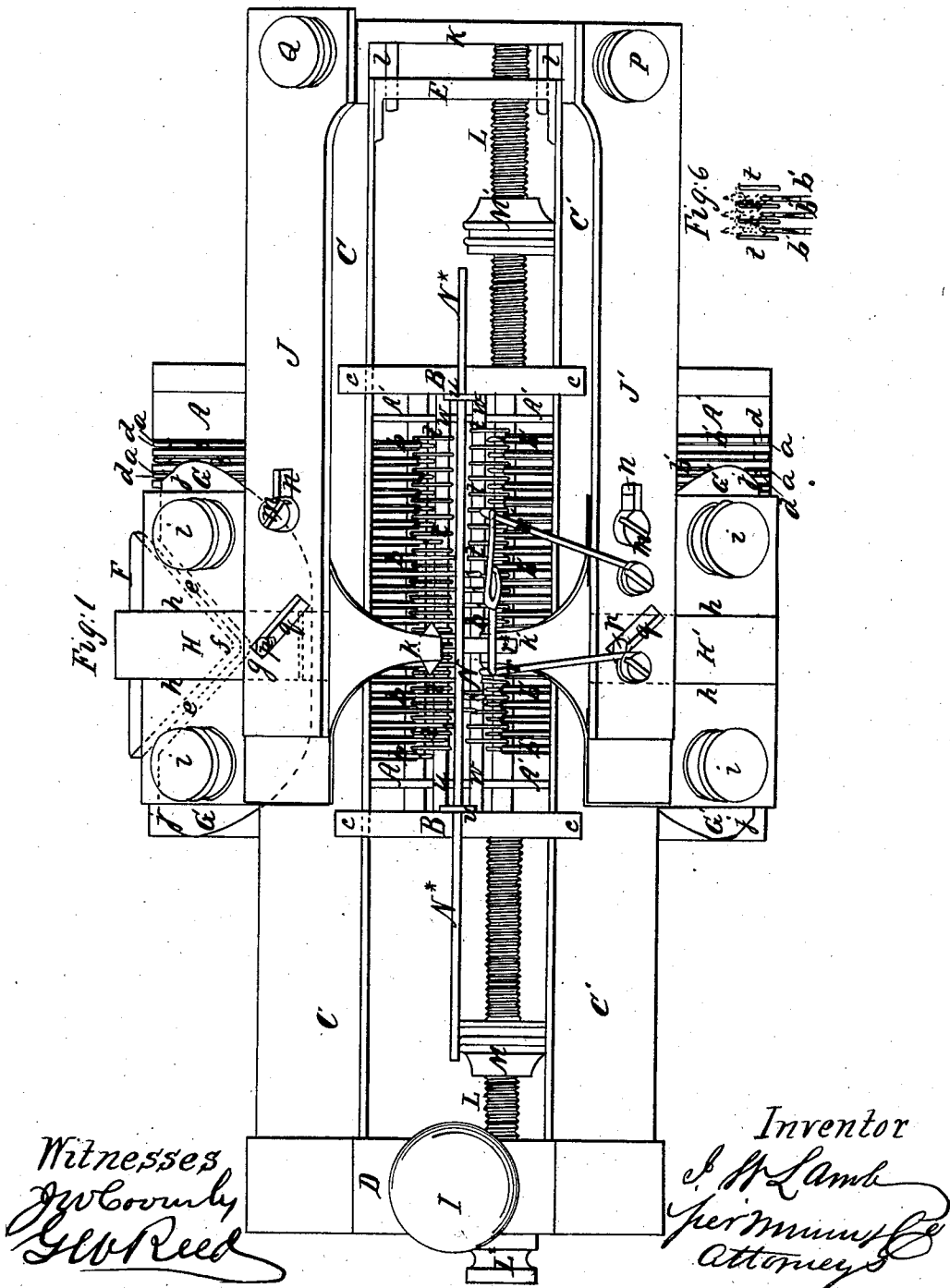


I. W. Lamb. Knitting Mach.

N^o 39,934.

Patented Sep. 15, 1863.



Witnesses
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G. W. Reed

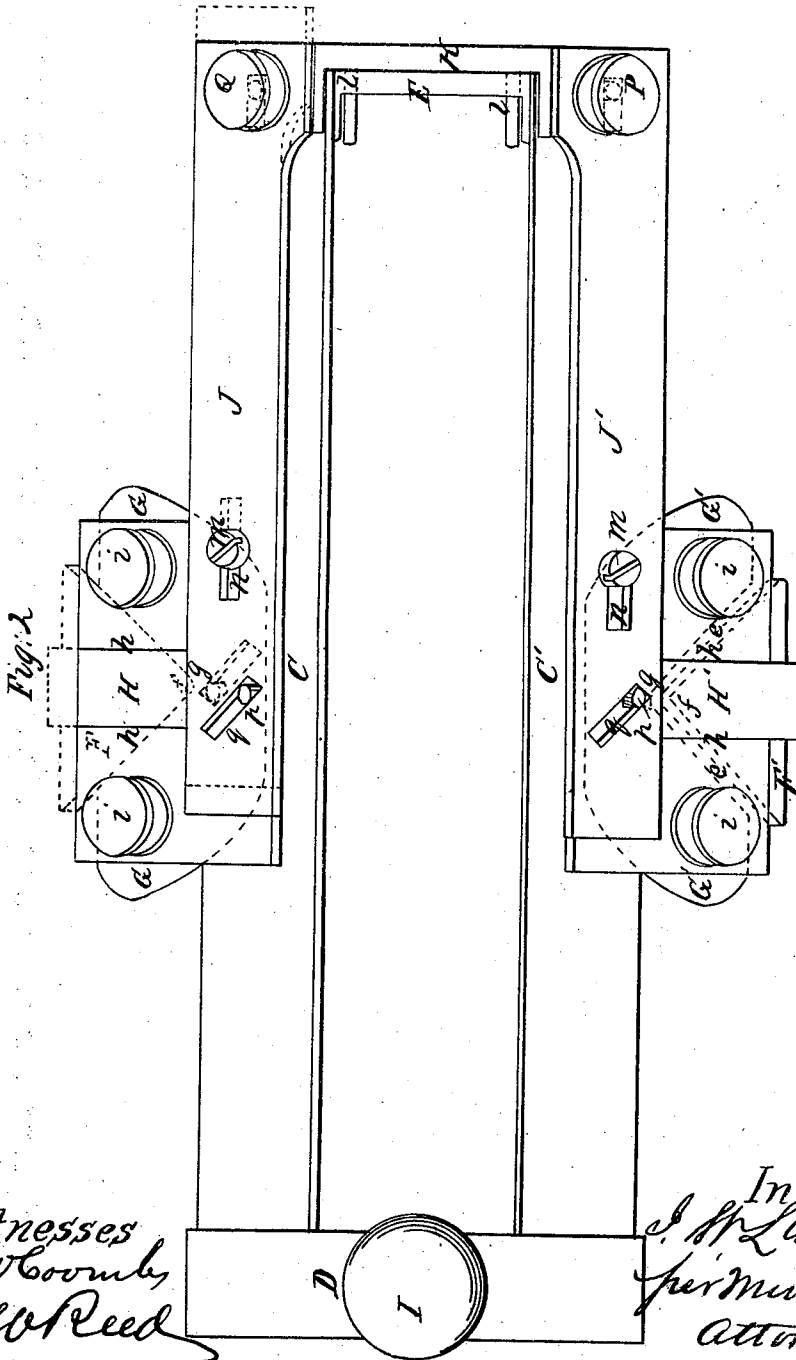
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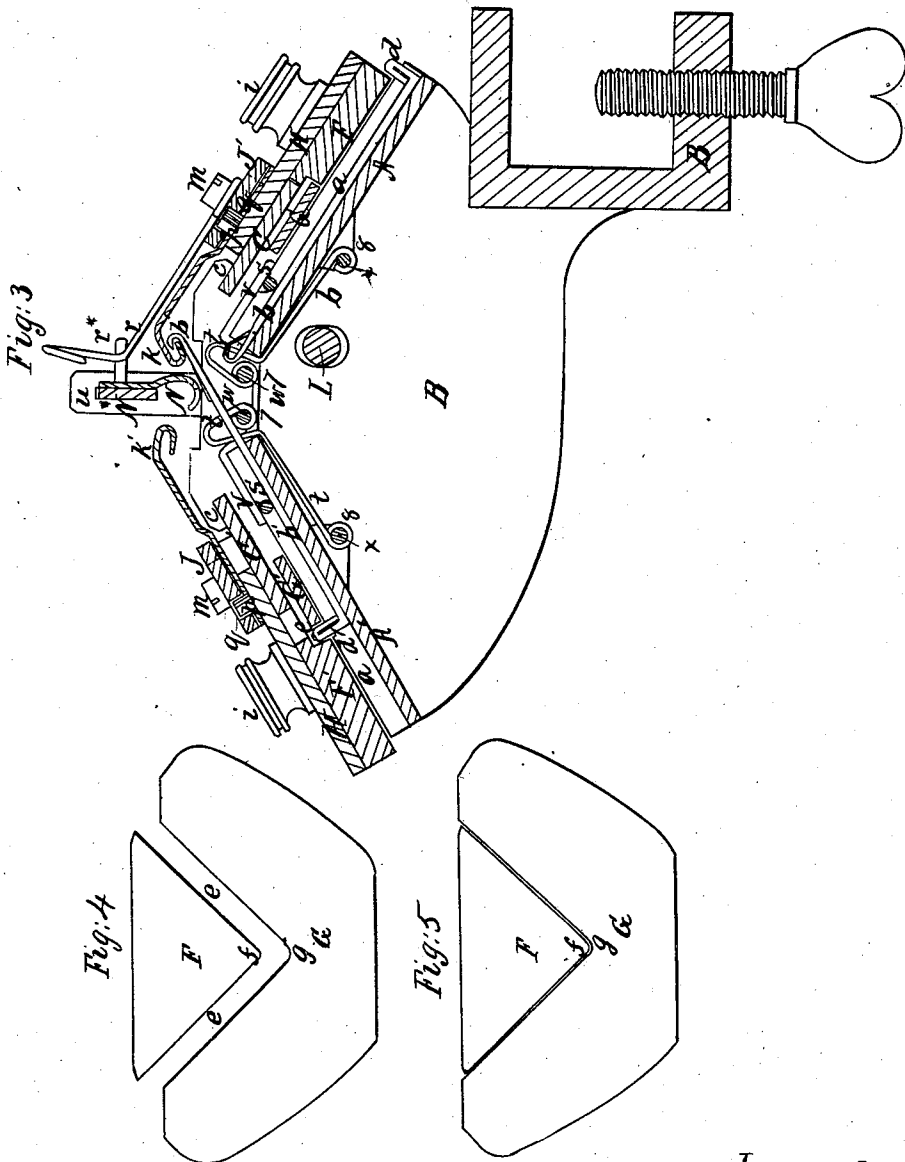
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UNITED STATES PATENT OFFICE.

ISAAC W. LAMB, OF DETROIT, MICHIGAN.

IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. 39,934, dated September 15, 1863.

To all whom it may concern:

Be it known that I, ISAAC W. LAMB, of Detroit, in the county of Wayne and State of Michigan, 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 of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan of a knitting machine with my improvements. Fig. 2 is plan of the sliding frames, by the reciprocating movement of which the movements of the needles, the latch-openers, and the yarn-conductor are produced. Fig. 3 is a transverse vertical section of the machine. Figs. 4 and 5 are plans of one of the needle-operating cams, showing its parts in two different positions. Fig. 6 is a plan view of a part of one of the needle-plates, and portions of some of the needles, and what I call the "jacks" employed in connection with them.

Similar letters of reference indicate corresponding parts in the several figures.

This invention consists in an improved system of operating two straight rows of needles in a knitting-machine, whereby tubular work—such as the legs and feet of hosiery—is produced, and provision is made for narrowing or reducing such work.

It also consists in certain arrangements of the mechanism for operating the two rows of needles, to provide for the production of either the tubular work or single-ribbed or plain work, as may be desired; also, in a certain construction of the grooved needle-plates, in which the needles slide, and mode of confining the said needles therein, whereby facility is afforded for throwing the needles out of and into operation for narrowing and widening the work without taking them out of the machine; and, further, in certain devices interposed between the several sliding needles of a knitting-machine for the purposes of enabling either fine or coarse yarn to be knit equally well in the same machine, and enabling the needles to be arranged closer together and a larger number be used in the same space.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A A' are two flat needle-plates—one for each row of needles—arranged side by side parallel

with each other, at a short distance apart, and with their upper faces; in which the needle-grooves *a a* are formed, inclining upward toward each other, but the length of the said plates having a horizontal direction. The said plates are firmly secured to a suitable bed, B, which may be constructed to screw onto the edge of a table, as represented, or supported upon suitable standards. The needle-grooves *a a* extend right across the plates, and are open at the lower as well as at the upper edges of the plates. The needles *b b' b'* represented are what are termed "latch-needles," though with slight modifications of known working parts, which would at once suggest themselves to persons skilled in knitting machinery, flexible bearded needles might be employed in carrying out my improvements.

C C' D E represent a sliding frame or carriage, somewhat longer than the needle-plates and their bed B. This frame is arranged over the needle-plates and fitted to slide horizontally and parallel with the length of the needle-plates in guides *c c*, secured to the said bed, and it carries the two V-shaped cams F G and F' G', for operating the needles. Each of these cams is made in two pieces, as is best shown in Fig. 4, where it will be seen that the piece F is so constructed that its edges present a salient angle, *f*, and the piece G that its edges present a corresponding hollow angle, *g*, and the space between the said angles forms a V-shaped passage, *e*, for the turned-up lower or butt ends, *d d*, of the needle-shanks, so that the said cam, in passing the said ends, will first move the needles inward or upward and afterward draw them outward or downward. The portions G G' of the cams are rigidly secured to the side bars, C C', of the sliding frame above mentioned by means of screws *i i*; but the portions F F' are attached to sliders H H', which are fitted to slide transversely to the bars C C' in guides *h h*, provided on the said bars, for the purpose of enabling the passages *e e* in the cams to be closed up, as shown in Fig. 5, thereby rendering those portions of the cams inoperative. The lower or outer edges of the portions G G' of the cams are sloped or rounded off, as shown at *j j*, and when the passage *e* in either cam is closed up the outer edge of its piece F or F' forms an unbroken straight continuation

of the edge of the corresponding piece, G or G', as shown in Fig. 5, and the cam F or F' will pass the projections *d d* on the needles without touching them. The bars C C' of the sliding frame have also rigidly attached to them the two latch-openers *k k'*, one for each row of needles. The sliding frame is furnished with a handle, I, by which to impart to it by hand a longitudinal reciprocating motion of a sufficient length to enable the cams to operate the whole set of needles, or it may have such a motion given to it by other means.

J J' are two straight bars of little more than half the length of the side bars, C C', arranged over the latter bars, and their cams F G F' G' parallel with the latter bars. These bars J J' are attached rigidly to a transverse connecting-piece, K, which is situated outside of the end piece E of the sliding frame. This piece K has attached to it two guide-pins, *l l*, parallel with the bars J J', and these pins are fitted to work in holes in the piece E to steady the said piece K and bars J J' and keep them in proper relation to the sliding frame. The said bars J J' are also attached to the bars C C' by means of screws *m m*, screwing into the latter bars, but passing through slots *n n* in J J', to permit a certain amount of movement of the sliding frame independently of the bars J J', the object of such movement being to shift the slides H H' and the attached portions F F' of the cams, and so open and close the passages *e e* of the cams.

The shifting of the slides is effected by means of pins *p p*, which are rigidly secured in the slides and received in obliquely-arranged slots *q q*, provided in the bars, the movement of the sliding frame, independently of J J', carrying the said pins along the said slots, and so producing the movement of the slides transverse to the bars.

The bars J J' are intended to move back and forth with the sliding frame, with the exception that they are arrested at a sufficient distance from the end of the movement of the said frame in either direction to provide for the aforesaid independent movement for opening and closing the passages in the cams. The arrest of the bars J J' is produced by means of stop-nuts M M', fitted to a long screw, L, which is rigidly secured at one end to the transverse connecting-piece K. This screw passes right through the bed-plate B and through both ends of the sliding frame, and has a head, L*, at the opposite end to that which is secured in the piece K, and the length of the said screw between the inside of its head and the inside of the piece K exceeds the outside length of the sliding frame by the desired length of the independent movement of the frame.

In moving the sliding frame the bars J J' are moved with the said frame by friction until the stop-nuts M M' come in contact with the end of the bed-plate, when the said bars are arrested, and the sliding frame moves on until the end D comes into contact with the

head L* of the screw L, or until the end E comes into contact with the piece K. The oblique slots *q q* are so arranged, as shown in Figs. 1 and 2, that as the sliding frame completes its movement to the right the slide H is drawn in and the passage *e* of the cam F G closed up, and at the same time the slide H' is pushed out and the passage *e* in the cam F' G' opened, and that as the frame completes its movement to the left the action on the slides is reversed, and the cam F' G' is closed and F G opened. By this action upon the cams only one cam is allowed to operate upon the needles at a time, the one whose passage *e* is closed up being inoperative, and its lower edge passing over the projections *d d* on the needle-shanks without producing any effect upon them, and as each cam is alternately operative the two rows of needles are operated alternately—one row while the sliding frame is moving in one direction and the other while it is moving in the opposite direction; and hence with a suitable arrangement of the yarn-conductor N to carry the yarn over one row of needles while passing one way and over the other row in passing the other way, the work performed on the two rows is united at the ends of the rows, and is equivalent to work performed on a circular machine.

The yarn-conductor N is attached to a horizontal sliding bar, N*, which is arranged parallel with the length of the needle-plates and sliding frame, and directly over the space between the two needle-plates, in suitable guides, *u u*, and derives the necessary movement to enable it to carry the yarn first over one and then over the other row of needles as they are respectively and alternately advanced by the action of the cams from tappets *r r*, carried by the sliding frame, the said tappets acting upon a projection, *r**, on one side of the bar N*. By this system of operating alternately on two rows of needles great facility is afforded for narrowing and widening tubular work. To narrow it, it is only necessary to take out or withdraw from the action of the cams one or more needles from either plate at each or either end of either or each row of needles, transferring the loop or loops from such needles to the adjacent needle or needles in the same row. To widen, it is only necessary to insert one or more needles at either or each end of either or each row. The length of movement of the sliding frame and cams should be adjusted according to the number of needles in operation, and this is done by adjusting the stops M M' on the screw L.

When it is desired to knit upon one row of needles only, as in making the heel of a stocking, the connecting-piece K, to which the bars J J' are secured, is brought close up to the corresponding end K of the sliding frame, as shown in Fig. 2, and secured to the frame in that position by a screw, P, provided for the purpose. This secures the bars J J' in such positions that the cam F G has its passage *e* closed, and will pass the needles *b b* without

operating them, but that the cam F' G' has its passage open, so that it will operate the needles b' b' and produce a course of stitches thereon in every movement of the sliding frame in either direction.

When it is desired to produce ribbed work, the bar J' and connecting-piece K are still kept secured to the sliding frame, as above described; but the bar J is liberated from K by unscrewing the screw Q, which attaches it thereto, and shifting it to such a position (indicated by red outline in Fig. 2) that by the action of its slot q on the corresponding pin p it forces out the portion F of the cam F G and renders the said cam operative. In this position the bar J is secured by the screw Q, and as the two cams are now in operative conditions every stroke of the sliding frame produces the operation of both rows of needles, and the needles of each row, owing to the relative arrangement of the grooves a a in the two needle-plates, pass between and across those of the opposite row, and thus produce a flat, single piece of ribbed knitting.

To provide for the above adjustment of the bar J the said bar is slotted where the screw Q passes through it.

To provide for easily throwing any number of needles out of operation for narrowing and bringing them back into operation for widening, without ever removing them entirely from the machine, the grooves a a in the needle-plates A A' are made entirely across the plates and open at their outer or lower as well as their inner or upper ends. To allow them to be drawn so far back that the cams will not touch the projections d d on their shanks, but to prevent them from slipping out altogether, as they would otherwise be very liable to do when liberated from the work, the upper surface of each needle-plate has cut in it across the grooves a a a longitudinal groove, v, for the reception of one of two rods or wires, s s, Fig. 3, which are inserted right through the bed B and needle-plates from end to end of the machine, and these rods or wires prevent the passage of the hooks of the needles, but allow the butt-ends of the needles to be drawn some distance out of the grooves a a.

The devices interposed between the several needles for the purpose of enabling coarser and finer yarns to be used in the same machine, and enabling the needles to be arranged closer together, and a larger number to be used in the same space, consist of what may be termed "jacks" t t, composed of thin steel wires, bent to the form shown in Fig. 3, but presenting a straight appearance as viewed from above. (See Figs. 1 and 6.) These jacks, of which there is a separate set for each row of needles, and which may be used in machines in which only a single row or series of needles is used, are each made with two eyes, 7 and 8, to fit two horizontal fixed rods, w and x, which extend the whole length of the needle-plates and are secured on the ends of the bed-plate B. One of these rods is arranged nearly close against

the upper or inner edge of the needle-plate and the other under the needle-plate, the said rods serving to support the jacks, which are arranged opposite to the spaces between the needle-grooves a a of the needle-plates, and which project upward and forward above and in front of the edges of the plates. The jacks thus supported are free to yield slightly in a lateral direction. The use of the said jacks enables the width or depth of the needle-plates to be reduced at the front or inner edge, so that the hooks of the needles need not be drawn entirely within the grooves a a, and obviates the necessity for drawing the loops into the said grooves, the said jacks serving to support the loops at the sides of the needles in the same manner in which they are commonly supported by the ends of the 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 into the needle-grooves, and as there is much more room between the jacks than in the needle-grooves coarser yarn may be used with the needles at a given distance apart, and a larger number of needles may be used in the machine, thereby obviating the necessity of making the machine any wider than the finished work is to be. These jacks work equally well with fine yarn, and therefore allow either fine or coarse yarn to be used in the same machine, and in case of any unevenness or thicker places or knots in the yarn, they, being free to vibrate laterally, permit the passage of the thicker or knotty portions.

The jacks, instead of being made of wires, may be punched out of plate metal of the same form. They may be used in all kinds of knitting-machines in which sliding needles are used.

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

1. The employment, in a knitting-machine, of two straight rows of needles operating alternately in such a manner that the yarn-conductor, passing down and back, will carry the yarn over one row of needles while passing in one direction, and over the other row while passing in the opposite direction, substantially as herein described, thereby uniting the work produced by the two rows of needles at each end of the rows, and making tubular knitting in a straight knitting-machine.

2. The employment, for giving motion to the two straight alternately-operating rows of needles to produce tubular knitting, of two cams, F G and F' G', a portion of each of which is shifted at every stroke of the machine to produce the alternation in the operation of the two rows of needles, substantially as herein specified.

3. Combining the movable portions of the cams with the sliding frame or carriage which carries them by means of slides H, longitudinally-moving parallel bars J J', oblique slots q q, and pins p p, the whole operating substantially as herein set forth.

4. Combining the longitudinal parallel bars *J J'* with the sliding frame or carriage which carries the cams by means of a screw, *L*, secured to the transverse connection *K* of the said bars, and furnished with a head, *L**, and adjustable stop-nuts *M M'*, operating substantially as and for the purpose herein specified.

5. Providing for the permanent attachment of the parallel bars *J J'* to the sliding frame or carriage, either in position to fix both needle-cams in an operative position to operate both rows of needles for the production of ribbed work, or in a position to secure one cam in an operative condition and the other in an inoperative condition for the knitting on but one row of needles, as in knitting the heels of stockings.

6. In combination with the needle-plates, having their several needle-grooves open from the inner to the outer edges of the needle-plates, the rods *s s*, inserted through grooves *vv* in the needle-plates, intersecting the needle-grooves, substantially as set forth, for the purpose of preventing the needles from slipping out.

7. The yielding jacks *t t*, applied in combination with the needle-plates and needles, substantially as and for the purpose herein specified.

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Witnesses:

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