(No Model.) 4 Sheets—Sheet 1.

J. G. POWELL.

STRAIGHT KNITTING MACHINE.

No. 523,867. Patented July 31, 1894.

FIG. 1.

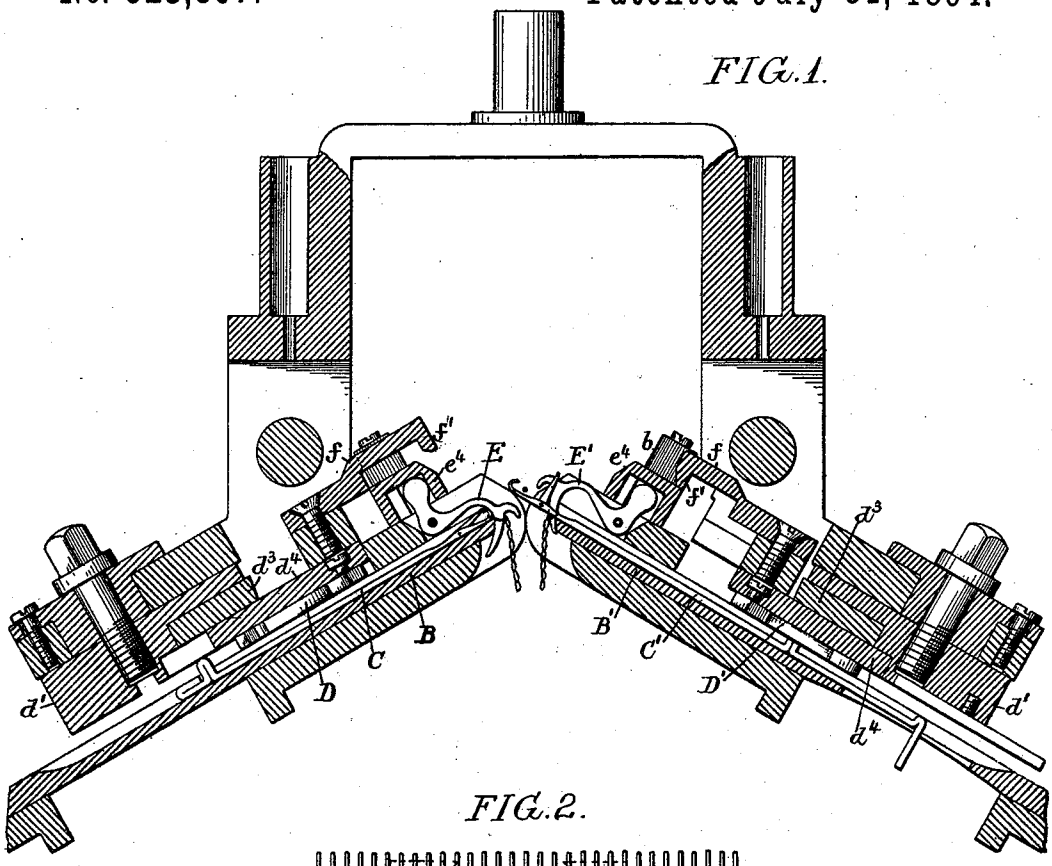


FIG. 2.

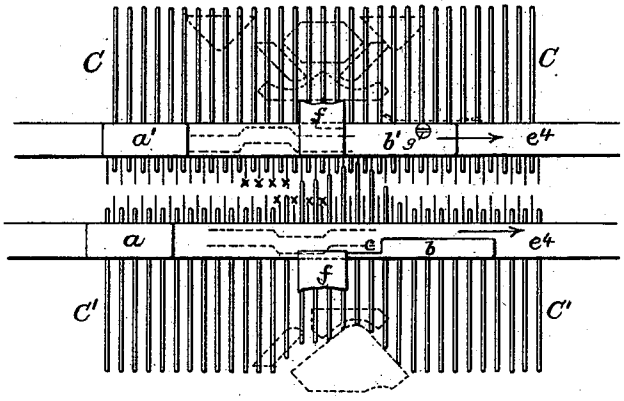
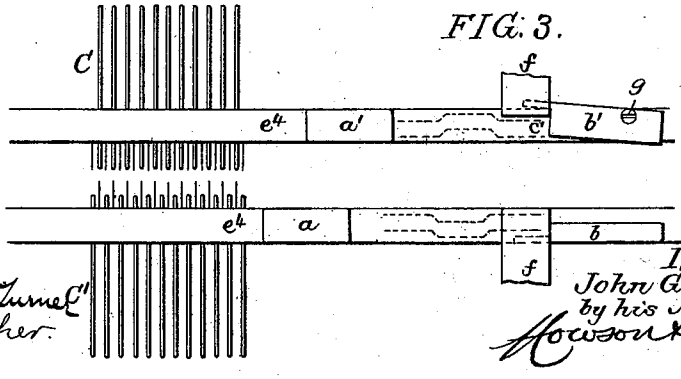


FIG. 3.



Witnesses:
Hamilton D. Turner
R. Schleicher.

Inventor:
John G. Powell
by his Attorneys
Howson & Howson

(No Model.) 4 Sheets—Sheet 2.

J. G. POWELL.

STRAIGHT KNITTING MACHINE.

No. 523,867. Patented July 31, 1894.

FIG. 4.

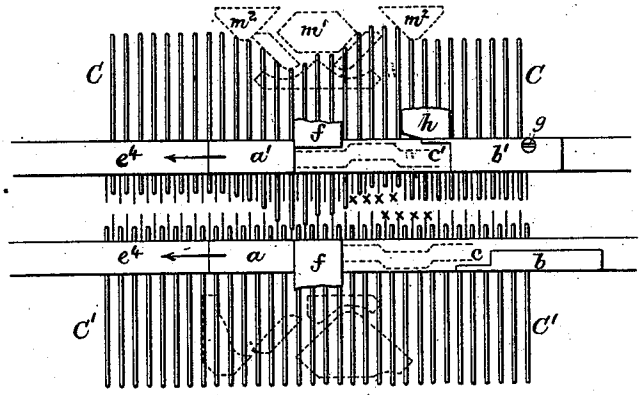


FIG. 5.

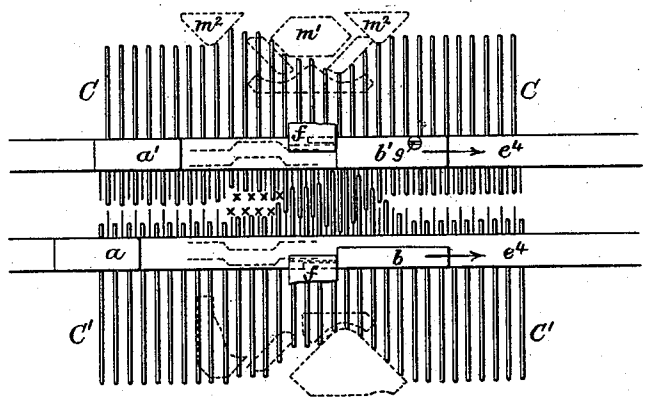
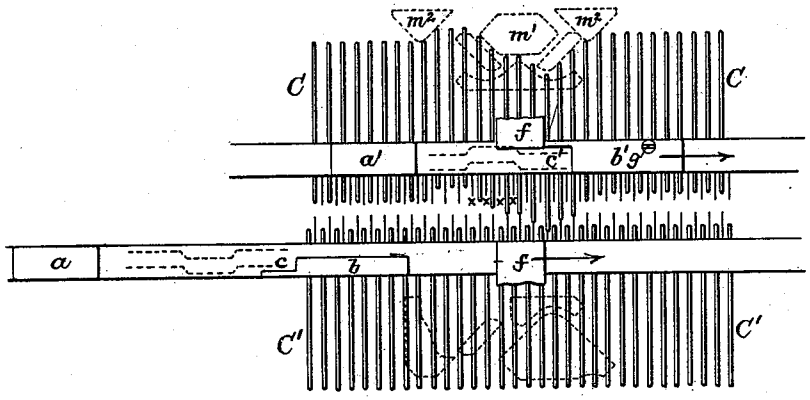


FIG. 6.



Witnesses:
Hamilton D. Turner
R. Schleicher.

Inventor:
John G. Powell
by his Attorneys
Howson & Howson

(No Model.) 4 Sheets—Sheet 3.

J. G. POWELL.

STRAIGHT KNITTING MACHINE.

No. 523,867. Patented July 31, 1894.

FIG. 7.

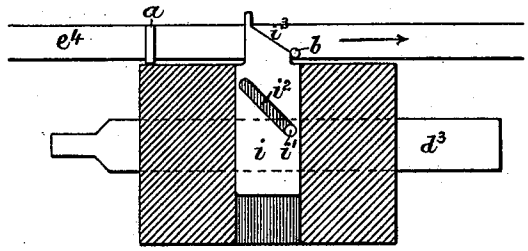


FIG. 8.

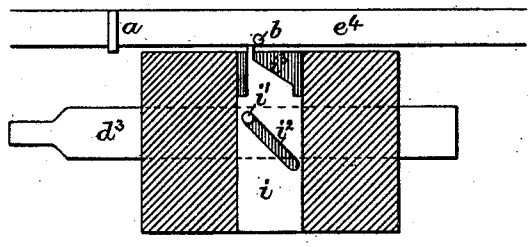


FIG. 9.

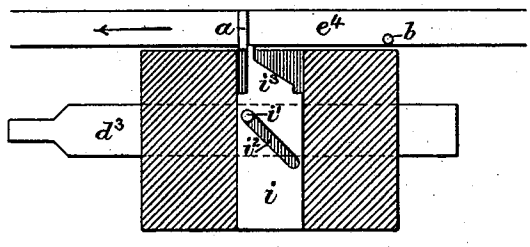
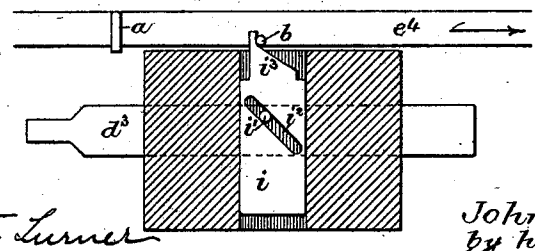


FIG. 10.



Witnesses:
Hamilton D. Turner
R. Schleicher.

Inventor:
John G. Powell
by his Attorneys
Howson & Howson

(No Model.)

4 Sheets—Sheet 4.

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STRAIGHT KNITTING MACHINE.

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FIG. 11.

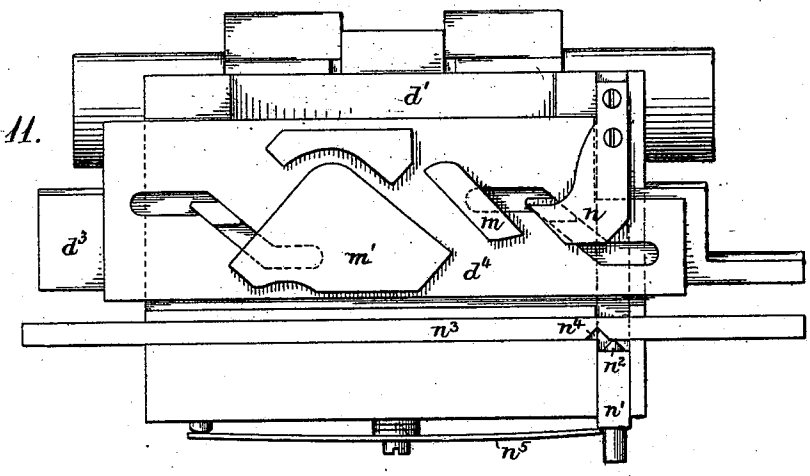


FIG. 12.

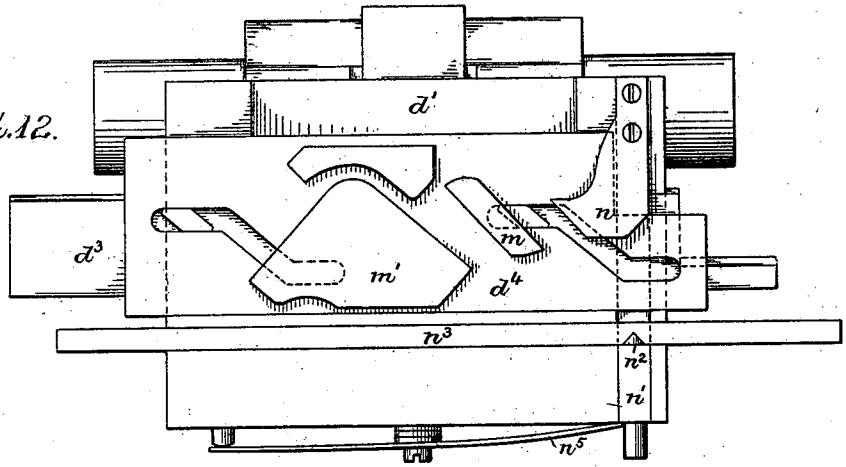
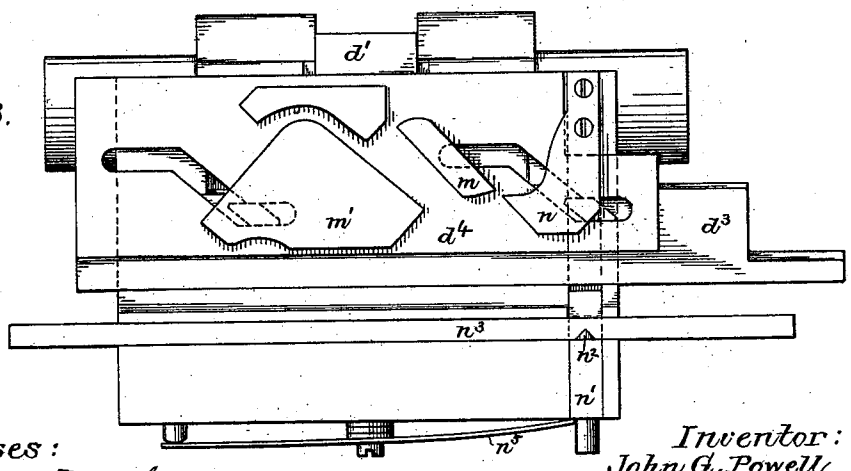


FIG. 13.



Witnesses:
Hamilton D. Turner
R. Schleicher

Inventor:
John G. Powell
by his Attorneys
Howson & Howson

UNITED STATES PATENT OFFICE.

JOHN G. POWELL, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO HIMSELF AND EDWARD POWELL, OF SAME PLACE.

STRAIGHT-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 523,867, dated July 31, 1894.

Application filed September 1, 1892. Serial No. 444,772. (No model.)

To all whom it may concern:

Be it known that I, JOHN G. POWELL, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Straight-Knitting Machines, of which the following is a specification.

My invention consists of certain improvements in the knitting machine forming the subject of Letters Patent No. 440,389, dated November 11, 1890, one object of my invention being to so construct and operate the sinkers and web holders forming part of the machine that the sinkers of one needle bed may be placed directly opposite the needles of the opposite needle bed without any risk of interference with the latter when they are projected, the result being that the machine can be constructed of much finer gage than when the sinkers and web holders have to be laterally offset from the needles of the opposite bed in order to escape contact with said needles when projected.

A further object of the invention is to prevent the casting off from the needles of any of the stitches formed in the first or setting up course upon both sets of needles.

In carrying out my invention I so operate the sinkers and web holders that while they will be properly raised to permit the needles of their own bed to draw stitches beneath the same and will then be depressed so as to knock over the loops at the ends of the retracted needles, they will, on the return movement of the cam box, when their needles are out of action, be raised at a point somewhat farther in the rear of the acting set of needles on the other side of the machine so that said needles will be retracted or drawn back out of the way before the web holders have been lifted into such position as would otherwise cause them to come in contact with the needles.

In the accompanying drawings—Figure 1, is a transverse section of sufficient of said patented knitting machine to illustrate my present invention. Figs. 2, 3, 4, 5 and 6, are diagrams illustrating the operation of the parts to which my present improvement especially relates. Figs. 7, 8, 9 and 10, are diagrams illustrating a modification of the invention. Figs. 11, 12 and 13, are views illustrating the construction of cams whereby the second object of my invention is attained.

In Fig. 1, B, B′ represent the opposite inclined needle beds of the machine; C, C′ respectively the needles guided in said beds; D, D′ the opposite sets of needle actuating cams; E, E′ the sinkers and web holders; d^4 the laterally moving slides carrying the needle operating cams; d^3 the longitudinally moving slide bars which actuate said cam slides so as to move the cams into operative or inoperative position, and e^4 the sinker cam bars which act upon the tails of the sinkers so as to cause the hooked web holding ends of the latter to be raised in order to permit the stitches to be drawn beneath the same and then depressed so as to knock over the stitches at the ends of the needles. All of these parts are the same as in the patented machine, it being understood that both of the cam boxes d' are reciprocated simultaneously, and that in making the "first" or "setting-up" course the cams of both boxes are in operative position so that stitches are formed upon both sets of needles, the cams, however, not being depressed to their full extent.

As soon as the setting up course is completed the cams of one box, d', say that of the bed B′ are raised so as to be inoperative and the cams carried by the box d' of the other bed are depressed into full operative position, and are permitted to remain in this position for a certain number or reciprocations of the machine while a toe pocket is being formed upon the needles of said bed B, the cams of the box d' of the bed B′ being then thrown into operative position during one-half of each complete reciprocation of the machine, while the cams of the box d' of the bed B are inoperative, the latter cams acting during the return half of the stroke, for instance, the cams acting on the needles of the bed B′ are operative during the movement of the machine from left to right and those acting on the needles of the bed B during the movement from right to left, so as to produce tubular work, the production of which is continued until the formation of the foot tube has been completed whereupon the cams acting upon the needles of the bed B′ are again raised out of action and a heel pocket is produced upon the needles of the bed B, the production

of tubular work being then resumed to form the leg.

The movements of the cam slides d^4 are effected by contact of the ends of the slide bars d^3 with suitable stops at the ends of the fixed frame of the machine, all as fully set forth in the before mentioned patent.

In the patented machine the sinker cam bars e^4 were reciprocated with the cam boxes d', a projection on each cam box extending between suitable lugs upon the back of the sinker cam bar, the distance between the lugs being sufficient to provide for the proper lead of the knitting cams so that the web holders would always be raised as shown at the right hand side of Fig. 1, in order to permit the descending needles to draw stitches beneath the web holding hooks, each web holder being depressed as the needle in advance completed its descent and drew its stitch, thus knocking over the end of the needle the stitch intended to be cast off and holding said stitch when the needle was again projected. In the patented machine, however, the lost motion in the movement of the sinker cam bar was such that the cam in said bar for raising the web holders always operated at the same distance in the rear of the needle actuating cams whether the cam box was moving in one direction or the other, and as, when the cam box was moving in one direction, that is to say, the direction in which the cams acted on the needles, the web holders were raised adjacent to the retracting needles of the acting set, they would, on the return movement, when their own needles were inactive, be raised in corresponding relation to the needles of the acting set on the opposite bed, and hence if placed directly opposite said needles, would come in contact with the same, as will be understood on reference to Fig. 1. In consequence of this the web holders in the patented machine had to be laterally offset in respect to the opposite needles, a construction which prevented the building of machines of fine gage and limited the application of the invention to machines for the production of coarse work only. In carrying out my present invention, however, I locate the web holders of one needle bed directly opposite the needles of the opposite needle bed and in order to prevent contact of the same with the needles of the opposite bed I so locate the projections or lugs upon the back of the cam bar e^4 in respect to the needle actuating cams of the corresponding cam slide that while on the movement of the cam box when the cams are actuating the needles, the web holders will be raised in proper relation to the retracting needles of the acting set, on the inactive movement of said cam box, the web holders will be raised some distance in the rear of the retracting needles of the acting set on the opposite bed, hence before said web holders are raised on the backward movement, said opposite needles will have been withdrawn to such an extent that the web holders in rising will not come in contact with them. This will be understood on reference to Figs. 2, 3 and 4, which are diagrams representing the working of the parts under normal conditions, that is to say, when a tubular web is being produced by knitting on the needles C' in moving the cam boxes from left to right and upon the needles C in moving the said boxes from right to left.

On the back of one cam bar e^4 are two lugs a and b and on the back of the other cam bar are two lugs a' and b', each of the lugs b, b' having at its inner end, a recess, as shown respectively at c c'.

On the back of the cam slide d^4 of each needle bed is mounted an arm f which has at the front end a depending lug f', the latter, as the cam box is reciprocated, playing between the inner ends of the lugs a, b, or a' b', as the case may be.

Referring now to Fig. 2, it will be observed that the bars f are moving in the direction from left to right the bar f being in contact with the full end of the lug b of the cam bar e^4 of the acting set of needles (in this case the lower set) and the lug of the other bar f being in contact with the recessed portion of the lug b' of the cam bar e^4 of the upper or inactive set of needles. When the parts are in this position the cams of the lower bar e^4 occupy such relation to the needle actuating cams of the lower cam slide that the web holders E' will be raised in proper relation to the retracting needles of the acting set, for instance, on reference to Fig. 2 there are four raised web holders which are indicated by the four stars. The cams of the upper cam bar e^4, however, during this movement occupy such relation to the needle actuating cams of the upper cam box that they do not raise the web holders of the upper needle bed until the needles on the opposite side have been retracted sufficiently to prevent any interference therewith, as will be understood on reference to the stars indicating the four raised web holders of the upper bed. When the cam boxes have reached the limit of their movement to the right, the position of the cams is changed by reason of the movement of the slide bars d^3, the cams of the lower bed being raised out of action and those of the upper bed being drawn down into action. This causes the tripping of the lug b' by reason of the contact of the lug f' with the projecting portion of said lug b', as shown in Fig. 3, this tripping being permitted owing to the fact that said lug is pivoted at g to the cam bar e^4. On the backward movement of the cam box, however, a plate h suitably mounted upon said cam box acts upon the lug b' to restore it to its normal position, or, if desired, the restoration of the lug might be effected by a spring, as shown for instance by dotted lines in Fig. 2, as soon as its projecting end is released from the control of the lug f' of the upper bar f. The lug f' of the lower bar f is moved out of engagement

with the projecting end of the lug b shortly after the lower cam slide d^4 commences to rise when the cam box is approaching the limit of its movement toward the right, and by the time the cam box has reached this limit of movement and the cam slide has been fully lifted, the bar f occupies the position shown in Fig. 3. On the backward movement of the cam boxes, therefore, when the cam bars e^4 are operated by contact of the bars f with the lugs a a', the cams of the lower bar e^4 will occupy a position farther in the rear of the needle actuating cams than they did on the forward movement, the difference being equal to the depth of the recess c in the end of the lug b, and, correspondingly, the cams of the upper cam bar e^4 will occupy a position in respect to the needle actuating cams of the upper cam box in advance of the position which they occupied on the former movement, this advance being equal in extent to the depth of the recess c' in the end of the lug b', hence, on the backward movement, or movement from right to left, as represented in Fig. 4, the web holders of the upper needle bed will be raised in proper relation to the retracting needles of said bed, while the web holders of the lower bed will be raised in rear of said retracting needles, as indicated by the stars in Fig. 4.

In setting up a stocking on the patented machine both sets of needles are in action, this result being attained by limiting the movement of the slide bars d^3 so that they fail to throw either set of cams out of operative position, neither set of cams, however, occupying a fully depressed position because when both sets of needles are in action to form a tuck course, it is not desirable to draw full loops by either set of needles. Both sets of needles being in action, it becomes necessary to cause the web holders of both needle beds to rise at a point in the rear of the retracting needles and this is provided for by the fact that the bar f of the lower needle bed is not fully retracted so that its lug f' acts upon the recessed end of the lug b instead of upon the full end of the same, hence the cams of both bars e^4 follow the needle actuating cams to the same extent, and only raise the web holders after the needles have been so far retracted as to be out of the way of said web holders, as will be understood on reference to Fig. 5, it being understood that the setting up course is formed on the first movement of the cam boxes from left to right after casting off a finished stocking.

In connection with the central lift cam m' and side drawing down and lift cams m which are carried by the slide d^4 of the cam box d' of the bed B on which the heel and toe are formed, there are used fixed supplementary cams m^2 beyond the side drawing down cams m so that when on either movement of the cam box the bits of the needles leave said cams m, they will be raised by the cams m^2 so that on the reverse movement they will strike the backs of the cams m and will be lifted thereby, (see Figs. 4 and 5.) Said cams m^2 are such that they will lift the bits of the needles slightly above the bottoms of the draw cams m even when the latter are in the intermediate position which they assume when the setting up course is being formed, hence the needles, on this slight rise, would slacken the stitches so as to run the risk of slipping some of them in the absence of a counter-pull upon the needles of the opposite bed B'. I therefore use in connection with the cams m m' of the cam box d' of said bed B' a supplementary or "follower" cam intended to act upon the bits of the needles after they have left the regular drawing down cam m so as to continue to draw upon the stitches and confine them snugly to the needles in order to prevent them from being cast off because of insufficient tension upon them due to the slight rise of the opposite needles above referred to. One form of construction for this purpose is shown in Figs. 11, 12 and 13 of the drawings, on reference to which m represents the drawing down cam of the cam slide d^4, and n the follower cam adjacent thereto, this cam being carried by a slide n' vertically guided in the cam box, and having a beveled or V-shaped projection n^2 for the action of a longitudinal slide bar n^3 to which movement is imparted at the required times by contact of its ends with suitable stops on the frame of the machine in the same manner as the cam slides d^3, or, if desired, by contact with the same stops which act upon the latter. The slide bar n^3 has a beveled notch or recess n^4 adapted for the reception of the lug or projection n^2 when moved into line therewith.

When the cam slide d^4 is only partially depressed as in forming the setting up course, the bar n^3 is so moved as to act upon the lug n^2 and depress the bar n' and cam n, as shown in Fig. 11, hence, after the bits of the needles leave the drawing down cam m they are further depressed by the cam n and the stitches on said needles are thereby subjected to a further pull so as to hold them firmly upon the needles. When the cam slide d^4 is fully depressed, however, the bar n^3 is so moved that the lug n^2 can enter the recess n^4 and the slide bar n' and cam n will hence be raised by the spring n^5 to the position shown in Fig. 12, so that the bottom of the cam n is slightly above the bottom of the cam m, and hence fails to act upon the needle bits.

The cam n and slide n' retain the same position when the cam slide d^4 is elevated so as to carry the cams m m' out of action by lifting them above the bits of the needles, the bottom of the cam n in this case occupying a position slightly above the bottom of the cam m', as shown in Fig. 13.

After the setting up operation has been completed there is no movement whatever of the cam bar e^4 of the lower bed in which the needles are out of action, for the lug f' of the

lower bar f, as shown in Fig. 6, passes over the lug b which is somewhat shallower than the lug b', hence after the lower cam bar e^4 has been carried to the left on the backward movement of the lower cam box after completing the first course, there will be no further movement of said cam bar e^4 until the cam slide d^4 is again drawn down into operative position, when it becomes necessary to commence or resume the formation of tubular web. In forming the heel or toe, however, the lug f' of the upper bar f travels between the lug a' and the projecting end of the lug b' so that the element of lost motion due to the presence of the recess c' is eliminated and the web holders are raised in proper relation to the retracting needles of the set on both the right and left movement of the cam box, this being permitted owing to the fact that during the formation of the heel and toe the needles of the opposite bed are out of action altogether. The positions of the parts under these conditions of working are represented in Fig. 6.

In Figs. 7 to 10 I have illustrated a modification of my invention in which the cam bar e^4 has lugs a b acted upon by a slide i which is independent of the cam slide, and is adapted to be operated by a pin i' projecting from the back of the slide bar d^3 and entering an inclined slot i^2 formed in the slide. In this case also the end of the slide bar i is cut away as shown at i^3 so as to present portions in two different planes for acting alternately upon a pin b projecting from the back of the cam bar, as shown in Figs. 7 to 10.

The four views represent the positions of the parts under the various conditions of working, which, in the early part of the specification I have described with reference to Figs. 2, 3, 4, and 5, hence any more detailed description of this modification will be unnecessary.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination of the needle beds, their needles, the needle actuating cams movable into and out of operative position, the web holders, the cam bars for actuating the same, and means for actuating said cam bars whereby the cams of the web holders corresponding to the inactive needles occupy a position farther in the rear of the active set of needles on the reverse movement of the cam box than they did on the forward or acting movement of the same, substantially as specified.

2. The combination of the needle beds, their needles, the needle actuating cams movable into and out of operative position, the web holders, the cam bars for actuating the same, lugs on said cam bars, and slides for engaging with said lugs to move the cam bars, one of said lugs or slides being recessed to permit of a greater loss of movement of the cam bar in one direction than in the opposite direction, substantially as specified.

3. The combination of the needle beds, their needles, the needle actuating cams movable into and out of operative position, the web holders, the cam bars for actuating the same, lugs on said cam bars, a slide for engagement with said lugs to move the cam bars, one of said lugs or slides being so formed as to provide for two different degrees of lost motion in the movement of the bar, and for complete clearance of the slide when it is desired to stop the movement of the cam bar, substantially as specified.

4. The combination of the needle beds, their needles, the needle actuating cams movable into and out of operative position, the web holders, the cam bars for actuating the same, lugs on said cam bars, and slides for engaging with said lugs to move the bars, one of the lugs of one bar being pivoted so as to yield on the downward movement of the slide, substantially as specified.

5. The combination of the needle beds, their needles, the needle actuating cams movable into and out of operative position, the web holders, the cam bars for actuating the same, lugs on said bars, slides for engaging with said lugs to move the cam bars longitudinally, and means for moving said slides transversely, one of said lugs or slides being recessed for causing greater lost motion in one direction than in the other, substantially as specified.

6. The combination of the needle beds, their needles, the needle actuating cams, the cam boxes, cam slides movable transversely in said cam boxes, web holders, cam bars for actuating the same, lugs on said cam bars, and slides carried by the cam slides and engaging with said lugs to move the cam bars, one of said lugs or slides being recessed to provide for greater lost motion in one direction than in the other, substantially as specified.

7. The combination of the fixed drawing down cam of the cam box, with a supplementary or follower cam movable into and out of operative position and serving to impart further draft to the needles after they leave the fixed cam, and a supplementary cam bar, as n^3, for moving said follower cam, substantially as specified.

8. The combination of the fixed drawing down cam, with a supplementary cam movable into and out of operative position, and serving to impart further draft to the needles after they leave the fixed cam, a spring for raising said follower cam, and a supplementary cam bar, as n^3, for depressing the same, substantially as specified.

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

JOHN G. POWELL.

Witnesses:
JOSEPH H. KLEIN,
HARRY SMITH.