No. 673,163. Patented Apr. 30, 1901.

G. EICHENLAUB.

KNITTING MACHINE.

(Application filed Feb. 26, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

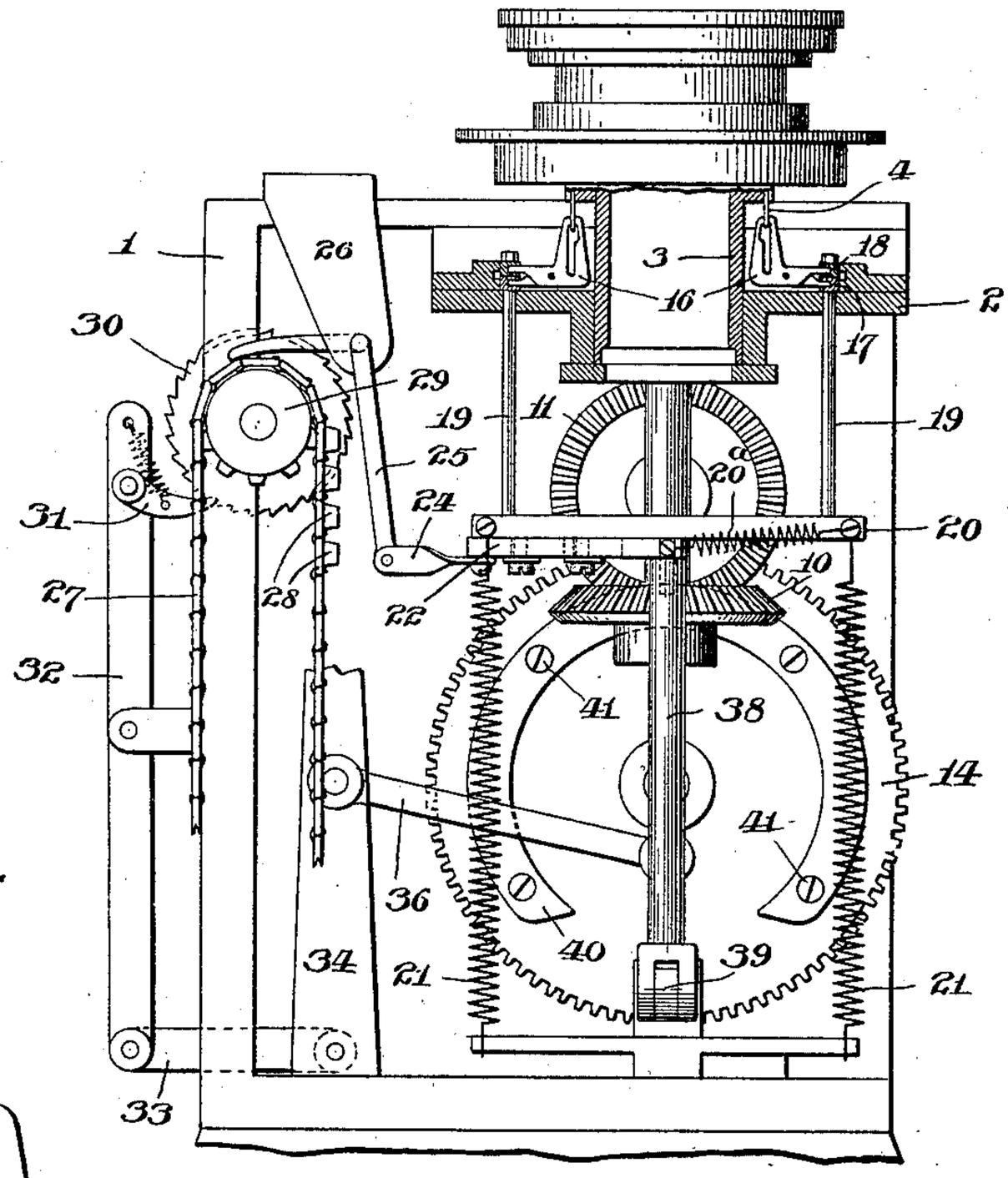


Fig. 4.

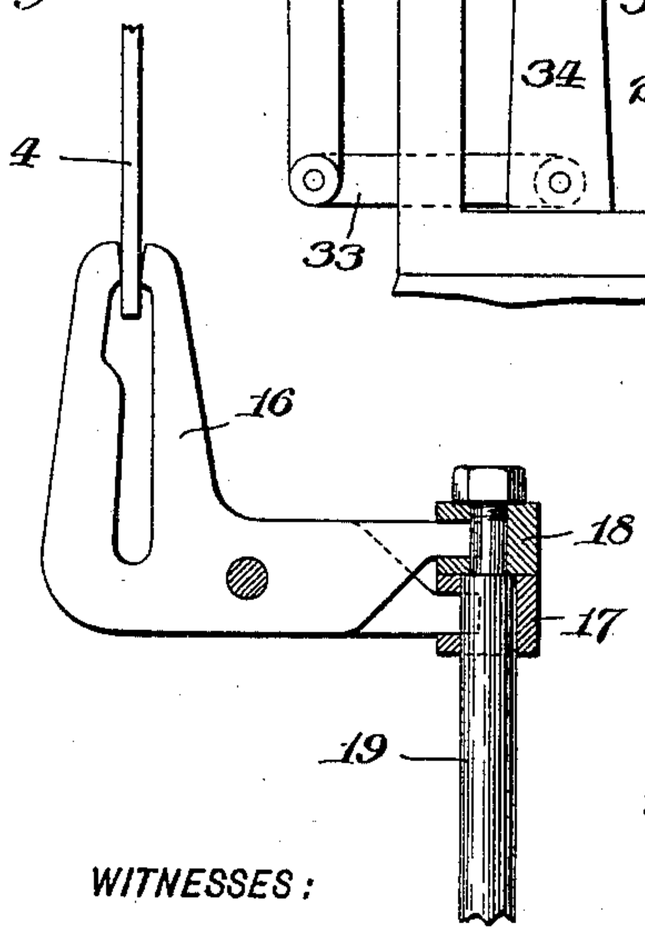


Fig. 3.

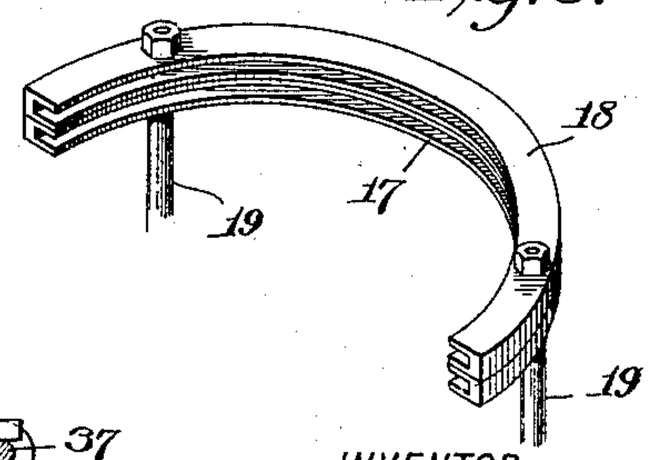
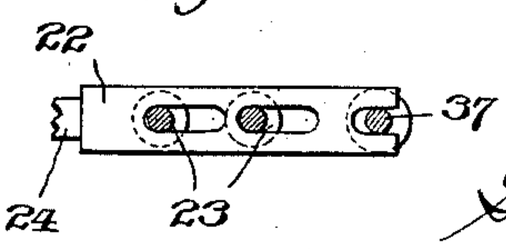


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2

Fig. 2.

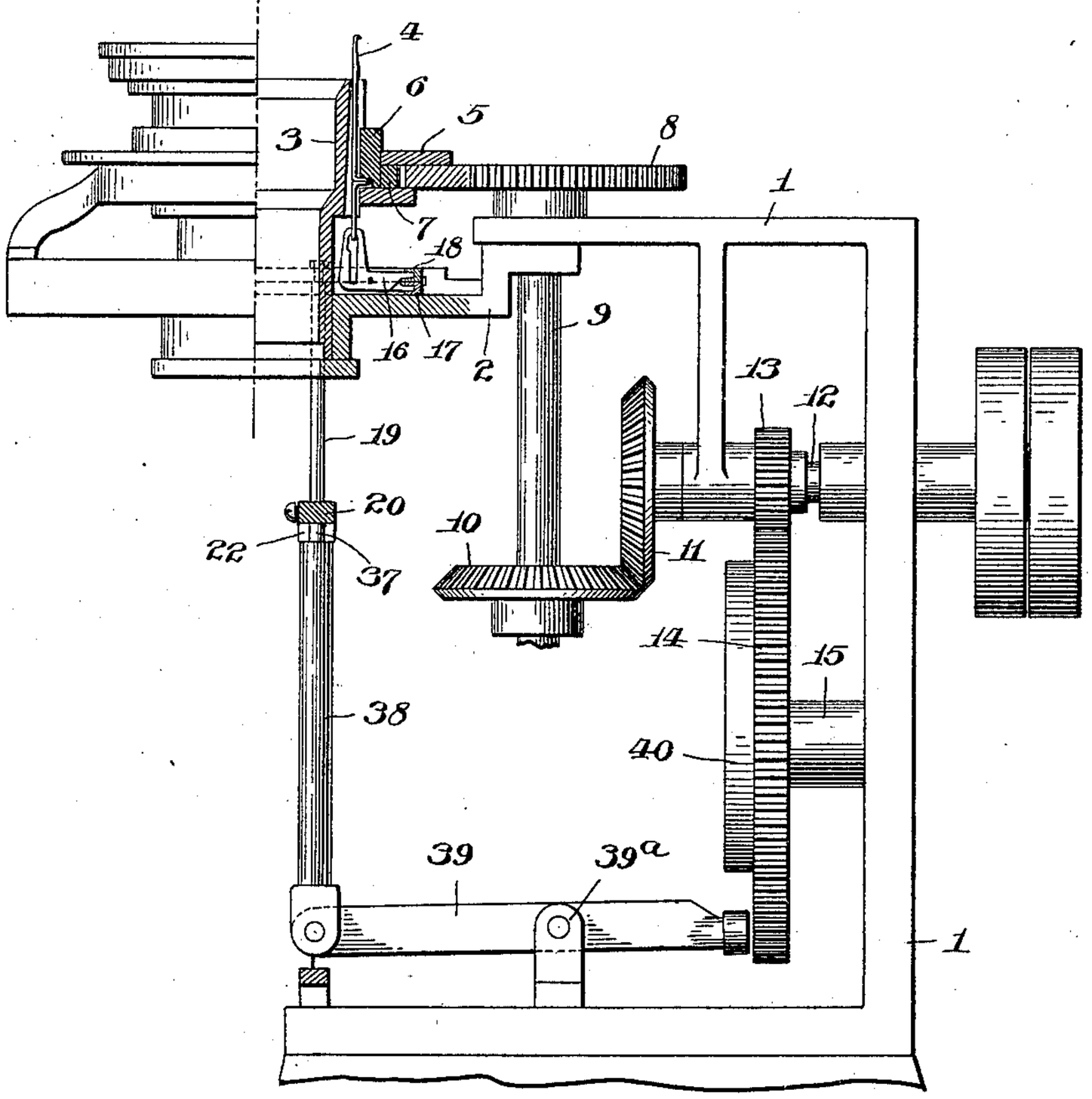
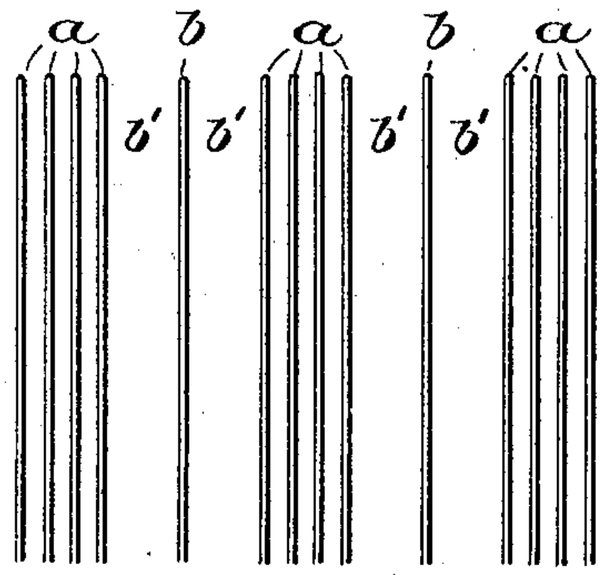


Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORGE EICHENLAUB, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THOMAS BUCK AND COMPANY, OF SAME PLACE.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 673,163, dated April 30, 1901.

Application filed February 26, 1900. Serial No. 6,445. (No model.)

To all whom it may concern:

Be it known that I, GEORGE EICHENLAUB, a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

The object of my invention is to provide a simple and efficient mechanism whereby the needles of a knitting-machine may be operated and controlled to produce a lace or open work effect in a predetermined part or parts of the knitted web, and thereby enable the formation of a variety of novel patterns or designs in the fabric and for other purposes.

The invention is applicable either to circular or to straight knitting machines, but more especially to that class of the former wherein fashioning mechanism is employed for rendering certain needles active and inactive in respect to the knitting-cams in the formation of the heel and toe parts of stockings.

The invention is herein shown and described in connection with that type of circular machines wherein needles are rendered active and inactive by shifting the same radially toward and from the path of the knitting-cams, the particular machine selected being that illustrated in Letters Patent of the United States No. 538,518, dated April 30, 1895, to which reference may be had.

In the drawings, Figure 1 is a sectional elevation of a portion of a knitting-machine embodying my invention. Fig. 2 is a similar elevation at right angles to Fig. 1, the pattern mechanism being omitted. Fig. 3 is a perspective of the main and supplemental segment for controlling the "back" needles. Fig. 4 is a sectional detail thereof, including a pair of needle-shifting levers. Fig. 5 is a sectional detail of the slide-plate and immediate connections for controlling the operation of the supplemental segment. Fig. 6 is a diagram of the "back-half" needles.

1 designates the main frame; 2, a bed or bracket thereon; 3, the needle-cylinder, supported by the latter, and 4 the needles, fitted in the peripheral grooves of said cylinder, so as to be radially as well as longitudinally movable therein.

5 is a stationary ring surrounding the needle-cylinder, and 6 is the rotatable cam-cylinder, supported by said ring. The cam-cylinder carries the usual knitting-cams, by means of which the needles when in active position are reciprocated. This cylinder is provided with an encircling gear-ring 7, with the teeth of which coacts a gear 8 on the upper end of a vertical shaft 9, the lower end of the latter being equipped with a bevel-gear 10, which coacts with a similar gear 11 on the driving-shaft 12. On the latter shaft is a pinion 13, which gears with a spur-wheel 14 on an underlying shaft 15, such spur-wheel in the said patented machine being connected with certain mechanism for imparting a reciprocating movement to the cam-cylinder during the knitting of the heel or the toe of a stocking. It is of course unnecessary herein to show or describe such reciprocating mechanism.

The particular needles illustrated are those technically termed the "back-half," which are rendered inactive in respect to the knitting-cams preparatory to the reciprocating operation, but which needles, in fact, while in operation effect the knitting of the entire front portion of the stocking. The lower depending extensions of the needle-shanks are fitted to the up-projecting slotted members of bell-crank levers 16, to the end that by oscillating the latter on their fulcra the said needles shall be shifted radially into and out of action relative to the knitting-cams. In the said patented machine the horizontal members of these crank-levers were fitted to a grooved segment 17, by the vertical reciprocation of which the levers and needles were controlled. In the present construction, however, certain needles are omitted, while the levers of certain other needles are constructed to engage the groove of a supplemental segment 18, imposed on the main segment, whereby when such supplemental segment is independently raised and lowered only those levers connected therewith are actuated to effect the production of open or lace work in the body of the fabric. In Fig. 6 of the drawings the back needles are indicated in sets

of four, *a*, which are those connected with the main segment, and interspersed single needles *b*, which are those connected with the supplemental segment, the latter needles being separated from the adjacent sets by spaces *b'*, from which needles are omitted. Of course the order in which the said needles are arranged may be varied to meet particular requirements. The arrangement of needles in sets and the actuation thereof for the general purpose mentioned are old. Besides, the supplemental segment for rendering certain needles active and inactive in the said patented machine was employed prior to my invention, the said segment being carried by a frame comprising in its construction rods 19, passing freely through orifices in the lower segment, so as to be reciprocable vertically without affecting the latter, and being connected at their lower ends by a cross-bar 20, held yieldingly depressed by retracting-springs 21, secured thereto and to the main frame. One part of my invention comprehends a somewhat specific construction and organization of devices whereby the said supplemental ring is effectively controlled for the production of the open or lace work portion or portions of the web, while another feature pertains, broadly, to mechanism whereby the needles employed in the formation of the open or lace work effect may be operated to produce plain or regular work at predetermined intervals in the knitting operation, and thereby enable the formation of a variety of effects with open and regular work in alternation, as well as the production of a fabric which not only is more durable and less liable to ravel than one with a continuous series of rows of lacework throughout its length, but, among other advantages, may be more expeditiously applied to the points of the "looper" in the closing of the usual toe-gap.

Referring to the novel features of my invention, 22 is a longitudinally-movable plate arranged on the under side of the cross-bar 20 and maintained in a normal position by a retracting-spring 20^a, secured thereto and to the bar. This plate is secured to the bar by pin-and-slot connections 23 or other suitable means and is connected by means of a link 24 with one arm of a bell-crank lever 25, fulcrumed on a lug or bracket 26 on the main frame. The other arm of the lever extends in proximity to an intermittently-movable pattern-chain 27, provided with suitably-located high links 28, which at predetermined times abut against and raise such arm, and thereby effect the retraction of the slide-plate in opposition to the stress of the spring 20^a. In the present instance the shaft carrying the sprocket-wheel 29 for the pattern-chain is provided with a ratchet-wheel 30, with which coacts a pawl 31 on the upper end of a vibratory lever 32, the latter being connected by a link 33 with a radius-bar 34, which is in turn eccentrically connected with the gear-wheel 14 by a link 36.

The forward end of the slide-plate is bifurcated and is adapted when in its normal position to embrace a stud 37, depending from the cross-bar 20. At the same time the lower face of the slide-plate is in contact, or nearly so, with the upper socketed end of a vertical rod 38, into which said pin freely extends. The lower end of this rod is pivoted to one end of a rock-lever 39, fulcrumed to a bracket 39^a on the main frame, the other end of the lever extending in close relation to a segmental cam 40 on the face of the gear-wheel 14, whereby during the rotation of said wheel the lever is oscillated and the rod 38 vertically reciprocated. When the lever-arm is bearing against the periphery of the cam, said arm is held in depressed position and the rod 38 is perforce raised. If at this period the bifurcated end of the slide-plate 22 be between the rod and the cross-bar, said plate, and therewith the bar, with its connected segment 18, will be correspondingly raised in opposition to the retracting-springs 21, in which case the series of needles engaged with the segment will be in inactive position, and in consequence the threads in the successive courses of the fabric being knit will loosely span the inactive needles. When, however, the open space of the cam 40 reaches the lever-arm, the latter, being free, will permit the rod and its connections to resume their normal or depressed position, in which case the said needles will be rendered active, and in the knitting of the next succeeding course the stitches formed thereby will tie together the intervening loose threads, and thus produce the desired lace effect in the fabric.

It will be obvious that when the slide-plate 22 is retracted from the upper end of the rod 38 the cross-bar, with its connections, will remain in the down position even though the arm of lever 39 be engaged with the cam 40 and the rod 38 be thereby raised and that in consequence the machine will proceed with the knitting of regular work with all the needles in action. Hence by properly locating the high links 28 on the pattern-chain the slide-plate may be retracted at certain times and for certain periods, so as to produce courses of plain work in alternation with the open-work courses or in any other desired order.

Inasmuch as the length of the segmental cam on the face of the wheel 14 determines the number of courses produced before the inactive needles are moved into operative position for and during the production of the lacework effect, I preferably detachably secure such cam to the wheel by screws 41 or the like, whereby one cam may be readily removed and another, either larger or smaller, substituted therefor, as occasion may require.

I claim—

1. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier and its knitting-cams, of a reciprocative frame, operative connections between

the same and certain needles whereby the latter may be rendered active and inactive in respect to the knitting-cams, a rock-lever, operative connections between the same and said frame, a wheel, actuating mechanism therefor, and a cam on the face of said wheel for actuating the said lever during the rotation of the wheel, substantially as described.

2. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier and its knitting-cams, of a reciprocative frame, operative connections between the same and certain needles whereby the latter may be rendered active and inactive in respect to the knitting-cams, a rock-lever, operative connections between the same and said frame, a wheel, its shaft, a detachable cam on said wheel for actuating said lever, and means for driving said wheel, substantially as described.

3. In a circular-knitting machine having therein a circular series of latch-needles, the combination with means for throwing the "back half" of said needles out of and into operation preparatory to and upon the completion of reciprocating work, respectively; mechanism for rendering certain of said "back needles" active and idle at predetermined intervals during the production of tubular work, and means for automatically rendering such mechanism inoperative for prescribed periods during the production of tubular work substantially as described.

4. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier and its cams, of a reciprocative frame, operative connections between the same and certain needles whereby the latter may be rendered active and inactive in respect to the said cams, mechanism for operating said frame, and means for periodically rendering such mechanism operative and inoperative in respect to said frame, substantially as described.

5. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier and its cams, of a reciprocative frame, operative connections between the same and certain needles whereby the latter may be rendered active and inactive in respect to the said cams, a rock-lever, a rod pivoted thereto and adapted to coact with said frame, a cam for actuating said lever, means for supporting and operating the cam, and means whereby said rod may be rendered active and inactive in respect to the said frame, substantially as described.

6. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier, its cams, and means for rendering the "back-half" needles active and inactive at certain times, such means including a device for independently rendering a number of such needles active and inactive in respect to the said cams, a reciprocative support for said device, mechanism for operating said support, and means for throwing such mechanism into and out of operation in respect to the support at predetermined intervals, substantially as described.

7. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier and its cams, of a reciprocating frame, operative connections between the same and certain needles whereby the latter may be shifted into and out of operative position relative to the said cams, mechanism for actuating said frame, a movable member between such mechanism and the frame, a pattern mechanism, and connections between the same and said member, substantially as described.

8. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier and its cams, of a reciprocative frame, operative connections between the same and certain needles whereby the latter may be shifted into and out of operative position in respect to the said cams, a vertically-reciprocative member to actuate said frame, means for reciprocating said member, a slide affording a movable connection between said rod and frame, a pattern mechanism, and operative connections between the same and said slide, substantially as described.

9. In a knitting-machine, the combination with the needle-support, its needles, the cam-carrier and its cams, of a reciprocative frame, operative connections between the same and certain needles, whereby the latter may be shifted into and out of operative position in respect to the knitting-cams, a vertically-reciprocative rod having a sliding connection with said frame, a lever connected with said rod, cam mechanism for actuating said lever, a slide movable to and from the upper end of said rod, a pattern mechanism, and operative connections between the same and said slide, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

GEORGE EICHENLAUB.

Witnesses:
WILLIAM T. BUCK,
ANDREW V. GROUPE.