

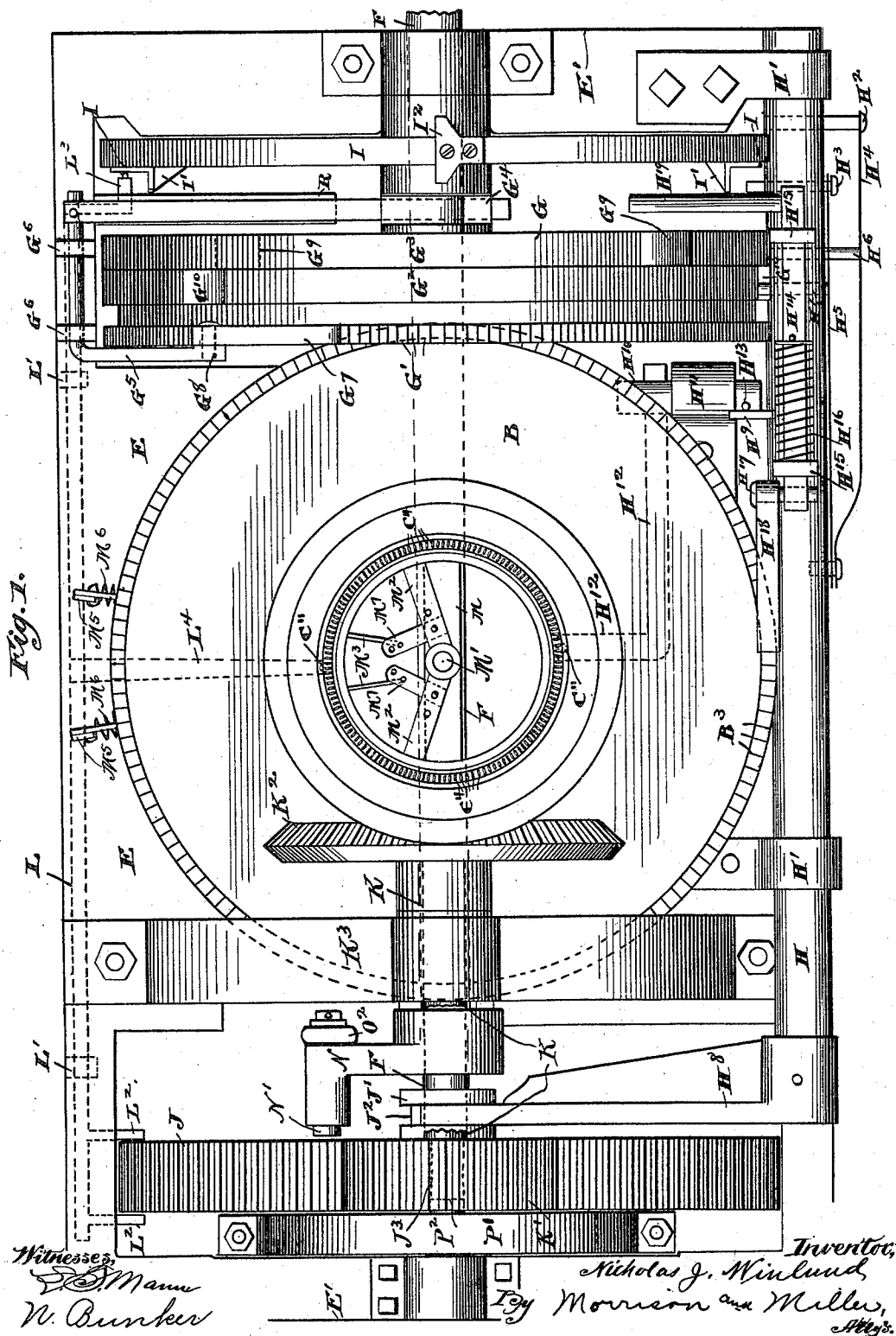
(No Model.)

5 Sheets—Sheet 1.

N. J. WINLUND.
CIRCULAR KNITTING MACHINE.

No. 585,496.

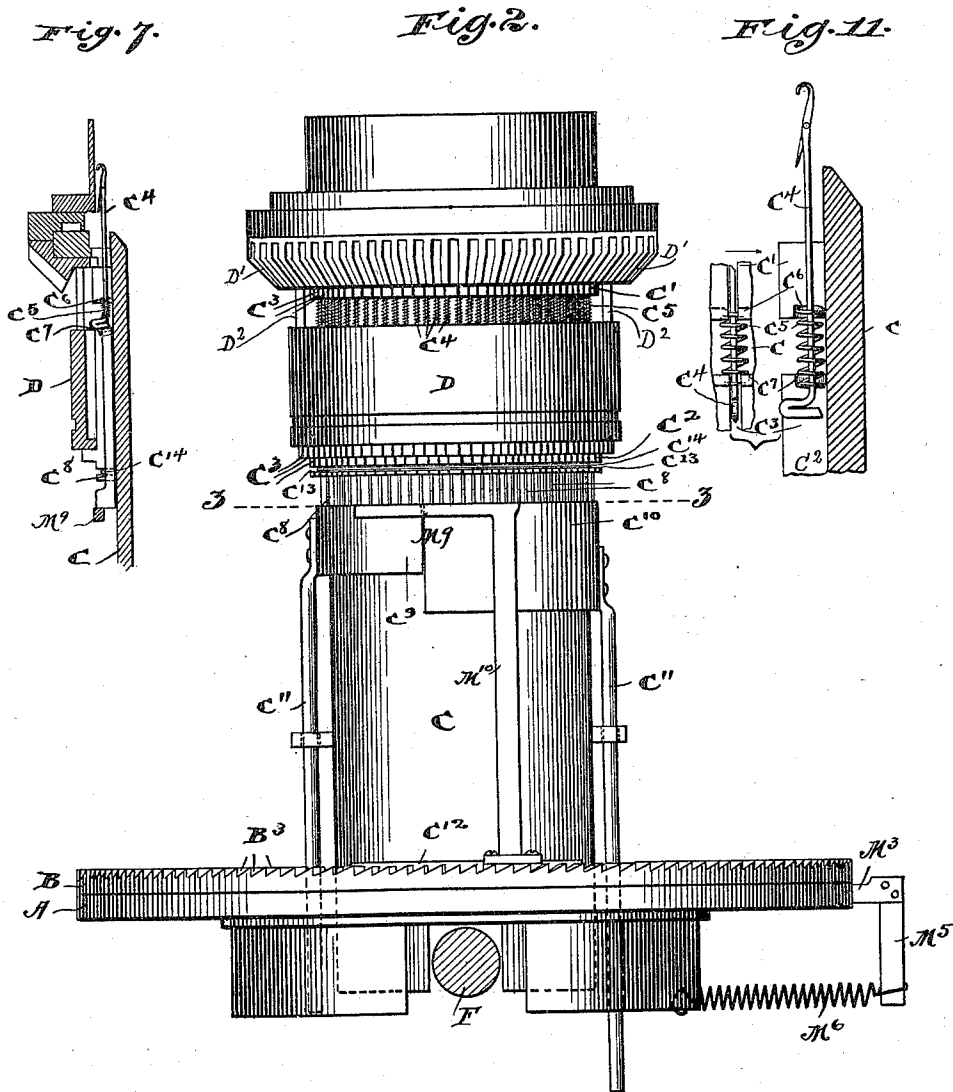
Patented June 29, 1897.



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Witnesses,
J. D. Mann.
N. Bunker

Inventor,
Nicholas J. Winlund.
By Morrison and Miller
Atty.

5 Sheets—Sheet 3.

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Fig. 3.

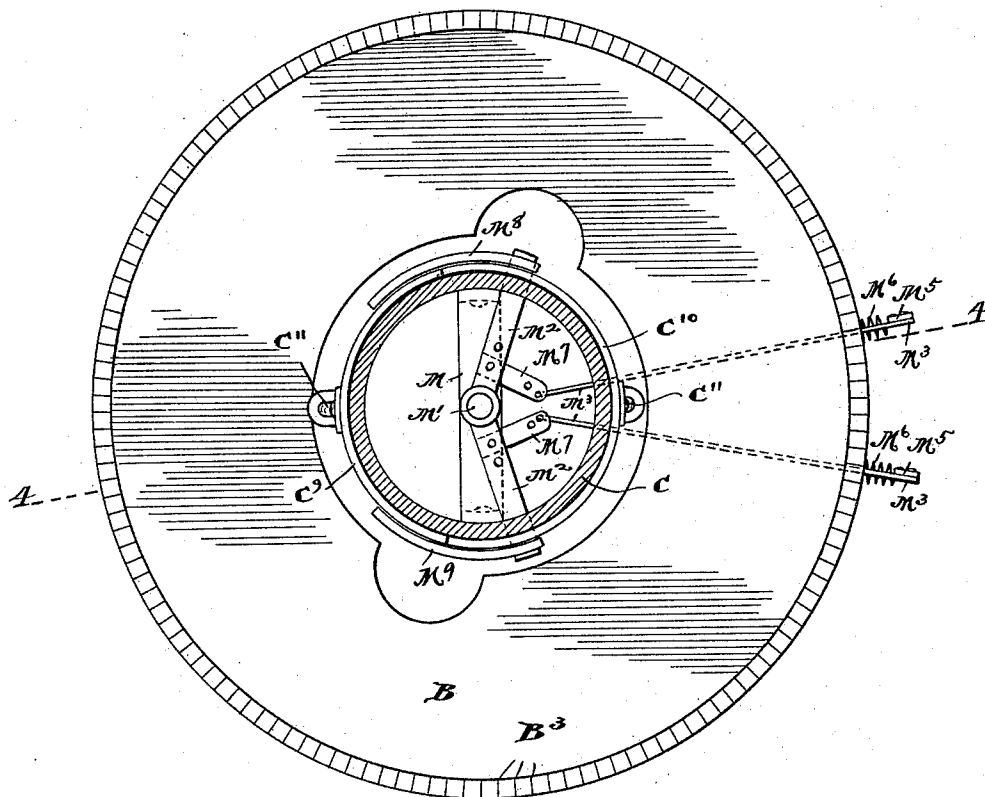
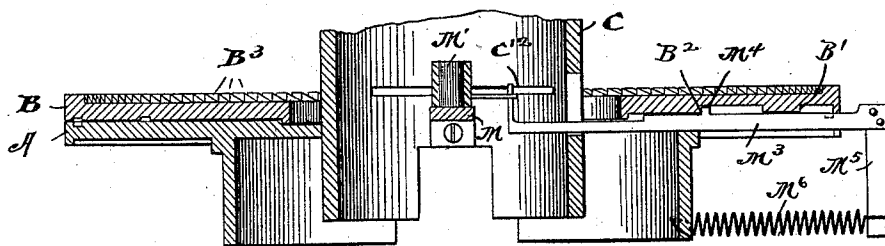


Fig. 4.



E. Mann.

N. Bunker.

Nicholas J. Winlund.

By Morrison and Miller.

Atty's.

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Fig. 5.

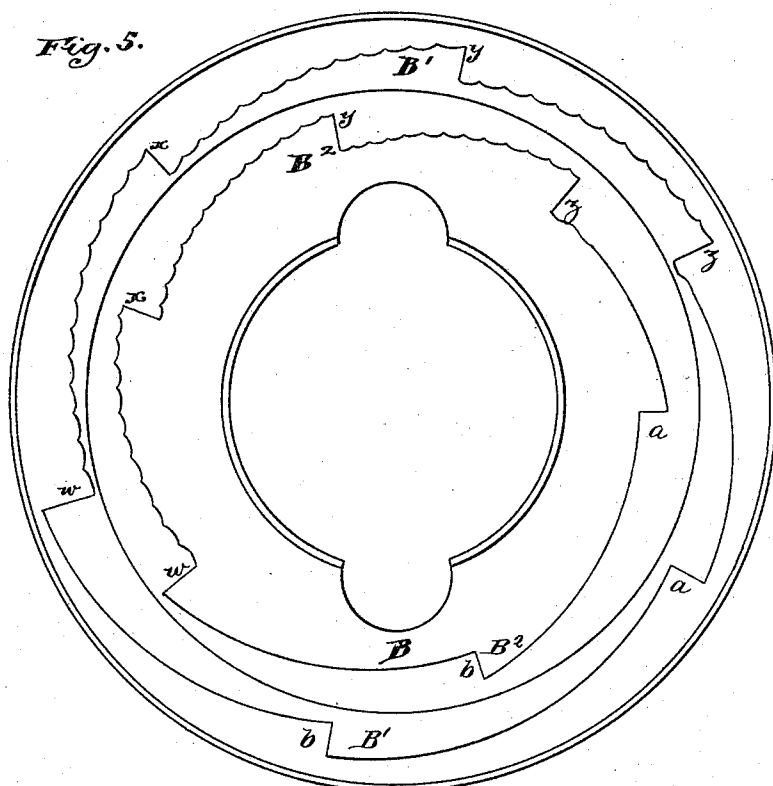
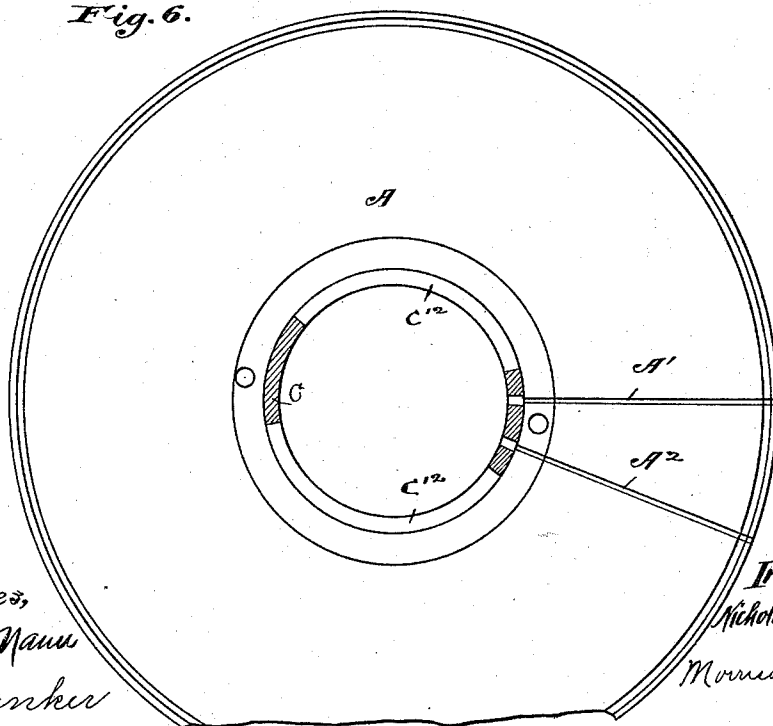


Fig. 6.



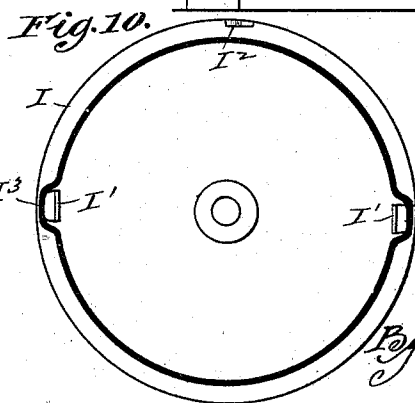
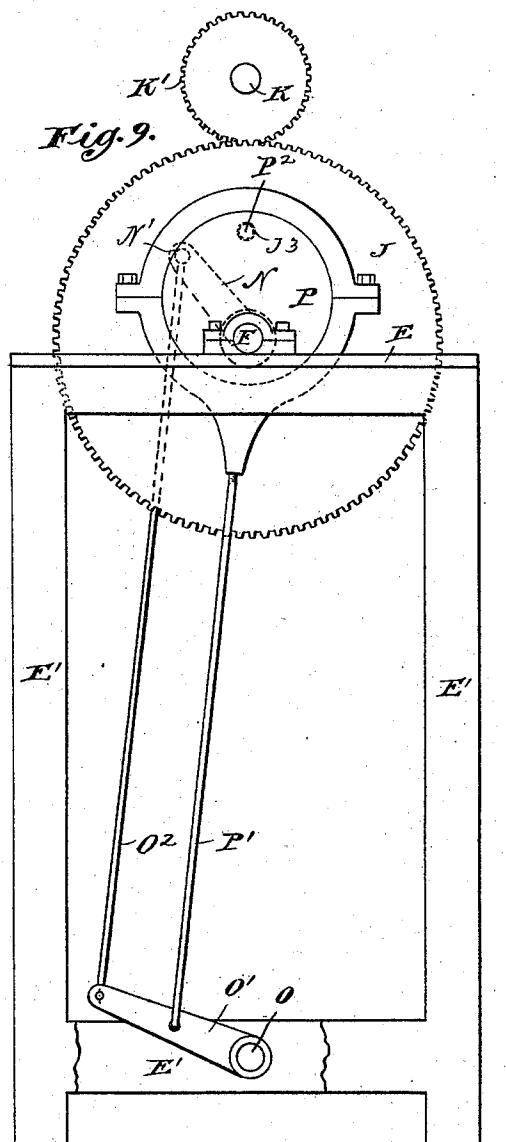
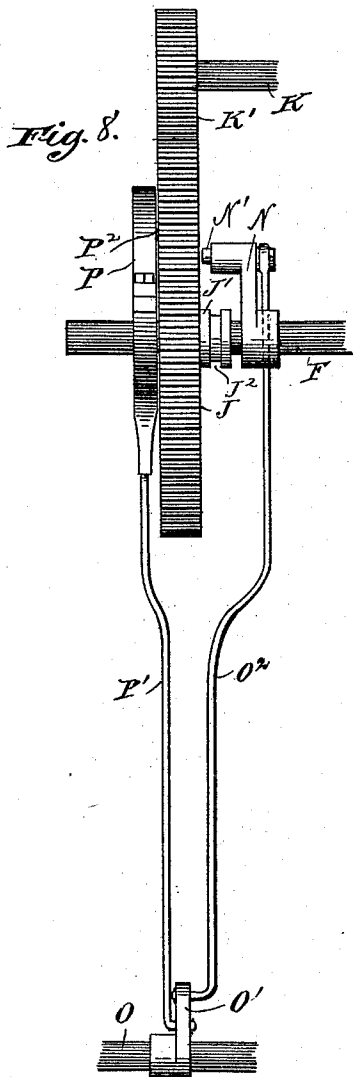
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UNITED STATES PATENT OFFICE.

NICHOLAS J. WINLUND, OF ROCKFORD, ILLINOIS.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 585,496, dated June 29, 1897.

Application filed July 11, 1896. Serial No. 598,885. (No model.)

To all whom it may concern:

Be it known that I, NICHOLAS J. WINLUND, a citizen of the United States, residing at Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Circular-Knitting Machines, of which the following is a specification.

The object of this invention is to produce a circular-knitting machine in which the number of needles employed in knitting the heel is greater than the number used in forming the toe, whereby the heel is made full and the stocking sufficiently loose over the instep. In the machine herein shown and described I also provide means for retaining the needles in an upright position without employing the usual inclosing ring or band for that purpose, by which means each needle is held independently of the others.

In the accompanying drawings, which form a part of this specification, Figure 1 is a top plan view of a knitting-machine embodying the features of my invention. Fig. 2 is an elevation of the head of the knitting-machine. Fig. 3 is a horizontal section on dotted line 3 3 in Fig. 2. Fig. 4 is a vertical section on dotted line 4 4 in Fig. 3. Fig. 5 is a bottom plan view of the pattern-wheel, only the cams employed in narrowing while knitting the heels being shown, the cams governing the narrowing while knitting the toes being omitted. Fig. 6 is a view of the base-plate of the machine, the needle-cylinder being cut away. Fig. 7 is a fragmental vertical section through the needle-cylinder, showing only one side thereof, together with the adjacent parts. Fig. 8 is a side elevation of the mechanism which produces the change in the cam-ring from rotary to oscillatory motion, and vice versa. Fig. 9 is an end view of the same. Fig. 10 is a face view of a cam-wheel. Fig. 11 is an enlarged fragmental view of a needle and the means for holding it in the needle-cylinder.

A is a base-plate of substantially the usual form.

A' and A² are radial grooves in the upper face of the base-plate.

B is a pattern-wheel supported by the base-plate A and is free to rotate thereon.

B' B² are cams on the under face of the pattern-wheel for controlling the fashioning-needles while narrowing.

B³ are ratchet-teeth on the face of the pattern-wheel B.

C is a needle-cylinder secured to the base-plate A.

C' C² are integral rings at the upper end of the needle-cylinder.

C³ are needle-grooves cut through both of the rings C' C².

C⁴ are needles in the needle-grooves.

C⁵ are coiled springs encircling so much of the needle-shanks as lie between the rings C' C². In order to retain the needles in an upright position in the cylinder C, the adjacent edges of the rings C' C² have been so channeled as to leave projecting edges C⁶ C⁷ thereon for retaining the springs C⁵ and the needles C⁴ in their cylinder C.

C⁸ are needle-slides, one of which lies in each of the needle-grooves below its needle.

C⁹ C¹⁰ are vertically-movable segments for the needle-slides. The segment C¹⁰ extends somewhat more than half-way around the needle-cylinder C.

C¹¹ are stems which support the segments C⁹ C¹⁰.

C¹² are narrow horizontally-extending openings through opposite sides of the needle-cylinder C.

C¹³ is a channel cut in the ring C².

C¹⁴ is a cord or band for retaining the needle-slides C⁸ in the needle-grooves C³.

D is a cam-ring of the usual form.

D' is a cogged ring above the cam-ring D. D² are pins fixed in the cam-ring D and entering openings in the cogged ring D' for causing the rings to rotate together.

E is the bed of the supporting-frame E' of the machine.

F is a main shaft journaled therein.

G is a governor-wheel loosely mounted on the shaft F, the periphery whereof is divided into three circular parts.

G' are ratchet-teeth formed on one of the parts of the governor-wheel G. G² G³, the

remainder of those parts, are cam-surfaces. These cam-surfaces are composed of two regularly-curved rings, each broken only by two depressions or pockets at nearly opposite points in their peripheries.

5 G^4 is a wiper-cam of the usual form fixed on the main shaft F.

G^5 is a two-arm rock-shaft.

G^6 are bearings for the shaft G^5 .

10 G^7 is a gravity-pawl for engaging the ratchet-teeth G' of the governor-wheel G.

G^8 is a pivotal pin set in one of the arms of the rock-shaft G^5 and forms a pivotal support for the pawl G^7 .

15 G^9 are cam depressions in the cam-surface G^3 of the governor-wheel G. G^{10} are like depressions in the cam-surface G^2 of the governor-wheel G.

20 H is a shaft, capable of an endwise-sliding movement, mounted on the bed E of the supporting-frame.

H' are the bearings of the shaft H.

25 H^2 H^3 are pins extending through openings in the shaft H and are capable of a free movement therethrough.

H^4 H^5 are flat springs for the pins H^2 H^3 , respectively, for thrusting the pins inward through the openings in the shaft H.

30 H^6 is a pin extending through an opening in shaft H and lies between the spring H^4 and the cam-surface G^3 of the governor-wheel G.

35 H^7 is a pin which extends through an opening in the shaft H, between the spring H^5 and the cam-surface G^2 of the governor-wheel G.

H^8 is an arm fixed on the shaft H, its free end being in yoke form.

H^9 is a pin extending inward from the shaft H and is fixed rigidly in relation thereto.

40 H^{10} is a rock-shaft.

H^{11} is a bearing for the rock-shaft H^{10} .

45 H^{12} is an arm extending from and is fixed to the rock-shaft H^{10} , and at its opposite end lies under and supports the stem C^{11} of the vertically-movable segment C^9 .

H^{13} is a pin rigidly set in the rock-shaft H^{10} and engages the pin H^9 .

H^{14} is a spring-actuated push-rod.

50 H^{15} are bearings for the push-rod H^{14} , which bearings are fixed to the shaft H.

H^{16} is a coiled spring surrounding the push-rod H^{14} and tending to actuate the push-rod H^{14} in one direction.

55 H^{17} is a pin fixed in one end of the push-rod H^{14} and extends inward therefrom.

H^{18} is a gravity-pawl pivoted upon the inner end of the pin H^{17} and engages the ratchet-teeth B^3 on the face of the pattern-wheel B.

60 H^{19} is a pin fixed on the push-rod H^{14} and extends inward therefrom.

I is a wheel fixed on the shaft F.

65 I' are two fin-cams fast to the face of the wheel I near its periphery. These fin-cams engage with the pin H^{19} , slide the push-rod H^{14} against the action of the spring H^{16} , and through the pawl H^{18} and the ratchet-teeth B^3 rotate the pattern-wheel B.

I^2 is a double wing-cam fixed on the periphery of the wheel I. This wing-cam engages with the pins H^2 H^3 alternately on either side of the wheel I, as the governor-wheel permits them to lie in the course of the wing-cam I^2 . 70

I^3 are cam-grooves in the face of the wheel I.

J is a gear-wheel loose on the main shaft F. 75

J' is a hub extending from the gear J.

J^2 is a channel formed in the hub J' for receiving the yoke end of the arm H^8 .

J^3 is an opening in the gear-wheel J.

K is a shaft. 80

K' is a gear meshing with the gear J and fixed on the shaft K.

K^2 is a beveled gear mounted upon the shaft K.

K^3 is a standard supporting the shaft K. 85

L is a rock-shaft capable of a slight endwise movement.

L' are supporting-brackets for the rock-shaft L.

L^2 are fingers extending inward from the rock-shaft L, embracing the rim of the gear-wheel J. 90

L^3 is a right-angle pin fixed to the opposite end of the rock-shaft L and engages the cam-groove I^3 in the face of the wheel I during the operation of narrowing. 95

L^4 is an arm fixed on the rock-shaft L near its middle portion. This arm lies under the stem C^{11} of the vertically-movable needle-slide rest C^{10} and imparts to that rest a reciprocating motion during the narrowing process in knitting. 100

M is a bar extending through the lower part of the needle-cylinder and is fixed therein.

M' is an upright stud in the center of the bar M. 105

M^2 are arms pivotally mounted upon the stud M' and extend through the openings C^{11} in the sides of the needle-cylinder C.

M^3 are cam-rods adapted to lie in the radial grooves $A' A^2$ of the base-plate A and have upwardly-turned inner ends. 110

M^4 are studs projecting upwardly from the rods M^3 and engaging the cams $B' B^2$ of the pattern-wheel B.

M^5 are downwardly-extending arms fixed in relation to the rods M. 115

M^6 are springs connected with the arms M^5 and tending to draw the rods M^3 inward.

M^7 are links connecting the arms M^2 with the upwardly-turned ends of the rods M^3 . 120

M^8 M^9 are segments for supporting the needle-slides C^8 .

M^{10} are stems secured to the arms M^2 for supporting the segments M^8 and M^9 . 125

N is an arm loose on the shaft F.

N' is a pin set in the free end of the arm N and extends parallel with the shaft F. This pin is adapted to engage the opening J^3 in the gear-wheel J. 130

O is a rock-shaft journaled in the lower part of the supporting-frame E' of the knitting-machine.

O' is an arm mounted on the shaft.

O² is a rod connecting the free ends of the arms N O'.

P is an eccentric fixed on the shaft F.

P' is an eccentric-rod having a connection with the arm O' intermediate its ends.

P² is a pin extending from the face of the eccentric P and is adapted to enter and engage the opening J³ through the gear-wheel J.

The gear-wheel J is free to be moved on the shaft F into such position that the pin P² will enter the opening J³ therein, and a continuous rotary motion will be thereby imparted to the gear-wheel J. When, however, the gear-wheel J is moved away from the eccentric and the pin N' of the rock-arm N engages the opening J³ of the gear-wheel J, the latter wheel will be oscillated on the constantly-revolving shaft F by reason of the action of the eccentric on the rock-arm O' and the connection between that rock-arm O' and the rock-arm N. The gear-wheel J is shifted by the arm H³, as will be explained hereinafter.

R is a flat spring for holding the long arm of the rock-shaft G⁵ upwardly against the cam G⁴.

To operate the knitting-machine, motion is transmitted to the cam-ring D through the main shaft F, the gear-wheels J K', and the beveled gear K² in the usual manner. In knitting round and round the cam-ring D is rotated continuously. In knitting back and forth it is oscillated. The segment C⁹ supports the back needles, which, when the machine is knitting back and forth, are elevated out of action. The segment C¹⁰ supports the fashioning-needles and during the operation of knitting back and forth has a vertically-reciprocating movement. The segments M⁸ M⁹ alternate in a step-by-step movement toward each other around the needle-cylinder and pick up and hold out of engagement the fashioning-needles, first one on one side and then one on the other of the needle-cylinder. This alternate step-by-step movement is imparted to the segments M⁸ M⁹ through the pivoted arms M² by the action of the cams B' B² of the pattern-wheel B, which pattern-wheel during the operation of narrowing is rotated by the pawl H¹³, connected with the push-rod H¹⁴, which is reciprocated longitudinally by the action of the pin H¹⁹, engaged by the fin-cams I' of the wheel I and the spring H¹⁶. The governor-wheel G during the operation of the machine is constantly rotated by the pawl G, connected with the short arm of the rock-shaft G⁵, which is rocked by the cam G⁴ acting upon the long arm thereof. The machine knits a web of uniform diameter until the governor-wheel G has turned to a point which will allow the spring H⁴ to push the pin H⁶ into the depression G⁹ in the governor-wheel G, when the spring H⁴ will project the pin H² into the path of the wing-cam I². The engagement of the wing-cam I² with the pin H² slides the shaft H endwise to the opposite limit of its throw, changes the rotary motion of the cam-ring D

to an oscillating motion, and projects the pin H¹⁹ of the push-rod H¹⁴ into the path of the fin-cam I'. The endwise movement of the shaft H rocks the shaft H¹⁰ and its arm H¹², which latter lifts the needle-slide rest C⁹ and the back needles out of action, leaving only the fashioning-needles in action. Said endwise movement of the shaft H also moves the gear-wheel J through the arm H³ and throws the rock-shaft L into engagement with the cam-groove I³ in the face of the wheel I. The cam-groove I³ is so formed that it imparts a rocking motion to the shaft L, and by means of its connection with the segment C¹⁰ through the arm L⁴ and the stem C¹¹ gives to the said segment C¹⁰ a vertically-reciprocating movement. As the pattern-wheel B is rotated the cam-rods M⁸ are forced outward against the action of the springs M⁶, and as the segments M⁸ M⁹ are thereby caused to move alternately step by step toward each other around the needle-cylinder they pass one at a time, first from one side and then from the other, in alternation, beneath the lower ends of needle-slides C⁸, the segment M⁸ passing under the needle-slide adjacent thereto on one side and the segment M⁹ passing under the needle-slide adjacent thereto on the other. The remaining needle-slides and needles not held out of action by the segments M⁸ M⁹ again descend with the segment C¹⁰ into action, and after knitting across once are again elevated by the segment C¹⁰, and the segment M⁸ passes under another needle-slide and its needle and withdraws them from action. The segment C¹⁰ again descends with the remainder of the needle-slides and needles into action, and the needles, after knitting across once more and knitting one less stitch than before, are again elevated by the segment C¹⁰, and the segment M⁹ passes under another needle-slide and its needle and withdraws it from action. When the operation of narrowing has been continued to the extent desired, the cam-rods M⁸ are released by the cams B' B² on the pattern-wheel B, the studs M⁴ rest at the points *z* of said cam-surfaces, and the pattern-wheel ceases to rotate.

At the beginning of the narrowing process the studs M⁴ engage the cam-surfaces B' B² at *w*, and as the pattern-wheel B is turned the cam-surfaces press against the studs M⁴ and force their cam-rods M⁸ outward against the restraining action of the springs M⁶.

When the pattern-wheel B is turned until the points *z* of the cam-surfaces B' B² coincide with the studs M⁴, the cam-rods M⁸ are suddenly released, because of the conformation of the cam-surfaces at the points *z*, and are drawn inward by the action of the springs M⁶, thus causing the segments M⁸ M⁹ to fly backward, as before described, and let into action all the fashioning-needles except two, which the said segments had held out of action by their step-by-step movement toward one another around the needle-cylinder C. The

two needles remaining on the segments $M^8 M^9$ so remain because the points x are farther removed from the center of the pattern-wheel B than the points w , and therefore do not permit the segments $M^8 M^9$ to fly backward to their first position. The points y are also farther from the center of the pattern-wheel B than the points x , and when the studs M^4 coincide with said points y two of the fashioning-needles will remain upon each of the segments $M^8 M^9$. The pattern-wheel B is turned as before, causing the cam-surfaces $B^1 B^2$ to force the cam-rods M^3 outward and producing thereby step-by-step advances of the segments $M^8 M^9$. As the segments $M^8 M^9$ range themselves underneath the reciprocated fashioning-needles they hold said needles out of action one by one, first from one end of the row of fashioning-needles and then from the other, releasing them again as the points x and y pass under the studs M^4 of the cam-rods M^3 .

At x the cam-rods are held outward by the form of the cam-surfaces, so that the segments $M^8 M^9$ clear themselves of all except one needle-slide each. At y two needles at each end of the row of fashioning-needles are retained upon the segments $M^8 M^9$; but at z the said segments clear themselves of all needle-slides, and all the fashioning-needles are then in an operative position. This also is the position occupied by these needles when the points w are engaged by the studs M^4 of the cam-rods M^3 and before the fashioning process had commenced.

The operation just described completes the process of narrowing for the heel, and the work is ready for round-and-round knitting.

During the process of narrowing just described the governor-wheel G is turned by its pawl G^7 until at the completion of the narrowing it occupies such a position that the depression G^{10} therein coincides with and admits the pin H^7 , which lies between the spring H^5 and the face G^2 of the governor-wheel G. This inward movement of the pin H^7 (passing into the depression G^{10}) permits the spring H^5 to project the pin H^8 into the path of the wing-cam I^2 on the wheel I, which cam at its next revolution slides the shaft H endwise in its bearings and places the mechanism in position for round-and-round knitting. To this end and by the movement of the shaft H the gear-wheel J is removed from engagement with the arm N into engagement with the eccentric P, the pin P^2 of the eccentric entering the opening J^3 in the gear-wheel J, whereby a continuous rotary motion is imparted to the last-named gear-wheel. This movement of the shaft H also permits the rock-arm H^{12} , with the segment C^9 , which it supports, to move downward, thus allowing the needles to be pressed downward into action by their springs C^5 .

The narrowing for the toe is performed in substantially the same manner as that for the

heel described above with the exception that the points a and b in the cams of the pattern-wheel B are sufficiently removed from the center of that wheel to hold the segments $M^8 M^9$ from their extreme backward movement about the needle-cylinder, restricting the segment C^{10} to a manipulation of only one-half the needles in narrowing for the toe. As a consequence a portion of the needles used as fashioning-needles for the heel are back needles when the toe is being knit, they being held out of action by the segments $M^8 M^9$. These fashioning-needles are picked up by the segments $M^8 M^9$, governed by the steep inclines in the cams of the pattern-wheel just succeeding the points z , segment M^8 taking three and segment M^9 four needles from action at one movement.

The springs C^5 , which surround the needles C^4 , are compressed when the needles are raised in the needle-grooves by the segments $C^9 C^{10}$, and when the support of said segments $C^9 C^{10}$ is removed the springs force the needles downward into operative position. The springs also extend into the channels within the projecting edges C^6 and C^7 of the rings $C^1 C^2$ and insure the needles against displacement without the use of a band or cord for that purpose.

As suggested by the form of the cams $B^1 B^2$ of the pattern-wheel, the heel and toe of the stocking produced by my knitting-machine are each formed by the knitting of three narrowed gussets connected together at their edges.

I claim—

1. In a knitting-machine, in combination, a needle-cylinder, a needle therein, means for operating the needle to knit and a coiled spring surrounding the needle for retaining the needle in the needle-cylinder substantially as and for the purpose specified.

2. In a knitting-machine, in combination, a needle-cylinder, a needle therein, means for operating the needle to knit, and a coil-spring surrounding the needle-shank for pressing the needle longitudinally into an operative position substantially as and for the purpose specified.

3. In a knitting-machine, in combination, a needle-cylinder, a needle therein, means for operating the needle to knit, a two-part needle-groove for the needle and a spring on the needle for retaining the needle in the groove, substantially as and for the purpose specified.

4. In a knitting-machine, in combination, a needle-cylinder, a needle therein, means for operating the needle to knit, a two-part groove for the needle and a spring on the needle, which spring is compressed between the two parts of the needle-groove, substantially as and for the purpose specified.

5. In a knitting-machine, in combination, a needle-cylinder having needle-grooves therein, needles in the grooves, means for operating the needles, a segment for supporting the fashioning-needles, means for raising and low-

ering the segment and means for holding certain of the needles out of action, substantially as and for the purpose specified.

6. In a knitting-machine, in combination, a needle-cylinder, two integral rings on the cylinder having a channel in the adjacent edges of the rings, needle-grooves formed in the rings, needles for the grooves and a spring coiled about the shank of each needle and included between the integral rings, substantially as and for the purpose specified.

7. A needle-cylinder for circular-knitting machines having two integral circular rings, channeled in their adjacent edges and needle-grooves extending lengthwise of the cylinder through both of the rings, substantially as and for the purpose specified.

8. In a knitting-machine, in combination, a needle-cylinder having needle-grooves therein, needles in the needle-grooves, a cam for operating the needles, a segment for vertically moving the fashioning-needles, and segments for holding a part of the needles out of action, substantially as and for the purpose specified.

9. In a knitting-machine, in combination, a needle-cylinder having needle-grooves therein, needles in the grooves, a cam for actuating the needles, a segment supporting the fashioning-needles, means for raising and lowering the segment, two segments for holding a part of the needles out of action and means for moving the last-named segments into a position to support the idle needles, substantially as and for the purpose specified.

10. In a knitting-machine, in combination, a needle-cylinder having needle-grooves therein, provided with needles, a cam for operating the needles, needle-slides, a segment for supporting certain of the needle-slides and vertically moving the same, two segments for holding a part of the needles out of action, a pattern-wheel, means for rotating the pattern-wheel, a rod for each of the segments, a stud on each of the rods for engaging the pattern-wheel, and a connection between the rods and the last-named segments, substantially as and for the purpose specified.

11. In a knitting-machine, in combination, a needle-cylinder having needle-grooves therein, provided with needles and needle-slides, a cam for operating the needles, means for moving the needle-cam, a segment for supporting the fashioning-needles, two segments for holding needles out of action, a pattern-wheel for moving the last-mentioned segments, rods having studs for engaging the pattern-wheel, springs for the rods and links for the rods for actuating the segments, substantially as and for the purpose specified.

12. In a knitting-machine, in combination, a needle-cylinder, needles for the cylinder, a cam-ring for operating the needles, a driving-shaft, a gear-wheel loosely mounted and capable of a sliding movement thereon, an arm loosely mounted on the driving-shaft, an eccentric fixed on the shaft, a rock-arm, a connecting-rod between the eccentric and the rock-arm, a connecting-rod between the rock-arm and the arm loosely mounted on the driving-shaft, a pin on the latter arm and a pin on the eccentric, an opening in the gear-wheel, coinciding with the pins, a connection between the gear-wheel and the cam-ring and means for moving the gear-wheel lengthwise on the shaft, substantially as and for the purpose specified.

13. In a knitting-machine, in combination, a needle-cylinder, needles for the cylinder, a cam-ring for operating the needles, a driving-shaft, a gear-wheel loosely mounted and capable of a sliding movement thereon, an arm loosely mounted on the driving-shaft, an eccentric fixed on the shaft, a rock-arm, a connecting-rod between the eccentric and the rock-arm, a connecting-rod between the rock-arm and the arm loosely mounted on the driving-shaft, a pin on the latter arm and a pin on the eccentric, an opening in the gear-wheel, coinciding with the pins, a connection between the gear-wheel and the cam-ring, a slide-rod, an arm extending from the slide-rod to the gear-wheel, a cam-wheel for moving the slide-rod and a governor-wheel for permitting such movement, substantially as and for the purpose specified.

14. In a knitting-machine, in combination, a needle-cylinder, needles for the cylinder, a cam-ring for operating the needles, a driving-shaft, a gear-wheel loosely mounted and capable of a sliding movement thereon, an arm loosely mounted on the driving-shaft, an eccentric fixed on the shaft, a rock-arm, a connecting-rod between the eccentric and the rock-arm, a connecting-rod between the rock-arm and the arm loosely mounted on the driving-shaft, a pin on the latter arm and a pin on the eccentric, an opening in the gear-wheel, coinciding with the pins, a connection between the gear-wheel and the cam-ring, a slide-rod, an arm extending from the slide-rod to the gear-wheel, a sliding pin in the slide-rod, a cam for engaging the pin and a governor-wheel for moving the pin, substantially as and for the purpose specified.

NICHOLAS J. WINLUND.

Witnesses:

L. L. MILLER,

L. L. MORRISON.