

No. 657,182.

Patented Sept. 4, 1900.

B. T. STEBER.
CIRCULAR KNITTING MACHINE.

(Application filed Feb. 7, 1900.)

(No Model.)

5 Sheets—Sheet 1.

Fig. 1.

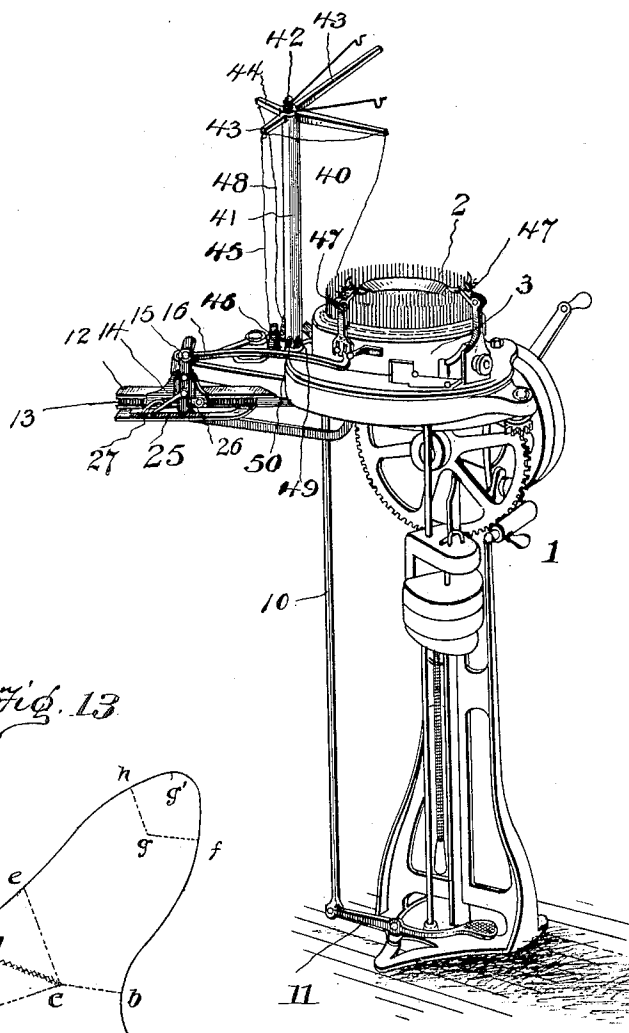
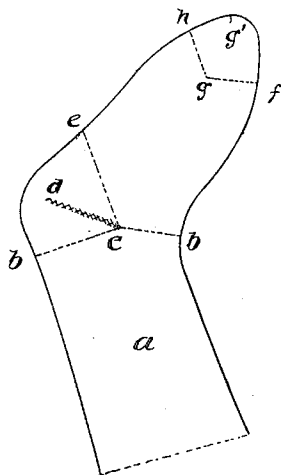


Fig. 13



Witnesses

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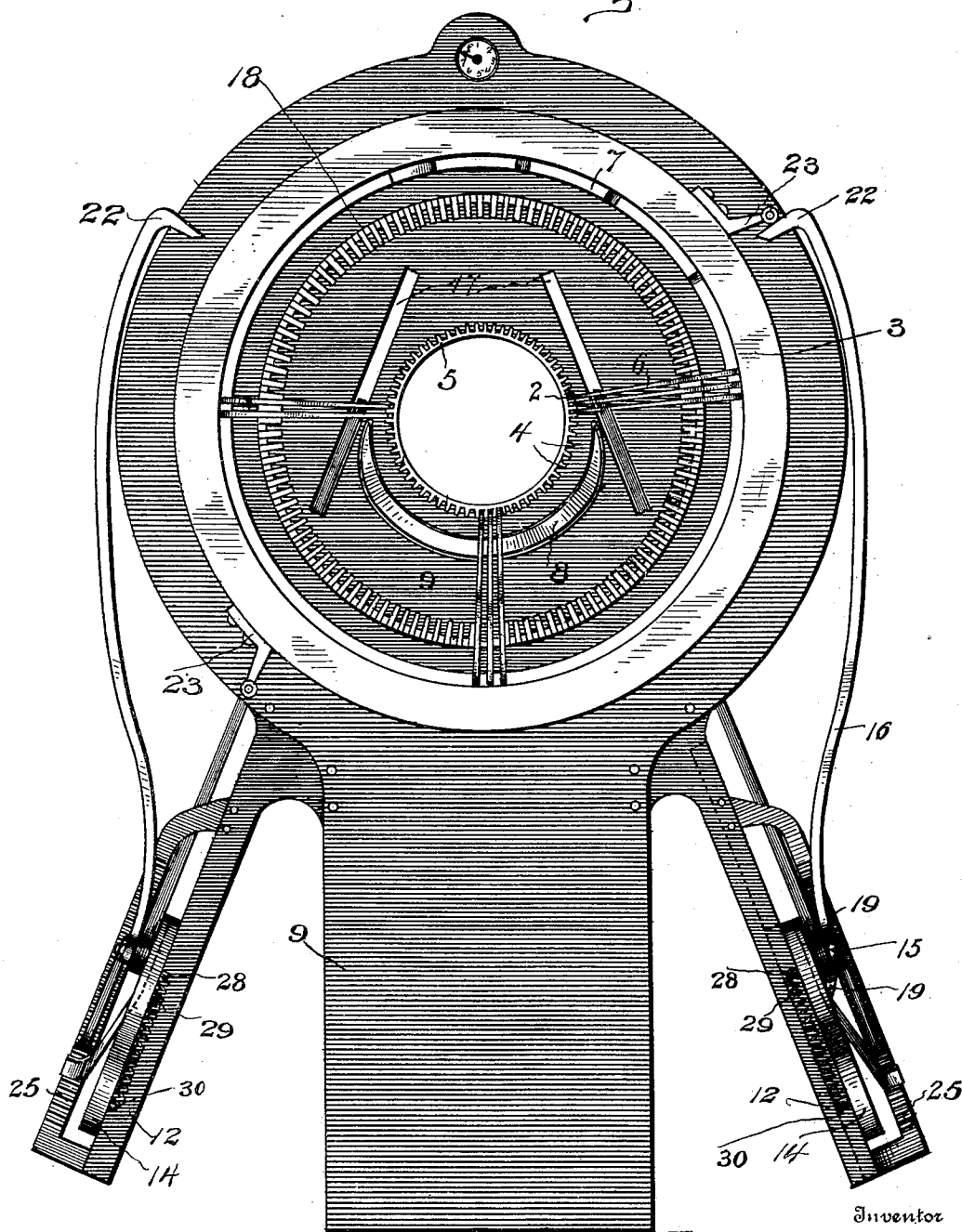
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5 Sheets—Sheet 2.

Fig. 2.



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Fig. 3.

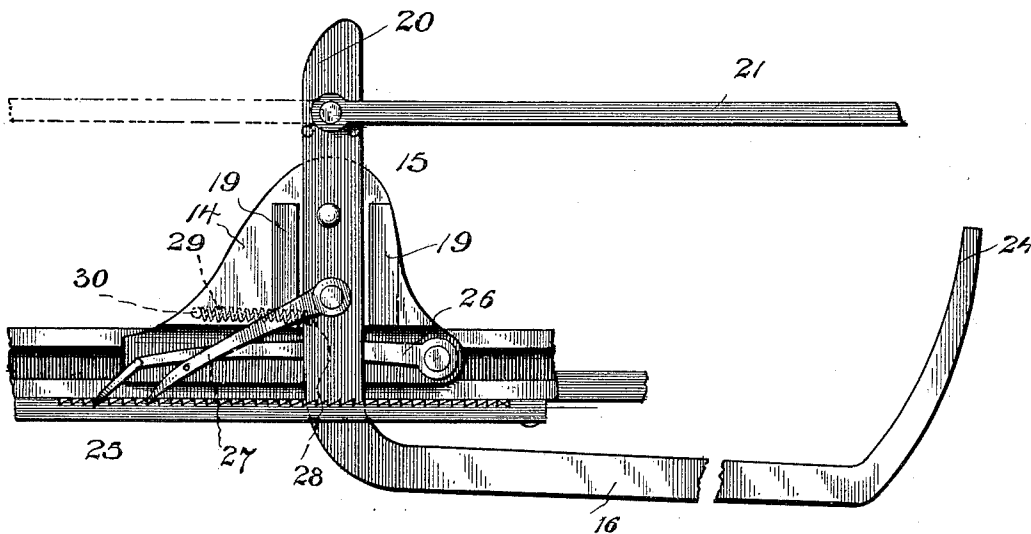


Fig. 5.

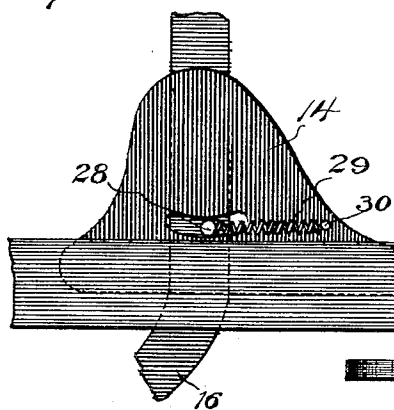


Fig. 4.

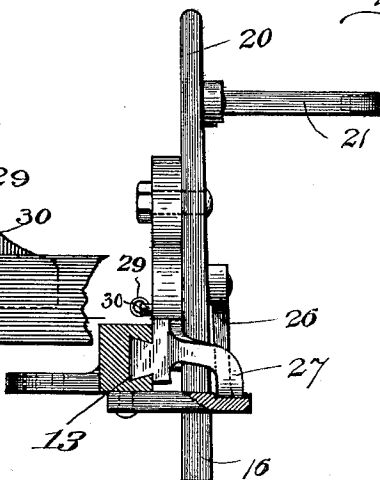


Fig. 15.



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5 Sheets—Sheet 4.

Fig. 6.

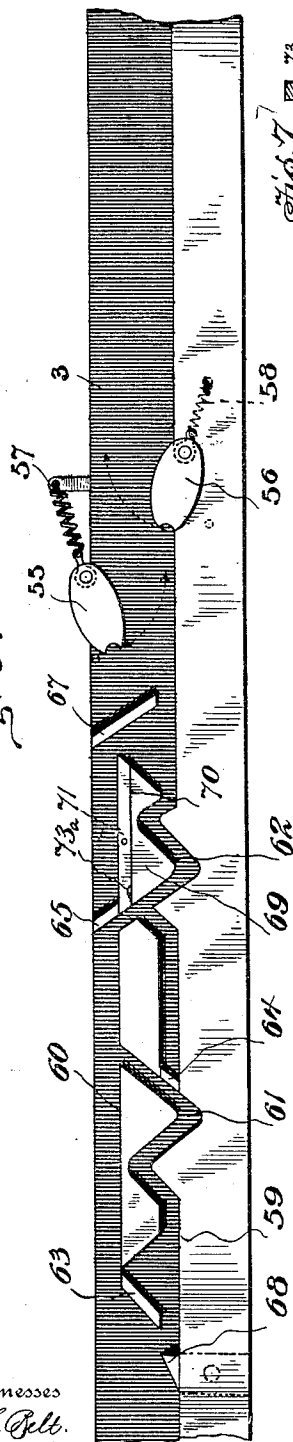


Fig. 7.

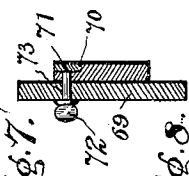


Fig. 8.

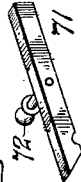


Fig. 9.

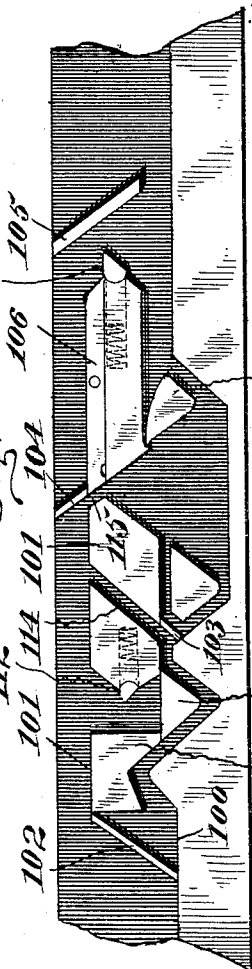


Fig. 10.

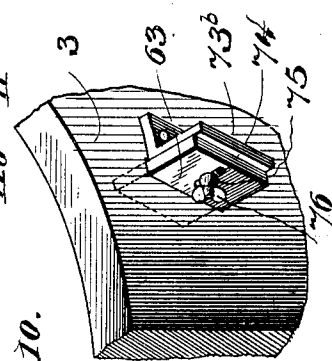


Fig. 11.

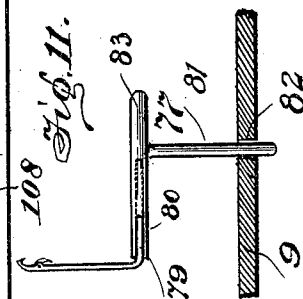


Fig. 12.

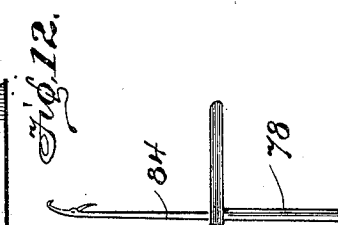


Fig. 13.

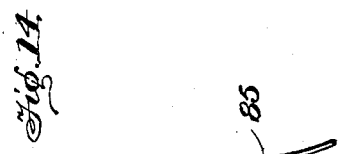
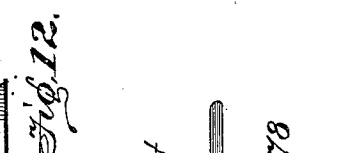


Fig. 14.



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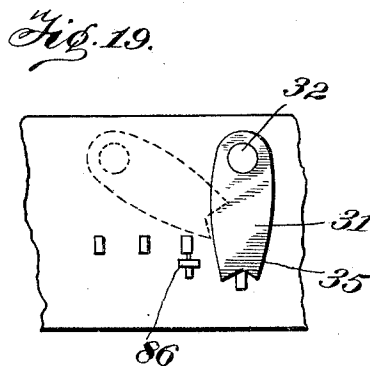
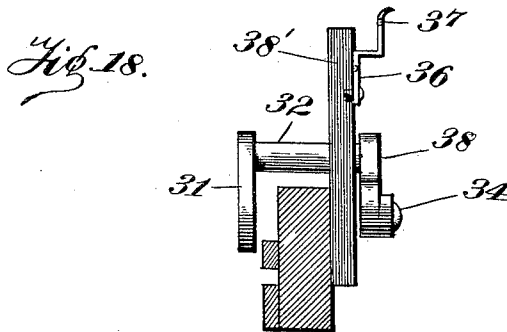
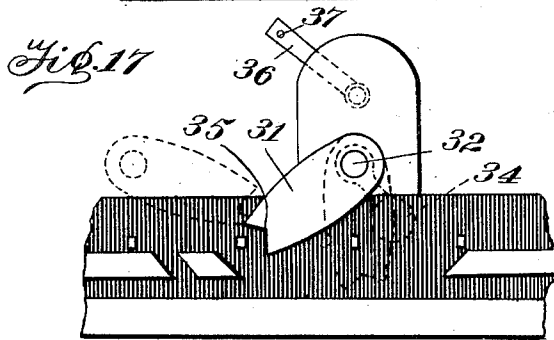
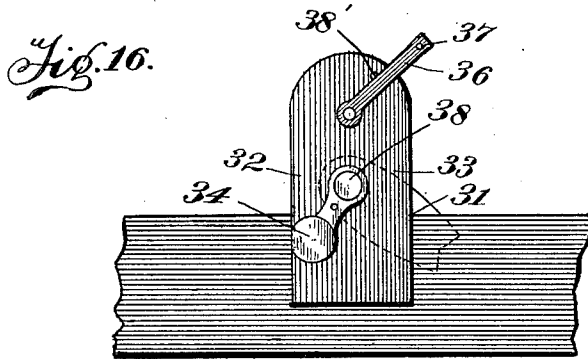
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5 Sheets—Sheet 5.



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UNITED STATES PATENT OFFICE.

BERNARD T. STEBER, OF UTICA, NEW YORK.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 657,182, dated September 4, 1900.

Application filed February 7, 1900. Serial No. 4,376. (No model.)

To all whom it may concern:

Be it known that I, BERNARD T. STEBER, a citizen of the United States, residing at Utica, in the county of Oneida and State of New York, have invented certain new and useful Improvements in Circular-Knitting Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in knitting-machines, and particularly to circular-knitting machines which employ movable cams for operating the needles of the said machine.

It consists of certain novel constructions, combinations, and arrangements of parts, as will be hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 represents a perspective view of a knitting-machine embodying the features of my invention. Fig. 2 represents an enlarged top plan view of the bed-plate of the said machine, showing the cam-cylinder thereon and the mechanism for raising the needles one at a time. Fig. 3 represents a side elevation of the said needle-raising mechanism. Fig. 4 represents an end elevation of the same, a portion being shown in section. Fig. 5 is a detail view of the reverse side of the slide shown in Fig. 3 and illustrating the manner in which the spring is attached to the needle-raising lever. Fig. 6 represents an elevation of the inside of my cam-cylinder, the same being preferably straightened out flat for the purpose of illustration. Figs. 7 and 8 are detail views of slides used in the cams. Fig. 9 is a similar view to Fig. 10, but showing a different kind of cam. Fig. 10 is a detail perspective view showing the manner of mounting one of the switches used on the cam-cylinder. Fig. 11 represents a jack used for carrying a needle having a bent shank. Fig. 12 shows a jack adapted to carry a needle having a straight heel. Fig. 13 represents a portion of a sock which may be produced by my improved knitting-machine. Fig. 14 represents a perspective view of a needle having a bent shank. Fig. 15 represents a front elevation of a cam-

cylinder, showing the lever-actuating lugs upon the opposite sides thereof arranged one higher than the other. Fig. 16 is a detail view showing means for automatically depressing the needles. Fig. 17 represents a similar view of the said mechanism, but taken from the opposite side thereof. Fig. 18 represents a detail sectional view through a portion of the cam-cylinder, further illustrating the structure of the needle-depressing mechanism. Fig. 19 represents a detail view showing a ledge used in connection with the needle-depressing dogs.

My improved knitting-machine is so constructed that a portion of the needles employed therein may be thrown out of action simultaneously for changing the shape of the fabric being produced. It is also designed to enable the operator of the machine to have a series of needles automatically removed from action one after the other for further changing the fabric acted upon. While I may produce a number of different-shaped fabrics upon such a machine, yet it is particularly well adapted for knitting socks or stockings, the necessary changes for continuously knitting the heel, foot, and toe of the stocking or sock being specially provided for in this mechanism. In knitting a sock or stocking the leg portion is preferably first formed, and when a proper point is reached to begin knitting the heel a predetermined number of needles have to be thrown out of action for a short time. As the knitting of the heel progresses it is necessary to remove a needle out of action first upon one side and then upon the other until only a small number of needles are left knitting. These needles are then returned into action one at a time upon each side of the sock until the heel is completed, when all needles are again brought into action for knitting the foot of the sock. When the toe of the sock is reached, the operation is precisely the same as when knitting the heel. My invention is designed to facilitate the operation of these needles, so that when beginning on the heel a large number of the needles of the machine, say one-half of them, may be simultaneously thrown out of action, and as the knitting of the heel progresses the movement of throwing out one needle at a time may proceed automatically.

In carrying out the features of my invention I preferably use a knitting-machine, as 1, of ordinary construction and one which is preferably formed with a series of circularly-arranged needles, as 2 2, and a circular cam-cylinder, as 3, provided with a suitable set of cams for operating the same. This cylinder 3 is operated by the usual mechanism, so as to be under perfect control of the operator, and may be moved back and forth like the balance-wheel of a watch or may have a continued rotary movement. The needles 2 2 preferably operate in the grooves 4 4 of a needle-cylinder 5, the said needles being provided with heels 6 6, which extend horizontally from the needle-cylinder to the cam-cylinder 3, where the ends of the said heels are adapted to engage a suitable cam, as 7, for producing the knitting operation.

In order to raise a predetermined number of needles at a single operation, I preferably arrange a segmental piece or plate, as 8, at a point beneath the heels of the needles to be raised and between the same and the bed-plate 9 of the machine. This segment 8 is preferably secured to the upper end of the operating-rod 10, which extends downwardly through an aperture in the bed-plate 9 and may be pivotally secured at its lower end to a foot-lever 11, which is pivotally mounted upon the frame of the machine 1. It will thus be seen that when it is desired to raise the said needles out of action it is merely necessary to place the foot upon the lever 11, which will cause the segment to rise beneath the heels of the needles and lift the same. The needles could of course, if desired, be operated automatically by any suitable cam movement. By this mechanism half of the needles in the cylinder may, if desired, be raised out of action at once, as in producing a sock. When it is desired to return the needles to action, the foot is moved from the lever 11 and the segment may be permitted to drop. The needles may thus be pushed down by hand when desired.

After the needles have been raised by the segment 8 in knitting the heel, for instance, of a sock it is desirable to raise the next adjoining needles successively upon each side of the machine. To accomplish this I preferably form extended supports, as 12 12, upon each side of the bed-plate 9, the said supports being provided with dovetail grooves, as 13 13, adapted to receive the dovetail projections formed upon slides 14 14. Pivoted to slides 14, as at 15, are bent levers, as 16 16, which are so shaped as to extend downwardly and along beneath the bed-plate 9 and then upwardly at their ends through elongated slots or apertures 17 17, formed in the bed-plate 9. The apertures or slots 17 17 are preferably arranged between the grooved needle-cylinder 5 and the needle-guides 18. The slides 14 14 are provided with limiting projections or lugs 19 19 for limiting the extent of movement given to the levers 16 16. In order to

actuate the levers 16 16, I preferably connect the same at their upper outer ends 20 20 with the rods 21 21, which extend toward the cam-cylinder 3 and are provided with lug-engaging end portions 22 22, arranged in suitable proximity to the cylinder. The end 22 of one rod is arranged in a higher plane than the end of the other rod, so that the two rods will not be engaged by the same actuating-lugs. These end portions 22 22 extend each into the path of its operating-lug, as 23 23, one of which is located higher than the other so that each may engage its own operating-rod and not the other one, the said lugs being formed upon and secured to the outer periphery of the cam-cylinder. As the cam-cylinder is moved one way or the other these lugs will engage the ends of the rods 21 and actuate the levers 16, so as to raise their inner free ends 24 beneath the heels of the needles or needle-jacks to be lifted. In order to lift the needles successively, it is necessary to feed the levers 16 16 forward step by step. To accomplish this I provide the supports 12 12 with teeth forming racks, as at 25 25, the said racks being adapted to be engaged by pawls 26 and 27, secured to the slides 14 and the levers 16, respectively. The pawls 26 are pivotally secured to the slides 14 at one end and engage the racks 25 25 at their other ends. The pawls 27 are pivotally secured to the levers 16 at one end and at the other end are adapted to engage the said racks 25 25. When one of the rods 21 is actuated, the slide 14 is prevented from moving by means of its pawl 26, and when the lever 16 is raised it draws the pawl 27 forward one notch. When the said lever 16 drops again, it forces the slide 14 forward in the dovetail groove 13 through the agency of the pawl 27, and thus each time the lever is operated to raise a needle it is moved forward sufficiently to be beneath the heel of the next needle, when it is again raised. To insure the lever 16 returning to its normal lowered position, the said lever is preferably provided with a stud, as 28, which extends through a slot in the slide 14 and is connected by means of a spring, as 29, with a stud or projection, as 30, on the said slide. When knitting the leg of a sock, the cylinder 3 is preferably kept rotating continuously in one direction; but when the heel is reached half of the needles, more or less, are raised out of action and the cylinder is preferably moved first one way and then the other back and forth. In this way first a needle upon one side is raised out of action by means of the lever 16 on that side of the machine and then a needle on the other side of the machine is raised in a similar manner. This back-and-forth motion is continued until the heel is half formed and all but a few of the needles have been raised out of action. It is then time to begin bringing the needles back into action again successively. For this purpose I preferably mount upon the inner surface of the cam-cylinder 3 dogs, as 31, preferably two in num-

ber, being arranged upon the side of the cam 7. The dogs are preferably mounted upon short horizontal shafts 32, which extend through the cam-cylinder or upon projections 33 secured thereto and have secured to their outer ends suitable weighted arms, as 34, which normally tend to hold the dogs 31 in such positions as to engage the heels of the needles 2. As seen in Figs. 16 and 17 of the drawings, the free ends of the noses of the dogs are notched, as at 35, the said notched portion being held normally by the weighted arm 34 in a position to receive the end of the needle-heel, as clearly seen in Fig. 17 of the drawings. As the cam-cylinder continues its movement in one direction the nose of the dog 30 will engage the first needle-heel which it comes in contact with and gradually depress the same because of its pivotal action. As the resistance of the needle-heel continues the dog 31 will be brought sidewise against the next needle-heel and into a vertical position against the action of its weighted arm 34 and will be finally turned over, as indicated in dotted lines in Fig. 17, so that the said dog will ride on its back upon the remaining needle-heels. The dog will continue to ride upon the heels of the needles until the cylinder has been reversed and brought back again to the gap formed in the needle-heels by the raising of some of the needles. When the cylinder is again reversed, the dog, being in the gap of the needle-heels, will be brought to its position for engaging the next successive needle. It will thus be seen that upon every back-and-forth movement, first on one side and then upon the other side of the machine, the dogs will engage the heels of the needles successively upon one side and then the other of the machine, ending with the needles which are next to those which were raised simultaneously at the beginning of the operation or at any desired place. When the heel has been knitted and it is no longer desired to have the dogs 31 in operation, they may be raised out of such operation and held so by means of pivoted springs 36, which are provided with apertures 37 at their free ends, adapted to engage projections, as 38, on weighted arms 34. When it is desired to bring these dogs into operation again, it is only necessary to release the springs 36 from the weighted arms 34 and turn the said springs upwardly out of the way, as seen in Fig. 16 of the drawings. If desired, a pair of detents or slight projections 38' 38' may be formed upon the projections 33 to hold the said springs 36 in their raised positions. I contemplate using any desired means for depressing the needles again successively upon each side of the cylinder, so as to return them to action. This may be done by hand or by any suitable automatically-operating mechanism. I therefore make no claim to the above-described mechanism for depressing the needles in the present application.

The operation of knitting the heel, foot, and

toe of a sock by the above-described mechanism may be easily followed by reference to Fig. 13 of the drawings, in which a portion of a sock is illustrated. In starting the sock the leg portion *a* is first knitted, when the knitting progresses until it is desired to form the heel, say until the point *b* is reached, and the next operation is to raise the segment 8 and throw out of action about half of the needles. The levers 16 16 will then be brought into operation, the slides 14 being first set at the outer ends of the racks 25. The knitting will then progress, the levers 16 raising the needles successively out of operation upon each side of the machine until the knitting has progressed from the points *b* and *c* to the point *d*, at which point only about fifteen or sixteen needles may be left in operation. At this point the levers 16 are thrown out of operation by moving the rods 21 to the position shown in dotted lines in Fig. 3 of the drawings, and the slides 14 at the same time are moved to the outer ends of the racks 25. The dogs 31 31 are next thrown into operation and the knitting is continued until the points *e* and *c* are reached, each needle having been successively thrown into operation so as to carry the knitting to that point. The first half of the needles which were simultaneously lifted out of operation are then lowered again and the knitting of all the needles progresses, as before, from the points *b e*, so as to form the foot portion. While the heel portion just described was being knitted the cylinder was preferably being moved back and forth like the balance-wheel of a watch; but when the foot portion is reached the cylinder is preferably rotated continuously in one direction. This operation continues until a point, as *f*, is reached, when it is desired to form the toe of the sock. At this point about half of the needles are again simultaneously thrown out of operation, as before described with respect to the heel, and the knitting continues from the points *g* and *h*, the levers 16 having been brought into operation and the cylinder having had its operation changed from the rotary to the back-and-forth movement. This operation progresses until the toe has been knitted to the point *g'*, at which point the needles are successively returned to action by the dogs 31 for producing the remainder of the toe. The portion of the foot on the line *f g* is then brought to the portion of the toe at the same line and the sock is completed by looping together by a suitable machine or by hand.

As seen in Fig. 6 of the drawings, dogs, as 55, may be used for forcing the needles downwardly, while similar dogs, as 56, may be used to force the needles upwardly again in the place of the levers 16, without departing from the spirit of the present invention. In Fig. 6 these dogs are illustrated as being held in their normal positions by means of springs 57 and 58 in place of the weighted arms, said springs being attached at one of their ends

to the cam-cylinder and at their other ends to the projections upon the shafts of the said dogs. I do not make any claim in this application for this construction, as this operation may be accomplished by hand, if desired, or by other automatic means.

In Fig. 6 I have illustrated the style of cam which I prefer to use in connection with my knitting-machine, the same being similar to that described and claimed by me in Letters Patent No. 635,817, issued October 31, 1899. This cam, it will be seen, is formed with a lower needle-carrying ledge, as 59, and an upper needle-carrying ledge, as 60. It is also provided with two needle-actuating portions, as at 61 62, and with switch-blocks, as at 63, 64, and 67, so that by using long and short heeled needles the needles may be alternately thrown out of action while the intermediate needles are in action, and vice versa. This cam arrangement I find very superior, especially as by it I am enabled to produce a double-ribbed fabric of more complicated mesh than the plain fabric produced by many machines, all as described in the patent above referred to. In order to raise the long-heeled needles to the cam-path 60, I preferably shorten the switch-block 63 and raise the needles high enough to engage the said switch-block by means of a switch-bolt 68, which is situated in a vertical socket formed in the cam-cylinder and may be raised and lowered in any suitable manner—as, for example, by hand by means of a suitable handle provided for this purpose. When the said bolt 68 is raised, it will lift the long-heeled needles sufficiently to cause them to engage the switch-block 63, and when the bolt is depressed below the surface of the cam-path 59 it will permit the long-heeled needles to pass along the same. The switch-block 64 I preferably arrange as seen in Fig. 6, so as to carry the short-heeled needles upwardly at a point in the cam-path when they have just finished a knitting-stroke. The switch-block 65 is preferably arranged so as to carry the long-heeled needles directly to the portion 62 of the path where they will go to knitting at once. In addition to these changes over my previous construction I have further improved the cam by forming the projection 69 with a ledge, as at 70, half the depth of said projection, as seen in Fig. 7, and mounted upon the said ledge the sliding switch-bolt, as 71. This switch-bolt may be operated by means of a knob 72, secured to the outer end of the stud passing through the slot 73, formed in the cam-cylinder. When all the needles are being used, it is desirable to close the cam-path just below the switch-block 65 to return the short-heeled needles to the lower cam-path, and for this purpose the switch-bolt 71 may be moved along its supporting-ledge until it closes the space below the switch-block 65. When raising the long and short heeled needles successively out of action for producing a ribbed fabric, the bolt 71 is re-

tracted from its forward position and occupies a position as illustrated in Fig. 6, so that it forms an extension of the switch-block 65 and will guide the needles back into the path of the cam. When the switch-block 71 is shoved forward so as to close the outlet from the upper switch-path, it is so located that a notch, as 73^a, in its lower surface will complete the upper contour of the lower cam-path, forming a rounded surface at this point to smoothly guide the needles. Each of these switch-blocks preferably extends through a slot formed in the cam-cylinder 3, as clearly seen in Fig. 10 of the drawings, in which one of the switch-blocks, say 63, is shown being mounted upon a bracket, as 73^b, secured to the outer periphery of the said cylinder. The block 63 is provided with an elongated slot 74, and a bolt 75, secured to the bracket 73^b, extends through the same, being provided with a thumb-nut 76, which may be used to clamp the switch-block in its inner and outer positions.

In Fig. 9 of the drawings I have shown a form of cam such as is in common use, so that it may be readily seen that my system of switch-blocks for producing double-ribbed fabric may easily be applied to cams of various constructions and to many of the different kinds of knitting-machines in use. In this figure I have shown a different style of cam from that shown in Fig. 6 and have illustrated the manner in which the needles may be alternately operated by the arrangement of the switch-block. This structure comprises a lower cam-path 100 and an upper cam-path 101, together with switch-blocks 102, 103, 104, and 105. By pushing inwardly the switches 102 and 104 the long-heeled needles can be taken out of action for a short period of time and returned again to action by the switch 104. By pushing inwardly the switches 103 and 105 the short-heeled needles may be taken out of action and returned again thereto after a considerable period in the same manner as heretofore described with reference to Fig. 6 of the drawings. In this instance I also may employ the sliding switch-bar 106, similar in construction and operation to the switch-bar 71.

The main portion of the cam shown in this figure is constructed substantially like the principal cams in the patents to Mayo, Nos. 274,208 and 319,000, and is provided with movable cam-pieces 107 and 108, which are capable of being moved up or down, respectively, according to the direction in which the cam-ring is rotating. The ends of the upper cam-blocks are also provided with yielding noses 112 and 113, in all respects similar in construction and operation to the cam-noses illustrated in the patent to Mayo, No. 274,208. In altering a machine provided with such cams to adapt it for use in connection with my improved cams 63, 64, 65, and 67 I cut channels 114 and 115 through the upper cam-block and may retain the cam-blocks 116 and 117, which

is the device used in the Mayo machine for operating the knitting-needles as an auxiliary yarn-guide. In this device block 117 may be lowered and fills up the depression underneath itself, when block 116 is drawn outward and out of action. The device is also provided with other features to make the same operative in the manner described in connection with the present invention, as will be now set forth.

As shown in Figs. 11 and 12, instead of using needles which are made with integral heels and shanks I may employ needles carried by needle-jacks, as 77 and 78, without departing in the least from the spirit of my invention. The jacks 77 are designed to hold needles having bent heels, as 79, the said jacks having clamping-jaws, as 80, for operating the heels of the said needles. These jacks are provided with shanks, as 81, which are adapted to project downwardly through apertures 82, formed in the bed-plate 9. The jacks also have heels, as 83, for engaging the operating-cams. As seen in Fig. 12 of the drawings, the jack 70 is adapted to hold a needle 84, which is perfectly straight. I may also use needles made with integral heels and shanks, such as are in common use, and preferably form the needles, which are to be raised by means of the levers 16, with slightly-bent shanks 85, as seen in Fig. 14 and as heretofore described and claimed by me in my previous patent above referred to. These needles bind sufficiently upon the surfaces of their grooves to cause them to remain in their raised or lowered positions as they are actuated by the various parts of the machine.

As seen in Fig. 19, when needles without bent shanks are used, so that they do not fit snugly in their grooves, it may be desirable to form a short ledge, as 86, in proper relation to the dogs 31, so that while a dog is in the operation of moving one of the needles downwardly it cannot accidentally push the next one down at the same time.

It will be evident from the description of my machine that by the use of the double cam-path and the switch-blocks the appearance of the mesh of the fabric can be altered—as, for instance, from a ribbed goods to a smooth or plain goods—while by the use of the mechanism for raising some of the needles simultaneously and some of the others successively out of operation the form or shape of the fabric can be varied all in the one device.

From the above description it will be apparent that I am enabled to produce a circular-knitting machine of superior quality and one which can be used in knitting fabrics of various shapes—as, for instance, a sock, producing the leg, heel, and toe portion continuously in a simple and yet effective manner, parts of the operation being automatic. It will be further seen that a machine of this character can be kept entirely under the control of the operator and manipulated to suit

the fabric which it is desired to produce. By using also a machine which employs a cam-cylinder, as described in my Patent No. 635,817, previously referred to, I can knit a sock with the leg formed of a double-ribbed fabric and with the heel, foot, and toe formed with a plain stitch. It will be further seen that the change can be readily effected from one stitch to the other and also that yarns of different degrees of coarseness or fineness and of different colors may be used at any desired point in the fabric.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a knitting-machine, the combination of reciprocating needles having comparatively-long heels, means for movably supporting the same, a traveling cam for reciprocating the said needles, and means for engaging the operating-heels of the needles intermediate their lengths for throwing a predetermined number of said needles out of the path of the cam simultaneously, substantially as described.

2. In a knitting-machine, the combination with a rotating cam, of a series of reciprocating needles having comparatively-long heels adapted to be operated by said cam, means for engaging the operating-heels of the needles for throwing a predetermined number of the said needles simultaneously out of the path of the cam comprising a movable piece adapted to engage the heels of the needles at an intermediate point between their shanks and the ends of the heels, and means for moving said movable piece, substantially as described.

3. In a knitting-machine the combination with a rotating actuating cam-cylinder, of a series of needles adapted to be actuated thereby, means for directly engaging the operating-heels of said needles for raising a predetermined number of the same above the path of the cam and thereby throwing them out of operation simultaneously, the said means comprising a horizontal piece independent of the cam-cylinder and adapted to extend beneath and engage the under sides of the heels of the said needles at a point between the ends of the said heels and the shanks of the needles, and means for raising or lowering the same, substantially as described.

4. In a circular-knitting machine, the combination of a needle-cylinder, a cam-cylinder carrying cams for engaging the heels of the said needles to operate them, means for engaging the actuating-heels of said needles for raising a number of the said needles simultaneously so as to be out of the path of the cam comprising a segmental piece independent of the moving cam-cylinder and arranged between the needle-cylinder and the said cam-cylinder, a rod carrying the said piece and extending downwardly through the bed-plate to a point in suitable proximity to the floor, a foot-treadle for operating the

said rod, the construction being such that by placing the foot upon the said treadle a number of the needles may be raised out of operation, substantially as described.

5 5. In a knitting-machine, the combination with a moving cam, of a series of reciprocating needles adapted to be operated thereby, means independent of the cam for engaging the working heels of the needles inside the
10 cam-cylinder and between their shanks and their outer guided ends for raising the needles out of reach of the cam, first one upon one side and then one upon the other side of the machine successively until the desired
15 number of needles have been thrown out of action, and means for returning them into action again, substantially as described.

6. In a knitting-machine, the combination with a movable cam, of a series of reciprocating needles adapted to be operated thereby, means independent of the cam for engaging the guided heels of the needles intermediate
20 their length for raising a predetermined number of the said needles simultaneously out of the path of the cam, and means independent of the said cam for raising other needles out of action, one at a time, first upon one side of the machine and then one upon the other
25 side of the machine for altering the shape of the fabric being knitted, substantially as described.

7. In a knitting-machine, the combination with a rotating cam-cylinder, of a series of reciprocating needles adapted to be operated
35 thereby, means for engaging the heels of said needles between their shanks and their outer guided ends for raising some of the said needles out of reach of the cam, one at a time, comprising a lever adapted to extend interiorly of the cam-cylinder and to engage the
40 heels of the said needles from beneath so as to lift them, and means for operating the said lever, substantially as described.

8. In a knitting-machine, the combination with a rotating cam-cylinder, of reciprocating needles having heels engaging the said
45 cam-cylinder, means for raising a series of the said needles out of action, one at a time, comprising a pivoted lever, the free end of which is adapted to engage the ends of the
50 needles, a rod connected with said lever at one end and adapted to be struck by a projection on the cam-cylinder at the other end for operating said lever and raising the needles, substantially as described.

9. In a knitting-machine, the combination with a rotating cam-cylinder, of reciprocating needles having heels for engaging the cam-cylinder, means for raising some of the said
60 needles, one at a time, comprising a pivoted lever, a slide carrying the said lever, a rod for actuating the said lever, a rack mounted upon the bed-plate of the machine, and pawls upon the said lever, a slide for feeding the
65 lever forward with a step-by-step movement so as to bring its free end under the heels of the successive needles, whereby the knitting

of the fabric may be varied as desired, substantially as described.

10. In a knitting-machine, the combination
70 with a rotating cam-cylinder, of a series of reciprocating needles having horizontal heels engaging the said cam-cylinder, means for raising some of the said needles successively out of action, comprising a lever and slide
75 pivotally carrying the same, a rod connected with said lever and extending into the path of a projection on the cam-cylinder, limiting-lugs on the said slide for determining the extent of movement of the said lever, a rack
80 mounted on the bed-plate of the machine, a pawl on the said slide for holding the slide from slipping away from the machine, a pawl upon the said lever also, engaging the said rack for feeding the carriage forward one step
85 upon each movement of the lever, and a spring for holding the lever normally in its lowered position, substantially as described.

11. In a knitting-machine, the combination with a rotating cam-cylinder, of needles adapted to be operated thereby, means for raising
90 needles out of action, first upon one side of the machine and then upon the other side of the machine successively, comprising pivoted levers having their free ends extending up
95 through slots in the bed-plate of the machine so as to be beneath the heels of the needles, actuating-rods pivoted to the said levers and projecting into the path of lugs upon the cam-cylinder, the construction being such that
100 upon rotating the cylinder in first one direction and then the other the levers will be alternately actuated, and means for feeding the levers forward with a step-by-step movement to bring their alternating ends beneath the
105 heels of successive needles upon each side of the machine, substantially as described.

12. In a knitting-machine, the combination with a rotating cylinder, of a cam mounted thereon for actuating the needles of the machine, the said cam comprising upper and
110 lower paths for engaging the heels of the needles, switches mounted upon the cylinder and adapted to engage the ends of the needles to raise some of the needles out of operation
115 while the others are knitting and to return the said inactive needles to operation while the others are raised out of operation, whereby a ribbed fabric is produced, and means extending upward interiorly of the cylinder and
120 engaging the heels of the operating-needles intermediate their length for raising some of the needles out of operation simultaneously, and some of the needles out of operation successively, one at a time, for altering the shape
125 of the fabric and without interfering with the operative mechanism of the machine, substantially as described.

13. In a knitting-machine, the combination of a series of reciprocating needles, a needle-cylinder directing the shanks of said needles
130 and a guide cage or cylinder for directing the ends of the needle-heels and a cam engaging the ends of their heels for operating the same,

the said cam comprising upper and lower paths and switches for directing the needles to each, whereby the mesh of the fabric knitted may be varied, and means for engaging the heels of the needles between the needle-cylinder and the guide cage or cylinder located near their outer ends for raising some of the needles simultaneously out of action, and some of the needles successively out of action for varying the form of the fabric knitted, substantially as described.

14. In a knitting-machine, the combination with reciprocating needles of a cam-cylinder for actuating the same, some of the needles having long heels and some short heels, the said cam having an upper and a lower cam-path, switches extending through the side of the cylinder, some of the said switches extending far enough to engage the long-heeled needles, and some of the switches extending in sufficiently far to engage the short-heel needles, a switch-bolt for raising the long-heeled needles for engaging the first switch-block, a sliding switch-bolt for closing the cam-path when all the needles are knitting, the structure being such that the needles may be operated alternately or all together for producing a ribbed or a plain fabric, and

means for raising some of the needles entirely out of operation simultaneously, and means for raising some of the needles out of operation successively, whereby the form of the fabric knitted may be varied, substantially as described.

15. A knitting-machine, comprising a series of reciprocating needles, a revoluble cam-cylinder having cams thereon for engaging the said needles, means for raising some of the said needles successively to remove them from action, comprising levers, operating-rods connected with said levers, the outer ends of the said operating-rods being arranged one in a higher plane than the other, actuating-lugs mounted upon the cam-cylinder, one higher than the other, to engage the ends of the said operating-rods, the construction being such that each lug will only engage its own operating-rod and will not affect the other as the cylinder is rotated, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

BERNARD T. STEBER.

Witnesses:

HENRY A. STEBER,
JOHN KRUSE.