

No. 635,817.

Patented Oct. 31, 1899.

B. T. STEBER.
KNITTING MACHINE.

(Application filed June 26, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

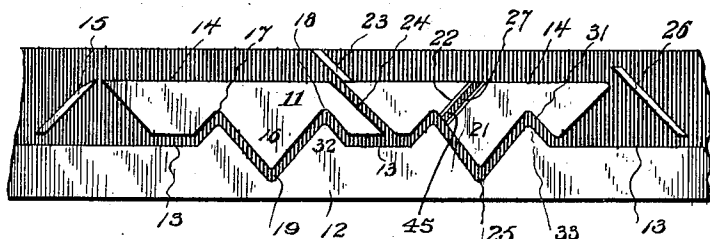


Fig. 2.

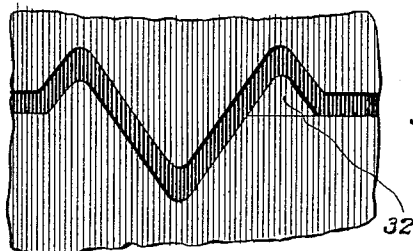


Fig. 3.

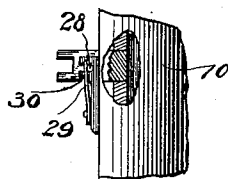


Fig. 4.

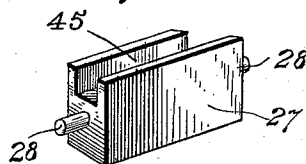


Fig. 8.

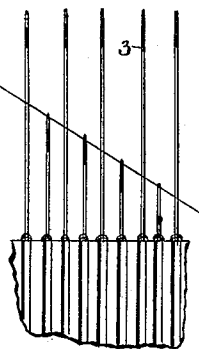


Fig. 5.

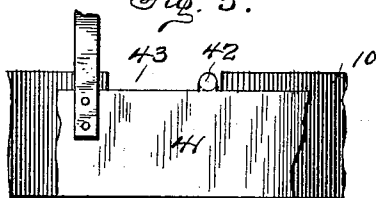


Fig. 6.

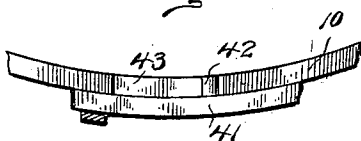
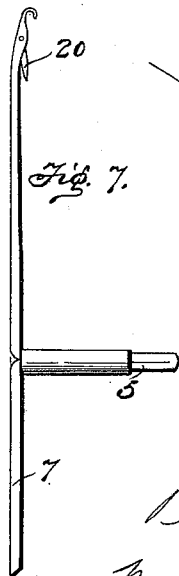


Fig. 7.



WITNESSES

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2 Sheets—Sheet 2.

Fig. 9.

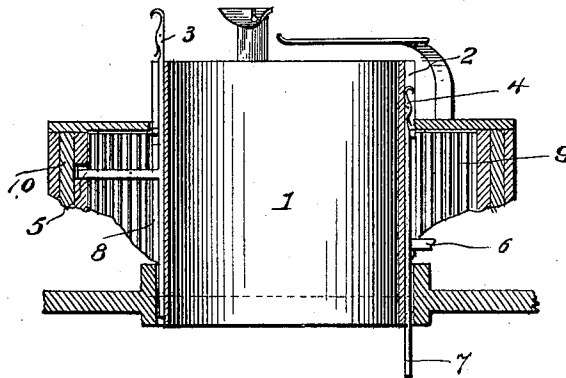


Fig. 10.

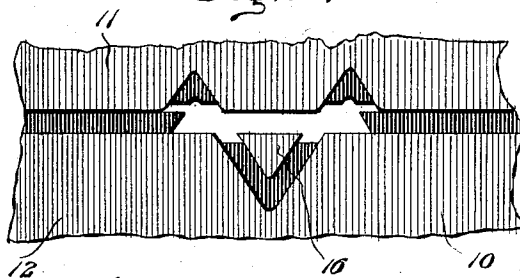


Fig. 11.

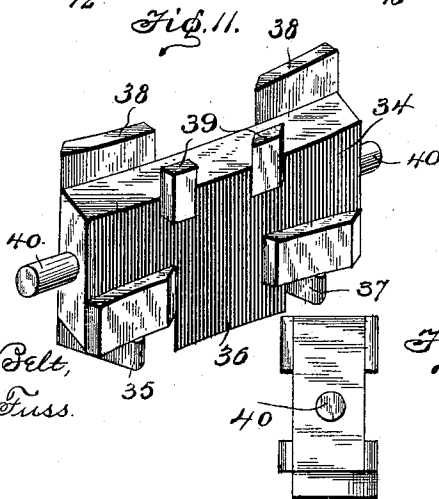


Fig. 12.

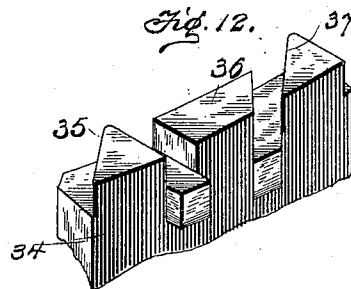
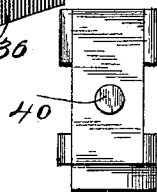


Fig. 13.



WITNESSES

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BERNARD T. STEBER, OF UTICA, NEW YORK.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 635,817, dated October 31, 1899.

Application filed June 26, 1899. Serial No. 721,925. (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 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 that class of knitting-machines which employ a cylindrical guide for the needles and a circular cam for operating the same.

It consists first in a knitting-machine having suitable needles, said needles being provided with long and short heels, cam-paths for engaging the said heels, and means for raising out of action the long-heeled needles while the short-heeled needles are working, and means for raising the short-heeled needles out of action when the long-heeled needles are in operation for knitting a ribbed fabric.

It also consists in a knitting-machine having vertical reciprocating needles, some of the said needles having long heels and others having short heels, cam-paths for engaging the said heels, a switch-block adapted to engage the long-heeled needles and elevate them to a higher path, means for returning the said long-heeled needles to the cam-path, a passage-way through one of the walls of the cam-path for raising the short-heeled needles to the upper path while the long-heeled needles are in operation, and means for returning the short-heeled needles to the cam-path again.

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

In the accompanying drawings, Figure 1 represents an interior elevation of a portion of the cam-plate of a knitting-machine, the same being straightened out to better illustrate its form. Fig. 2 represents a detail elevation of a portion of the cam-path. Fig. 3 is a detail view showing one of the removable switch-blocks in place in the cam-cylinder. Fig. 4 represents a detail perspective view of

the said switch-plate. Fig. 5 is a fragmentary side elevation of a portion of the cam-plate and the cylinder which carries the yarn-holder. Fig. 6 represents a top plan view of the same. Fig. 7 represents a side elevation of a needle constructed in accordance with my invention. Fig. 8 represents a side elevation of a portion of the knitting-cylinder, showing alternate needles in action and alternate needles out of action. Fig. 9 represents a central vertical section through the knitting-cylinder. Fig. 10 represents a detail elevation of one of the cams of the cam-path, showing the aperture through which the switch-block is adapted to be inserted. Fig. 11 is a perspective view of one of the switch-blocks. Fig. 12 is a fragmentary sectional view of the other edge of the same. Fig. 13 is an end view of the said switch-block; and Fig. 14 represents an edge view of one of the short-heeled needles, showing its lower end or shank slightly bent.

My improved knitting-machine is adapted to be used for ordinary plain knitting when desired and yet is capable of being changed so as to produce a ribbed fabric without removing the fabric from the machine. I am aware that machines have been constructed heretofore for producing ribbed fabrics and also for knitting plain fabrics with the ordinary stitch. These devices, however, have been only able to produce a very coarse rib and one rib for every two needles, so that they are not suitable for very fine knitting. By constructing a machine so that every needle produces a rib I am enabled to knit a very fine fabric and yet produce one which is ribbed. To accomplish this, I so construct the cams which control the knitting-needles that the alternate needles will be thrown out of operation while the other alternate needles are in action and then bring the alternate set of needles which are out of operation into operation while the other set of needles is lifted out of engagement.

In carrying out my invention I preferably employ a needle-cylinder 1, having the usual guide-ribs 2 upon its outer periphery, forming grooves in which the knitting-needles 3 reciprocate. The needles 3 are preferably provided with heels 5, which are made longer than the heels 6 of the needles 4. The lower

ends or shanks 7 7 of the needles are preferably made quite long, so as to extend a considerable distance down the cylinder 1 and be held in place in the grooves by means of a cylindrical portion 8 of the frame of the machine. This forms a long bearing-surface for guiding the needles in their vertical movement and prevents them from binding and moving with much friction in their grooves.

10 A skeleton guide-cylinder, as 9, is adapted to engage the heels of the needles near their outer ends for assisting in directing the movement of the said needles. The outer ends of the heels of the needles engage a cam-path 15 formed on a cam-cylinder 10, arranged outside the skeleton cylinder 9. To the inner surface of the cam-cylinder 10 is secured upper and lower steel plates 11 and 12, respectively, so arranged as to form actuating cam-paths between them. The plate 12 preferably extends entirely around the inner surface of the cam-cylinder, while the plate 11 only extends part way around the same. As seen in Fig. 1 of the drawings, the cam-path 13, formed between the plates, is preferably provided with two or more actuating portions for producing the knitting movement of the needles. The upper surface of the plate 11 is preferably made horizontal throughout, so as to form an upper path, as 14, to support the needles out of action at the proper time. In order to raise the long-heeled needles out of action for knitting ribbed fabric, I preferably employ a cam-block, as 15, which extends through a suitable opening in the sides of the cylinder and projects inwardly from the inner face of the cam-cylinder—say an eighth of an inch—which is sufficient to engage the heels of the long-heeled needles, but not sufficient to engage the heels of the short-heeled needles. Thus as the cam-cylinder is rotated the cam-block will engage the heels of the long-heeled needles and carry them upwardly, depositing them upon the upper path 14, the short-heeled needles at the same time being permitted to travel along upon the plate 12 until it engages the first cam 16. This cam is made with two upwardly-extending portions, as 17 and 18, each being removable, so one can be used if the cylinder revolves one way and the other if it revolves the opposite way, and a centrally-depressed portion, as at 19. The effect of this is to first lift the needles sufficiently high to open the latches 20 of the needles and permit the yarn-carrier to leave the yarn beneath the hooked portion of the needle. The cam-path then causes the needle to descend, drawing the yarn with it, and passes it through the loops of the fabric in the process of knitting. The needle is then carried upwardly again and returned to its normal position. The short-heeled needles having completed their knitting operation are next to be lifted out of knitting position, and when they approach the second cam, as 21, which is similar to the cam 16, they are permitted to be engaged by a cut-away portion 22 of the

upper plate 11, so that their heels will be carried upwardly and deposited upon the upper path 14, thus removing them from engagement with the cam 21. The long-heeled needles will in the meantime have engaged a cam-block 23 and been forced downwardly through a passage 24 to the upper edge of the plate 12 again in time to engage the second cam 21. The slot 22, which engages and lifts the short-heeled needles, is, however, not made of sufficient depth to permit the long-heeled needles to pass through. The said long-heeled needles will therefore be carried downwardly by the central portion 25 of the cam 21, so as to perform the knitting operation, as previously described with respect to the short-heeled needles. The long-heeled needles will then be returned to their normal position upon the upper edge of the plate 12. The short-heeled needles will also be returned to the said upper edge of the plate 12 by means of a cam-block 26, which is inserted in a suitable aperture in the side of the cam-cylinder and projects inwardly a sufficient distance to engage the short heels of the said needles—say a quarter of an inch. It will be observed that by this operation the long-heeled needles have been held out of engagement while the short-heeled needles were knitting and when the long-heeled needles were knitting the short-heeled needles were lifted out of action. This produces the desired fabric, with the rib for each needle. The cam-block 23 may be made integral with the cam-cylinder or with the plate 11, but is preferably made in the form of a separate block, like the blocks 15 and 26, and inserted through an opening in the side of the cylinder. The passage-way 22 is preferably formed in the block 27, which is adapted to be inserted in an aperture formed in the cam-cylinder and the plate 11. As seen in Figs. 3 and 4 of the drawings, one edge of the block 27 is provided with a recess 45, while the other edge of the said block is made solid, so as to be flush with the inner surface of the plate 11 when it is desired to prevent the needles from passing upwardly at that point. The block 27 may be provided with trunnions, as 28 28, which engage bearings, as 29, secured to the outer surface of the cam-cylinder 10. Spring-latches, as 30, may be employed to removably hold the trunnions 28 in the said bearings. This block is always inserted with its solid edge inwardly when ordinary plain knitting is being accomplished, but of course is reversed, so as to present the groove 22 inwardly when the rib-knitting is being formed. When the rib-knitting is in process of being formed and a tubular web is being knitted, the cam-cylinder 10 is rotated in one direction only.

When the machine is used, however, for plain knitting for the purpose of knitting a flat web or ribbon, I move it back and forth, giving it a forward and reverse motion. In this case I use as many needles as are required, according to the width of flat web or

ribbon to be knitted. The second upwardly-extending portions 18 and 31 of the cams 16 and 21, respectively, are not necessary for the operation of the needles in forming either
 5 a ribbed or plain fabric when the machine is revolving in one direction only, but are useful for insuring the opening of the needle-latches when the cylinder is being moved back and forth to knit either. When the cylinder is moved in one direction only, therefore,
 10 the needles need not be passed upwardly a second time by the cams, and the projections 32 and 33 may be made removable in the form of blocks similar to the block 27, they being inserted in place, as shown in
 15 Figs. 1 and 2, when the cylinder is moved back and forth, but may be removed when the cylinder is moving in only one direction, so that when the needle-heels are lifted out
 20 of the depressed portions 19 and 25 of the cams they will return immediately to the upper edge 13 of the plate 12.

In using both cams 16 and 21 in producing a ribbed fabric I employ two yarn-carriers.
 25 One supplies yarn to the needles which are about to do the knitting. The other needles remaining in their upper positions also receive yarn, but hold the same until they are actuated. Before the second set of needles,
 30 however, are actuated the second yarn-carrier places a second yarn around the said needles, so that when the needles descend they will knit two lines of yarn. The next set of needles will also receive two strands of yarn
 35 and will knit them in proper succession. When knitting a plain piece of fabric without ribs, it is not needful to employ two or more yarn-carriers, although it is generally preferable to do so, and all but one may be
 40 dispensed with. The yarn-carriers may be made in any suitable form and secured to the cam-ring, as desired.

When knitting plain fabric, it is not necessary to make the needles travel over the second cam and sometimes not desirable to do so, and to prevent this I employ a removable
 45 block, as 34, Fig. 11, which upon one edge is provided with projections, as 35, 36, and 37, adapted to form the complete cam-path when
 50 necessary in the cam-cylinder, either the projections 35 or 37 being removable, according to which way it is desired to revolve the cylinder, as seen in Fig. 1. This block 34 also
 45 has formed upon its other edge projections, as 38 and 39, which when the block is inserted with this edge innermost is adapted to form a straight path at this point. This block is
 55 preferably used at the cam 16, so that when knitting back and forth to form a plain fabric in a small machine the needles will not be engaged by the cam 16. The block 34 is also
 60 provided with trunnions, as 40 40, which engage bearings on the outside of the cam-cylinder 10, similar to the bearings 29, above described.
 65

In order to prevent the short-heeled needles 3 from dropping in the cam-path 21, I

preferably bend the shanks of the said needles slightly, as seen in Fig. 14 of the drawings, so that there will be sufficient friction to hold
 70 the needle up until some agency forces it to move one way or the other. This will enable the heels of the said needles to be properly engaged by the slot 22, so as to carry them upwardly to the path 14.
 75

When knitting a flat fabric or ribbon and moving the cylinder back and forth, the yarn-carrier would be in the wrong position with respect to the knitting-needles upon the reverse movement without proper provision being made against such a contingency. I have
 80 devised the plan of placing an outer ring, as 41, outside the cam-cylinder 10 and actuating the said cam-cylinder 10 through the instrumentality of the said ring 41. The ring
 85 41 is provided with an inwardly-extending projection or lug 42, which is adapted to move in the cut-out portion 43 of the cam-cylinder 10. This cut-out portion is made sufficiently
 90 long, so that when the ring is moved in one direction the yarn-carrier, which is carried by the ring 41, will be in proper position to feed the yarn to the needles before reaching the cams. Upon reversing the movement of
 95 the parts the ring 41 will be actuated first and will travel the length of the cut-out portion 43 before it actuates the cam-cylinder 10, thus carrying the yarn-carrier to the proper position for feeding yarn to the needles again upon the reverse movement. The rings are
 100 preferably locked together when knitting a tubular web to avoid the momentum from throwing the inner ring forward too far.

In using a knitting-machine of this character the yarn sometimes fails to come in contact with the hooked ends of the needles, especially when knitting ribbed fabric, as described, when the needles are constructed in the ordinary and well known manner. I
 105 have therefore conceived the idea of bending the upper ends of the needles outwardly slightly, as seen in Fig. 7 of the drawings. This I find by experiment causes the needles to always engage the yarn and therefore never
 110 to skip a stitch. It will be apparent from the above description that I am enabled in a very simple manner to knit a fabric with very fine ribs and to knit a fabric without ribs in a plain manner by the same machine, and
 115 also that I accomplish the knitting of the ribbed fabric by means of certain cams and cam-paths to lift the alternate needles at the proper time and carry them to a plane above the knitting position.
 120

It will be observed that the plate 11 does not extend all the way around the cylinder, so that at every point except where the cams are one or more of the needles can be lifted
 125 up by hand and held out of operative position. It is desirable usually to lift some of the needles out of operative position when
 130 knitting flat or like a ribbon or the heels of stockings.

It will be apparent that instead of placing

the switch 27 so as to raise the short needles at the beginning of the second cam 21 I may place it anywhere between the two cams, provided an additional raising-groove is placed at said point. The switches 26 and 15 may also be mounted in suitable bearings upon the outside of the cylinder in the same manner, as described with respect to the switch 27. A cut-out or switch similar to 27 may also be placed at 18, if desired, but inclined in the opposite direction, so that if the mechanism is reversed the same effect would be produced in that direction, as above described in the use of the switch 27, all within the spirit of the present invention.

It will be seen that by lifting one-half or more of the needles out of action and running first one way, changing the cams, and then running in the other way, and so on, back and forth, I can produce a flat-ribbed web of a width corresponding to the number of needles in action.

If desired, automatic means can be applied to throw the switches 15, 23, 27, and 26 into and out of action. It will be seen that instead of using a cylinder the needles may be made to reciprocate in grooves which are cut in the flat slab, and the cam may be placed upon a horizontal reciprocating slide to produce flat-ribbed webs without changing the invention. So, also, the needle-cylinder might be made to revolve instead of the cam-ring without altering the spirit of the invention.

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 with reciprocating needles, of a cam-carrier adapted to engage the heels of the said needles, cam-paths formed upon the inner face of the said carrier, and means for directing the needles therein in such a manner that alternate needles will be raised out of operative action to an upper path, while one set of needles is knitting and vice versa, substantially as described.

2. In a knitting-machine, the combination with reciprocating knitting-needles, having long and short heels, of a cam-cylinder or a cam-carrier having a cam-path upon its inner surface for engaging the heels of the said needles, means for engaging the long-heeled needles to raise them above the knitting position, while the short-heeled needles are performing the knitting operation, and means for raising the short-heeled needles while the long-heeled needles are performing the knitting operation, whereby a fabric will be knitted having a rib for each needle and a fine-ribbed fabric will be produced, substantially as described.

3. In a knitting-machine the combination with a cylinder having grooves for guiding the needles, of needles adapted to reciprocate in the said guides, a cam-cylinder surrounding the needle-cylinder and having plates secured to its inner surface forming between them cam-paths, a cam-block adapted to ex-

tend inwardly from the cam-cylinder a sufficient distance to engage needles having long heels and to lift them to an upper path out of operative position, a second cam-block adapted to direct the needles through a passage-way back into the cam-paths again, a cam-block having a passage-way formed in one edge adapted to raise needles having short heels up to the upper path out of operative position, and a cam-block for returning the short-heeled needles to the cam-path again, the construction being such that alternate needles may be raised and lowered at the proper time to produce a ribbed fabric, substantially as described.

4. In a knitting-machine, the combination with reciprocating knitting-needles, of a cam-cylinder surrounding the same having a cam-path formed upon its inner surface, two cams formed in the cam-path, means for raising the needles having long heels so that they will not engage the first cam, and means for returning the long needles to the cam-path in time to engage the second cam, and means for lifting the needles having short heels out of the cam-path in time to avoid the second cam, whereby a ribbed fabric may be produced, substantially as described.

5. In a knitting-machine, the combination with reciprocating needles, of a cam-cylinder surrounding the same having cam-paths formed upon its inner surface adapted to engage the heels of the needles, some of the said needles having long heels and some short heels, a removable cam-block inserted through an opening in the cam-cylinder and adapted to extend inwardly far enough to engage the long heels of the needles but not so as to engage the short heels of the needles whereby the long-heeled needles will be lifted out of operative position, a removable cam-block similar to the first block for returning the needles to the cam-path and similar removable blocks for engaging the short-heeled needles to lift them out of operative position and return them thereto, substantially as described.

6. In a knitting-machine, the combination with reciprocating needles, of a cam-cylinder surrounding the same having a cam-path upon its inner face, block-cams for directing the movement of the needles, one of the said block-cams being provided with a groove upon one edge and adapted to fill the space occupied by the said groove when turned to its opposite edge, trunnions upon the said block, bearings upon the outer surface of the said cam-cylinder for supporting the trunnions and spring-detents for holding the trunnions in the bearings, substantially as described.

7. In a knitting-machine, the combination with reciprocating needles, of a cam-cylinder surrounding the same having a cam-path provided with two cams, one of the said cams having its central portion removable and formed into a block, the said block having projections upon one edge so that when it is

inserted into position, it will complete the cam-path, projections upon the other edge of the said block which, when inserted in position, will complete a straight path through the cam so as not to actuate the needles, bearings upon the outer edge of the cylinder for holding the said block and spring-detents for retaining the block in position within the said bearings, the construction being such that the block may be removed from the cylinder and inserted with either edge innermost according as it is desired to move either one or the other of the cams, substantially as described.

8. In a knitting-machine, the combination with a series of reciprocating knitting-needles, of a cam-ring made of one piece of material surrounding the same having a cam-path formed with two cams, two yarn-holders for feeding yarn to the said needles at each cam, an outer ring for supporting the yarn-holders, said outer ring being provided with an inwardly-projecting lug, said lug being adapted to engage a cut-out portion in the cam-cylinder, the structure being such that when the ring is turned in one direction, it will engage one end of a cut-out portion to rotate the cam-cylinder and will place the yarn-holders in a new and proper position to feed yarn to the needles and when the said ring is reversed, the lug will travel to the other end of the cut-out portion before actuating the cam-ring and thus place the yarn-holders again in a new and proper position

for feeding the needles in the reverse movement, substantially as described.

9. In a knitting-machine, the combination of reciprocating needles each having a rigid bent portion bent below the latches, a cam-carrier adapted to engage the heels of the said needles, cam-paths formed upon the inner face of the said carrier, and means for directing the needles therein in such a manner that alternate needles will be raised out of operative action to an upper path, while one set of needles is knitting and vice versa, substantially as described.

10. In a knitting-machine, the combination with reciprocating needles, of a cam-cylinder surrounding the same having a series of pairs of cams, and pairs of yarn-guides for each pair of cams, means for regulating the movement of the needles so that some of the needles are raised high enough out of action to release their latches so the yarn being knit by the other needles will strike below the said latches in order to produce a ribbed fabric while others are working and then to raise the working needles out of action and bring the others into action, substantially as described.

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

BERNARD T. STEBER.

Witnesses:

HERMAN A. KLAGES,
JACOB SIEQUIST.