(No Model.) 4 Sheets—Sheet 1.

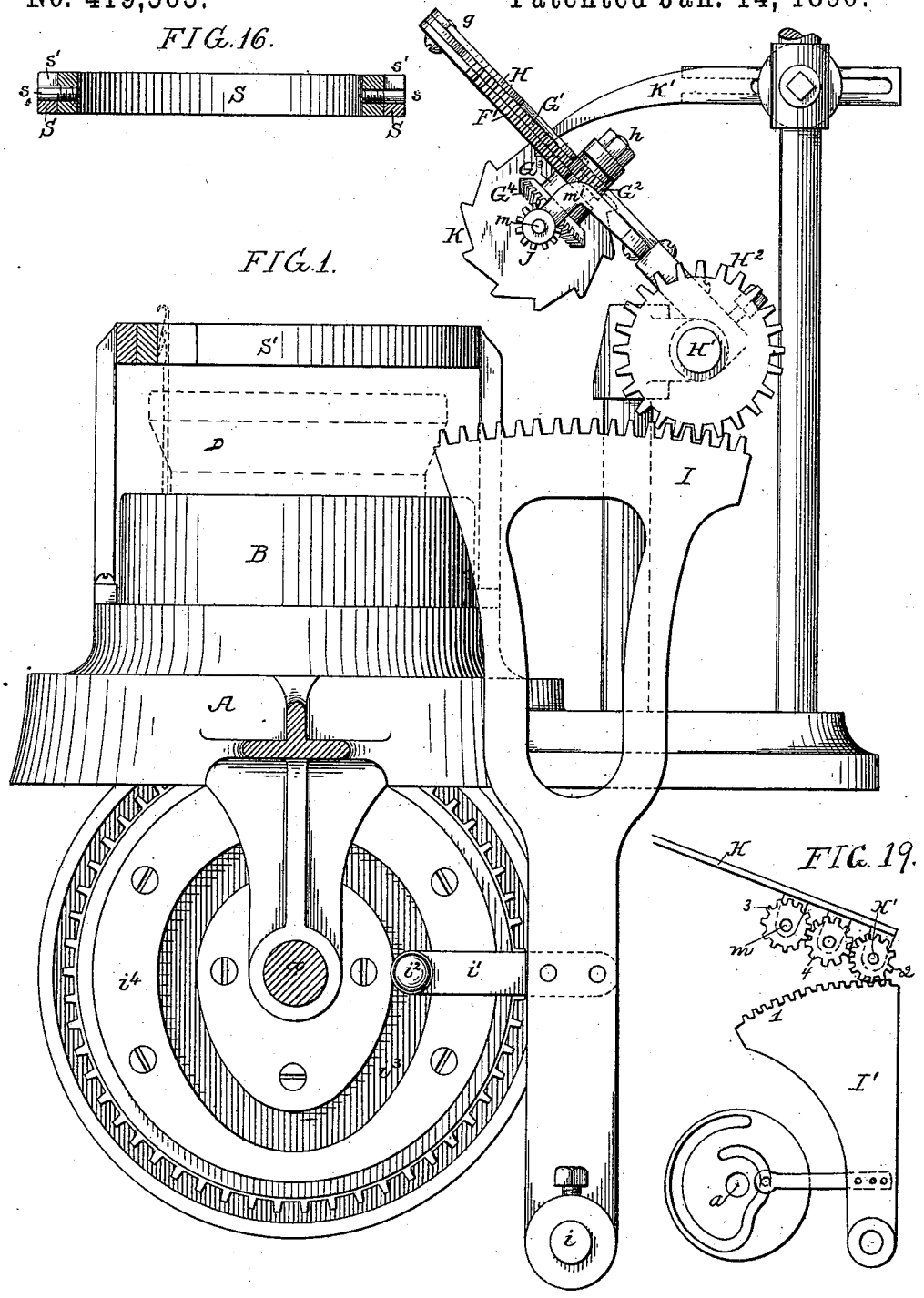
R. W. SCOTT & L. N. D. WILLIAMS.

CIRCULAR KNITTING MACHINE.

No. 419,565. Patented Jan. 14, 1890.

FIG. 16.

FIG. 1.



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(No Model.) 4 Sheets—Sheet 2.

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FIG. 3.

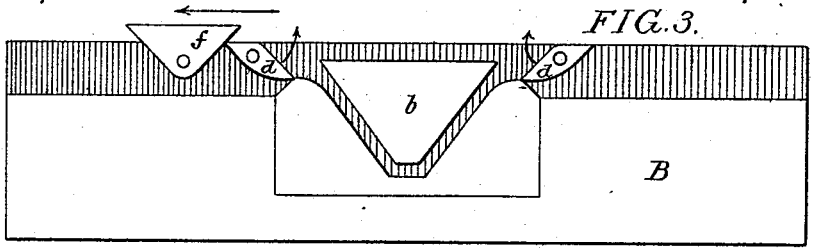


FIG. 2.

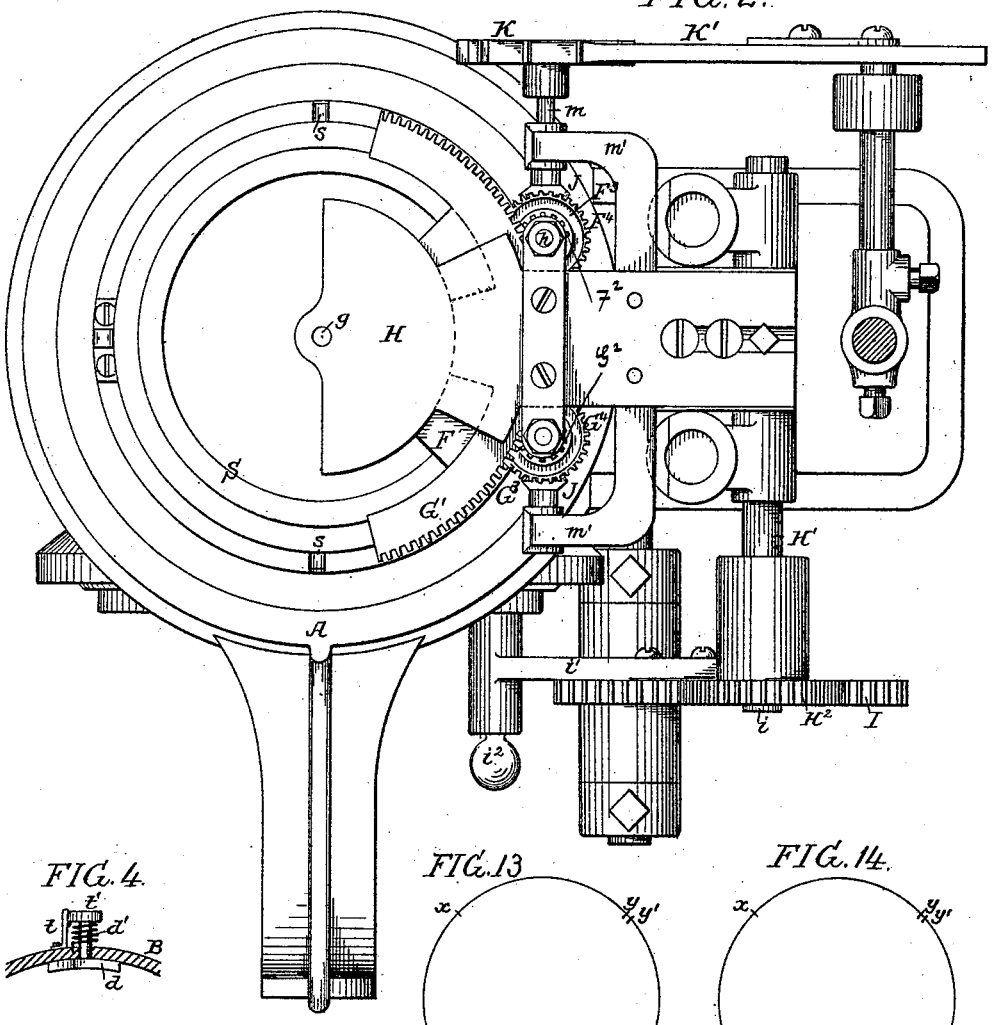


FIG. 4.

FIG. 13

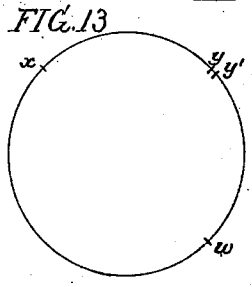
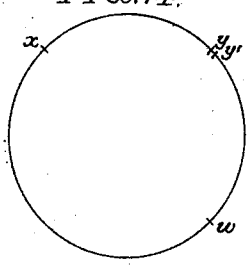


FIG. 14.



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(No Model.) 4 Sheets—Sheet 3.

R. W. SCOTT & L. N. D. WILLIAMS.

CIRCULAR KNITTING MACHINE.

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FIG. 5.

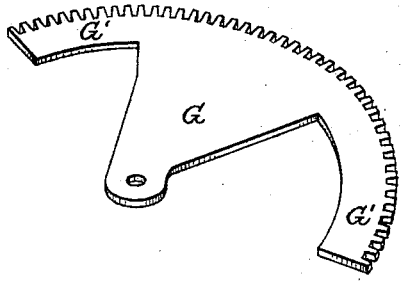


FIG. 6.

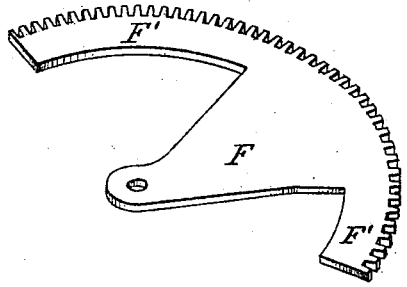


FIG. 7

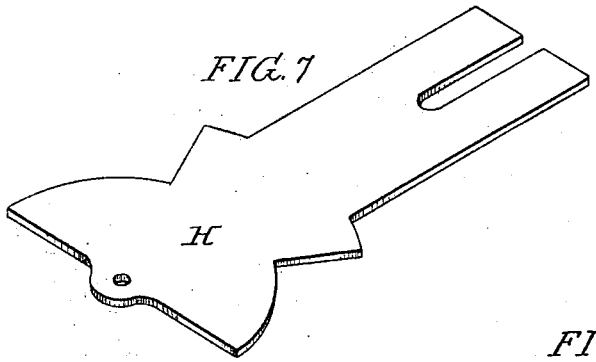


FIG. 8.

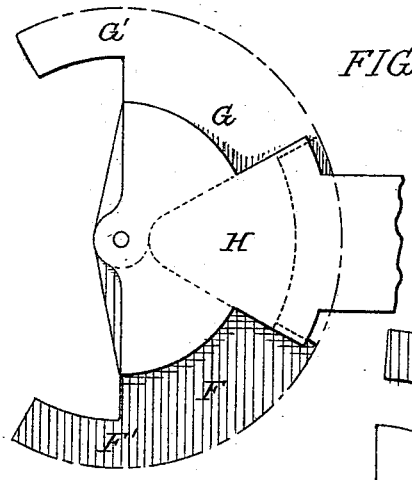
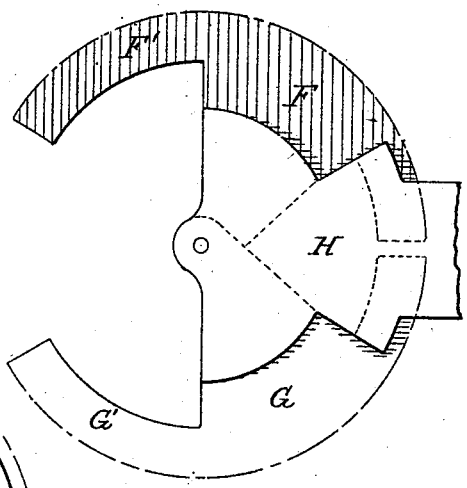


FIG. 10.



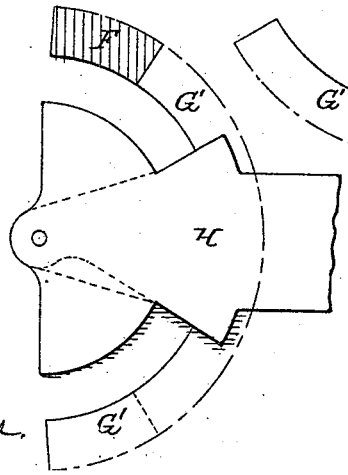


FIG. 9.

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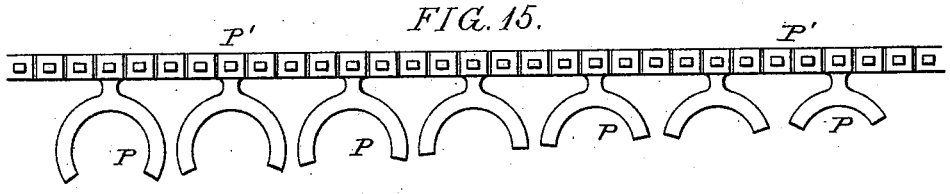
(No Model.) 4 Sheets—Sheet 4.

R. W. SCOTT & L. N. D. WILLIAMS.

CIRCULAR KNITTING MACHINE.

No. 419,565. Patented Jan. 14, 1890.

FIG. 15.



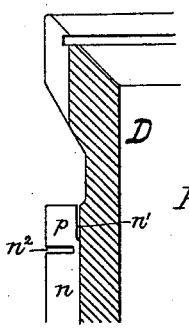


FIG. 11.

FIG. 12.

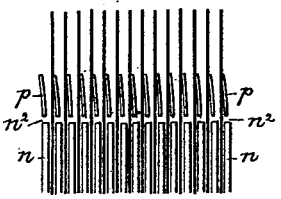


FIG. 17.

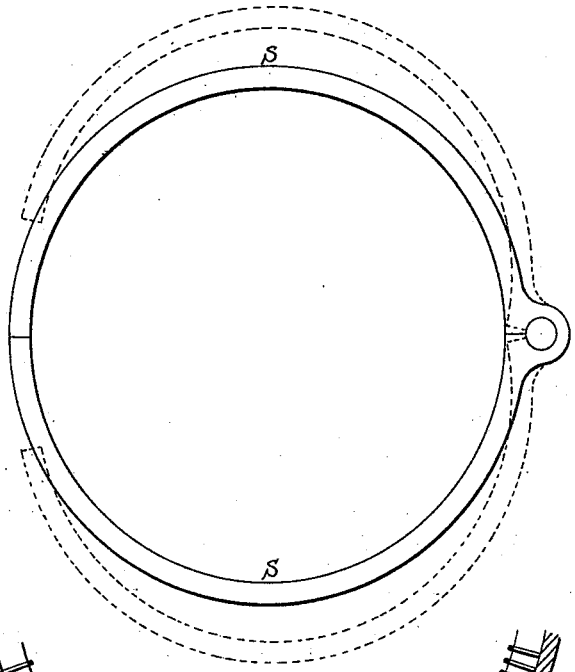
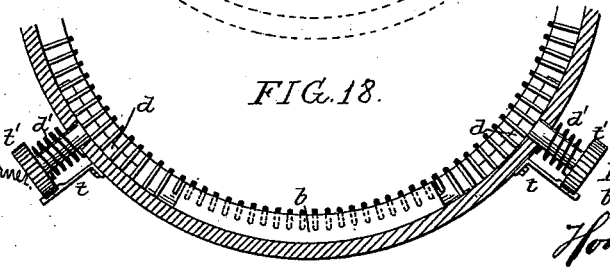


FIG. 18.



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UNITED STATES PATENT OFFICE.

ROBERT W. SCOTT AND LOUIS N. D. WILLIAMS, OF PHILADELPHIA, PENNSYLVANIA.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 419,565, dated January 14, 1890.

Application filed September 23, 1889. Serial No. 324,819. (No model.)

To all whom it may concern:

Be it known that we, ROBERT W. SCOTT and LOUIS N. D. WILLIAMS, both citizens of the United States, and residents of Philadelphia, Pennsylvania, have invented certain Improvements in Circular-Knitting Machines, of which the following is a specification.

Our invention consists of improved mechanism for operating the needles of a knitting-machine so that the number and location of the needles which are in action may be governed in a simpler manner than usual.

In carrying out our invention the normal position of the needles is the projected or inoperative one—that is to say, the position in which the bits of the needles are out of control of the cams or other devices whereby the needles are operated in order to draw the stitch—the needles being pushed into operative position or into control of the cams or other actuating devices by simple pressure upon the hooked or the butt ends of the needles.

In the accompanying drawings, Figure 1 is a sectional side view of sufficient of a circular-knitting machine to illustrate the application of our invention thereto. Fig. 2 is a plan view of the same. Fig. 3 is a view in an extended flat plane of the cams on the cylinder for operating the needles, and Figs. 4 to 19 are views illustrating special features of the machine or modifications in details of the same.

In Fig. 1, A represents part of the fixed frame of the machine, B the cam-cylinder, and D the needle-cylinder, the cam-cylinder being driven from the shaft *a* by gearing of any ordinary character—for instance, by gearing such as shown in Patent No. 410,859, dated September 10, 1889—so that said cam-cylinder can be rotated continuously in one direction or can be turned forward and backward, as required. The cam-cylinder has needle-operating cams such as shown in Fig. 3, there being a central drawing-down cam *b* and at each side of the same a pivoted throw-out cam *d*, the stem of which is under control of a spring *d'*, Fig. 4, tending to retain the cam in the position shown in Fig. 3, but permitting it to yield in the direction of the arrow shown in said figure, so that the bit of the needles may pass under the same in approaching the drawing-down cam. On leaving the drawing-down cam, however, the throw-out cam *d* will raise the bit of the needle above or out of range of said drawing-down cam, so that in order to form the next stitch upon the needle it must be depressed so that its bit will again come within range of the drawing-down cam.

In making plain tubular work the cam-cylinder moves in the direction of the arrow, Fig. 3, and a preliminary drawing-down cam *f* is located in advance of the first cam *d*, so as to draw the needles successively down into operative position before they reach said cam *d*, the bits of the needles then tripping said cam, passing under the cam *b*, and being then raised to inoperative position by the throw-out cam *d*, which follows said cam *b*. In reciprocating the machine, however, the cam *f* is removed and the needles are moved from the inoperative to the operative position by a presser acting upon the tops of the needles, the presser being capable of expansion and contraction, so as to provide for throwing more or less needles into action, as the character of work to be produced may suggest.

As shown in Figs. 1 and 2, the mechanism for effecting the pressing of the needles into action comprises a pair of segments F and G, Figs. 5 and 6, these segments being hung by a pin *g* to a plate H, Fig. 7, and said plate being secured to and projecting forward from a rock-shaft H', having at one end a pinion H^2, gearing into a segment I, pivoted at *i* to a suitable stud on the frame A and having an arm *i'*, with a pin i^2, engaging at its inner end with a cam-slot i^3 in a disk i^4 on the driving-shaft *a*, so that as said shaft is turned back and forth it will effect the reciprocation of the cam-cylinder, a vibrating motion will be imparted to the segment-rack I, the shaft H' will be caused to rock in its bearings, and a rising and falling movement in the arc of a circle will be imparted to the plate H and to the segments carried thereby.

As the needles after passing the drawing-down cam are raised by the succeeding cam *d* into inoperative position—that is to say,

into a position in which their bits are free from the control of the drawing-down cam—it follows that on the next movement only such needles will be operated upon by the drawing-down cam as have been pressed down into the path of the same by the action of the segments F and G, these segments in their descending movement acting upon the hooked upper ends of the needles, and thus depressing said needles sufficiently to bring their bits within the range of the cam *b*. In order that the number of needles thus rendered operative may be diminished or increased and the web of fabric produced by the needles thus narrowed or widened, we provide for contracting and expanding the segments F and G by means of the mechanism which we will now proceed to describe.

The outer portion of each segment radially beyond the line of the needles is provided with a segmental rack F′ G′, the rack F′ gearing into a spur-pinion F^2, which is secured to or forms part of a sleeve F^3, turning on a stud *h*, secured to and depending from the plate H, the lower end of the sleeve forming or being provided with a bevel-wheel F^4, which gears into a bevel-pinion J on a shaft *m*, free to turn in brackets *m′*, secured to or forming part of the plate H, one end of said shaft being provided with a ratchet-wheel K, which on the rise of the plate comes into engagement with a pawl K′, hung to a fixed standard on the frame, so that a movement of partial rotation is thereby imparted to the ratchet-wheel and to the shaft *m* carrying the same. The segmental rack G′ is operated by a spur-pinion G^2, sleeve G^3, bevel-wheel G^4, and bevel-pinion J in the same manner as the rack F′, so that as the plate H rises and falls movement in opposite directions will be imparted to said racks and to the segments, the number of needles covered by the segments being thereby increased or diminished.

In forming upon the machine shown a pocket or bulge such as is required to form the heel or toe of a stocking the segments F and G are in the first instance separated to the full extent, so that in conjunction with the segmental portion of the plate H they cover about one-half of the entire number of needles of the head, as shown in the diagram Fig. 8, and on each reciprocation of the cylinder the segments are moved toward each other to a slight extent, so as to gradually contract the area covered by the segments, and thus provide for a gradual increase in the number of needles permitted to remain in the elevated or inoperative position, the teeth of the ratchet-wheel K and of the racks F G′ and intermediate gearing being so proportioned in respect to the gage of the head that each successive movement of the ratchet-wheel K will cause the contraction of the segments F G to the extent of one-half the distance between the needles of the head, and one segment being set in advance of the other to the extent of a half a needle, so that the needles will be dropped out of action first at one end of the acting set and then at the opposite end of the same. This operation will continue until the segments have been contracted to the full extent and lie directly one over the other and beneath the segment of the plate H, as shown in Fig. 9, which position they assume when the desired narrowing of the fabric has been effected, the next movement of the racks causing the separation of the segments, so as to gradually bring needles into action again to widen the web, the two operations being effected by the continuous forward movement of the ratchet-wheel K. The widening operation continues until the segments are again fully separated, as shown in Fig. 10, after which the cam *f* is replaced and the making of continuous tubular fabric resumed, the segments being restored to their normal position, Fig. 8, before the next narrowing and widening operation has to be performed.

In order to insure the retention of the needles in the elevated or inoperative position, the ribs *n* of the needle-cylinder, which form the partitions between the needle-slots, are at their upper ends freed from connection with the body of the cylinder by means of a slot or incision *n′*, Fig. 11, and are also preferably recessed at the front edge, as at n^2, and reduced in thickness above this point, as shown in Fig. 12, so as to form on each rib or partition an elastic finger *p*, which can be bent laterally, so as to bear against the shank of the needle in the adjoining slot, and thus impart sufficient friction thereto to retain it in the elevated position to which it has been moved. The presser-plate is available for other uses than for the widening and narrowing of a web of fabric. For instance, it may be used effectively in connection with a circular machine for the production of flat webs by rotating the cam-box, so as to start the web on one needle, and, after carrying the cam-box around the head, finishing the course on the needle adjacent to the starting-needle, the direction of movement of the cam-box being then reversed and the second course started on the finishing-needle of the first course and finished on the starting-needle of the same, and so on, so as to form a flat web with opposite selvages. In using the presser-plate for this purpose said plate may extend around the entire head with the exception of so much of the segment as is necessary for the disposal of the needle-actuating cams of the cam box. For instance, it may extend throughout the greater segment from the point *x* to the point *y′* in Fig. 13, and, while the cams occupy a position adjacent to the lesser segment from *x* to *y*, the plate may be depressed so as to throw into action all the needles from *x* to *y′* around the greater segment. While the cam is traversing past these needles in the direction from *y′* to *x*, the plate may be shifted circumferentially and again depressed, so as to throw into action the needles in the lesser segment from

x to y before the operating-cams of the cam-box reach the same, leaving out of action the needles from y' to w, Fig. 14, so that the cams after actuating the needles from x to y pass beneath the needles from y' to w without forming stitches thereon. The plate is then again depressed and the movement of the cam-box reversed, so as to start the second course on the needle y, the presser-plate being again shifted and depressed, so as to bring the needles from w to y' into operative position before the cams reach the same on the backward movement, the course ending on the needle y', and the operations being then repeated, so that the adjoining needles y y' constitute the selvage-needles. The shifting of the presser here contemplated involves a back-and-forth movement of the shaft m with periods of rest—a movement which may be conveniently effected by gearing actuated by a cam-controlled toothed segment—such, for instance, as that employed for vibrating the presser-carrier at intervals. In Fig. 19 we have, for instance, illustrated gearing for the purpose, consisting of the cam-controlled lever I', having a segment 1, which gears into a pinion 2, loose on the shaft H', and driving a pinion 3 on the shaft m through the medium of an intermediate pinion 4, hung to a stud on the plate H.

The mode described of forming flat selvaged webs on circular machines is of value when such a web has to be formed as a continuation of a tubular web, as the entire number of needles in the machine are available for the production of said flat web, which has therefore the same number of stitches as the tubular web, and both can be produced upon the one machine, if desired.

Instead of shifting the presser-plate, the needle-cylinder and its needles may be shifted, and vertical movement may be imparted to the needle-carrier instead of to the presser, if desired, in order to effect the depression of the needles from inoperative to operative position. For instance, the needle-cylinder may be mounted upon a cam-ring, as in the patent of D. C. Bellis, No. 385,163, June 26, 1888, this ring being moved back and forth to raise and lower the cylinder.

In will be evident that our invention may be carried out in connection with straight machines as well as circular machines, and also that it may be used for widening or narrowing fabrics, instead of for both purposes, as before described, and various modifications in the construction of the needle-pressing plates and in the mode of operating the same can be effected without departing from our invention.

One of such modifications is illustrated in Fig. 15, in which is shown a succession of segmental plates P, carried by an endless chain P', intended to be located in the rear of the needle-cylinder and to be intermittently operated so as to bring the plates in succession over the needles, the plates being depressed by the vibrating frame or plate H of the machine, and the successive plates being of such dimensions as to effect the desired widening or narrowing of the fabric which is being formed upon the machine.

In order to prevent the closing of the latches of the needles as they are raised to the inoperative position or to the clearing position, it is advisable to mount at a suitable distance above the top of the needle-cylinder a guard-ring S, as shown in Fig. 1, which will strike any latches that may rise on clearing the stitches and thus prevent said latches from closing against the hooks of the needles and cause slipping of the stitches when the needles are depressed.

As shown in Fig. 16, the guard-ring has pins s, adapted to vertical slots s' in the carrier-ring S', so that said guard-ring rests on but is detachable from the carrier-ring, and can hence be removed to permit of the removal of the cylinder; but it will be evident that a split or two-part ring to be separated laterally, as shown, for instance, in Fig. 17, may be substituted therefor, and this ring may carry a thread-guide or may have an opening serving as a thread-guide, if desired.

In many cases it may be advisable to construct with short bits the needles which are intended to be always in action and to make the lifting-cams so thin that they will not elevate the short-bitted needles out of range of the drawing-down cam, the extra wear on these needles being thus prevented. (See Fig. 18.)

The use of the preliminary drawing-down cam f (shown in Fig. 3) may be dispensed with in the production of tubular work if the cam d, which follows the drawing-down cam, is so constructed as to be retained in the elevated or inoperative position, for in that case the bits of the needles on leaving the drawing-down cam will not be elevated to a point beyond said cam, but will remain in condition to be operated by it on the next rotation of the cam-box. A convenient device for holding the cam d in inoperative position is a spring-finger t, engaging with a notch in the enlarged head t' at the outer end of the stem of the cam, as shown, for instance, in Fig. 4. Other means than cams may also be used for operating the needles of the machine so as to clear the same or draw the stitches thereon—for instance, such means as are described in an application for patent filed by us on the 22d day of June, 1889, No. 315,288.

We do not in this application claim the process of knitting which we have herein described, as in a separate application filed by us on the 23d day of September, 1889, Serial No. 324,818, we have laid claim to such process.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. The combination, in a knitting-machine, of the needle-carrier and its needles, means

for actuating the needles to draw the stitch and for subsequently moving the needles to inoperative position, and a presser for acting upon the needles to restore them to operative position, substantially as specified.

2. The combination, in a knitting-machine, of the needle-carrier and its needles, means for actuating the needles to draw the stitch and for subsequently moving the needles to inoperative position, a presser for restoring the needles to operative position, and provision for expanding and contracting the presser, substantially as set forth.

3. The combination of the needle-carrier and its needles with the cam-box having a drawing-down cam, and at each side of the same a yielding cam for moving the needles out of the path of the draw-down cam, and a presser for restoring the needles to the influence of said draw-down cam, substantially as specified.

4. The combination of the needle-carrier and its needles, the cam-box having a draw-cam, and at each side of the same a yielding lift-cam for moving the needles out of the path of the draw-down cam, and a supplementary draw-down cam in advance of one of said lift-cams, substantially as specified.

5. The combination of the needle-carrier and its needles, means for operating said needles to draw the stitches and for subsequently moving them to inoperative position, a presser for restoring them to operative position, a carrier for said presser, and a rock-shaft on which said carrier is mounted, substantially as specified.

6. The combination of the needle-carrier and its needles, means for operating said needles to draw the stitches and for subsequently moving them to inoperative position, a presser for restoring them to operative position, said presser consisting of a pair of segments, and rack-and-pinion mechanism for moving said segments in respect to each other, substantially as specified.

7. The combination of the needle-carrier and its needles, means for operating said needles to draw the stitches and for subsequently moving them to inoperative position, and a presser for restoring them to operative position, said presser consisting of a vibrating frame, a pair of segments carried thereby, rack-and-pinion mechanism, a ratchet-wheel on the pinion-shaft, and a pawl for actuating said ratchet-wheel as it is moved with the vibrating frame, substantially as specified.

8. The combination of the needles with a needle-carrier having ribs with free portions forming laterally-bent fingers for bearing on the shanks of the needles and holding them in inoperative position, substantially as specified.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ROBERT W. SCOTT.
LOUIS N. D. WILLIAMS.

Witnesses:
R. SCHLEICHER,
HARRY SMITH.