

(No Model.)

J. L. ECK.  
CIRCULAR KNITTING MACHINE.

No. 592,134.

Patented Oct. 19, 1897.

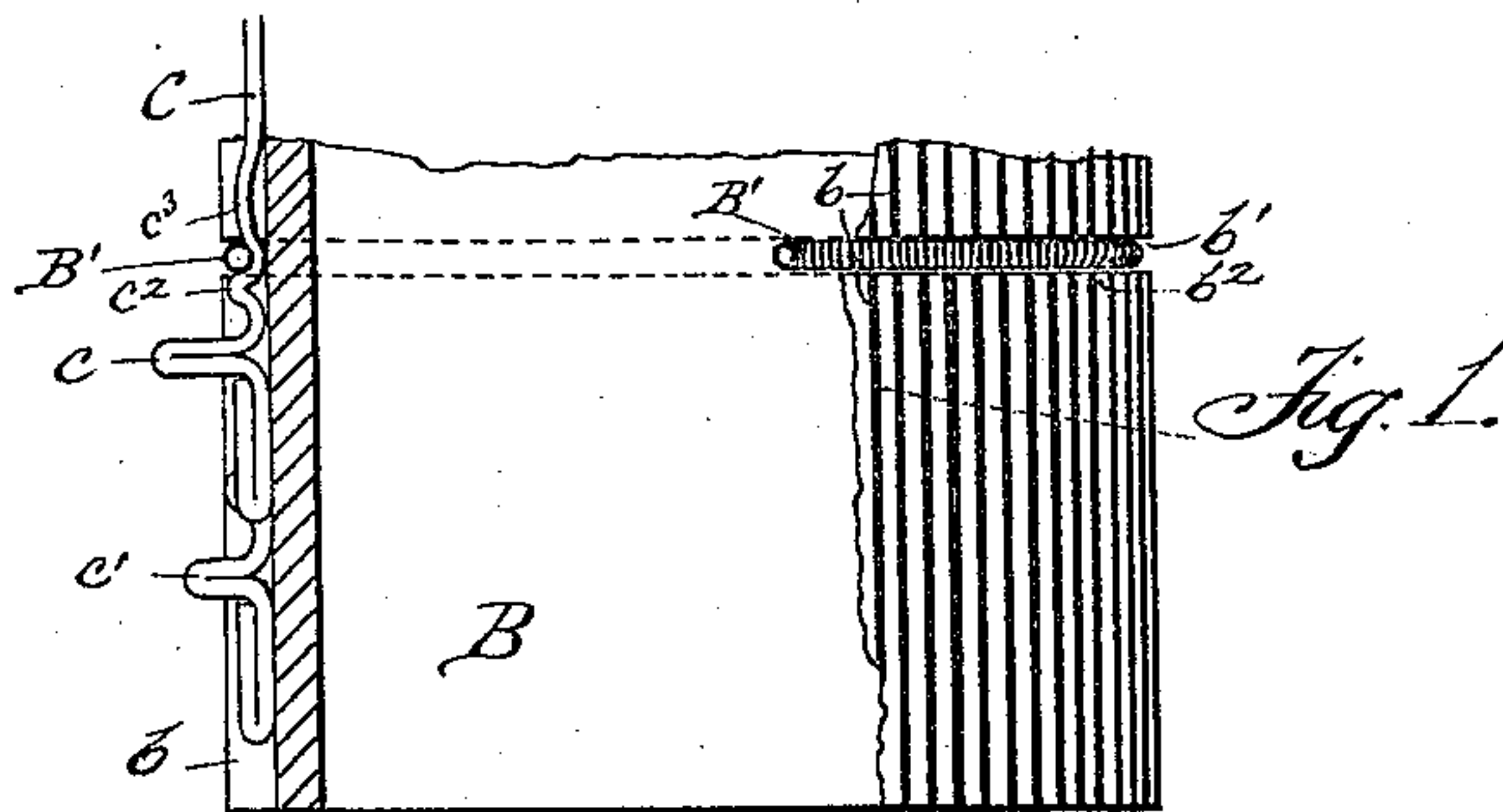


Fig. 1.

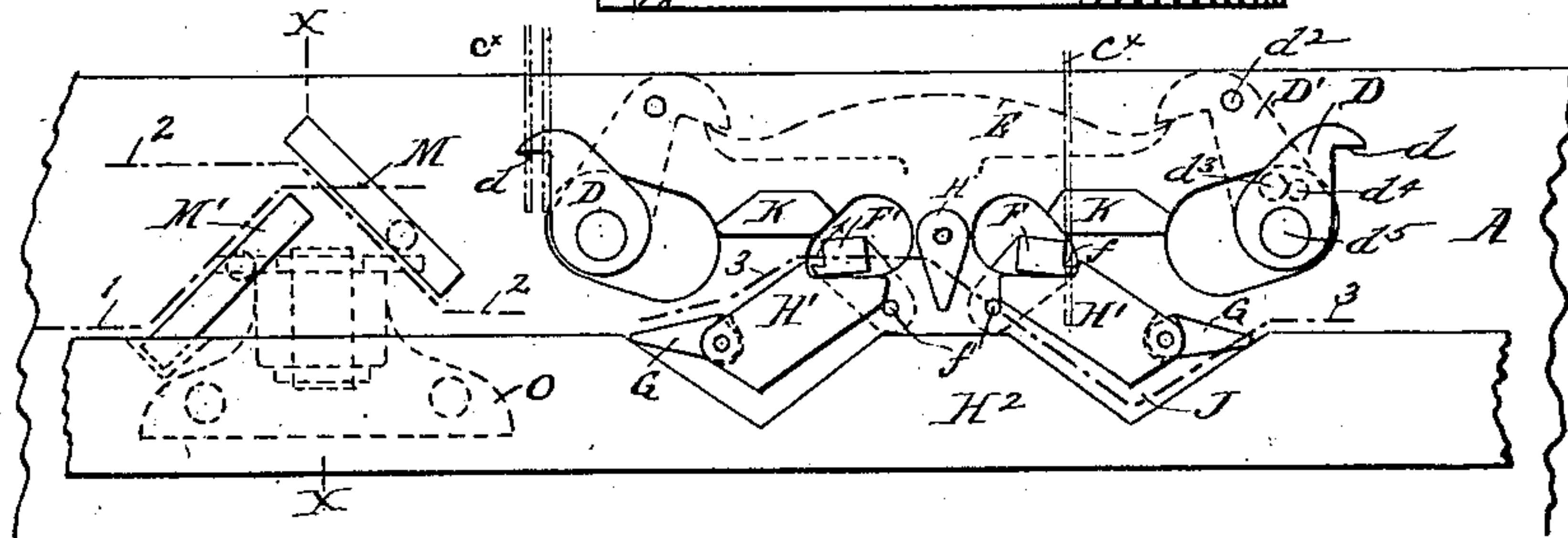


Fig. 2.

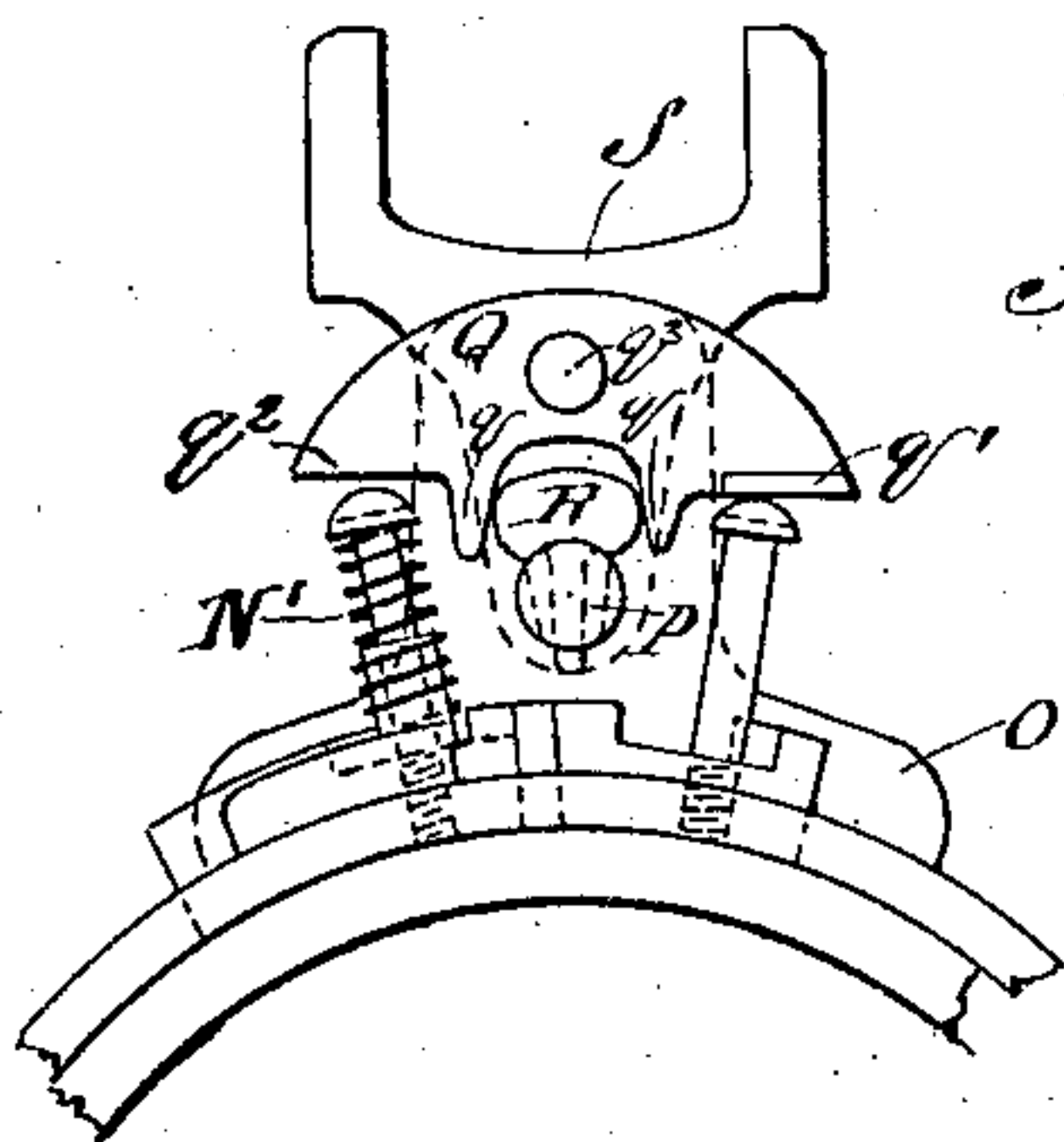


Fig. 3.

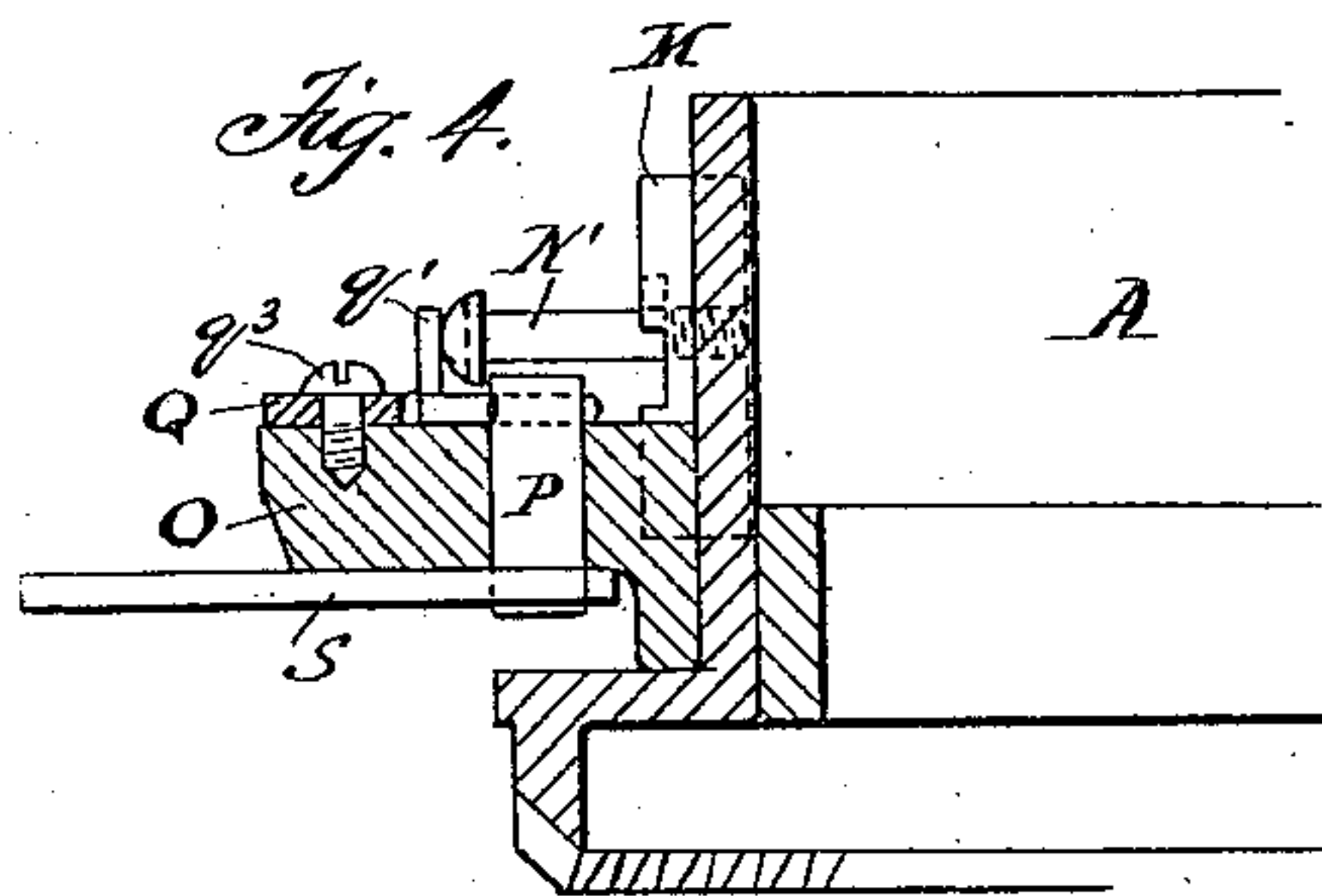


Fig. 4.

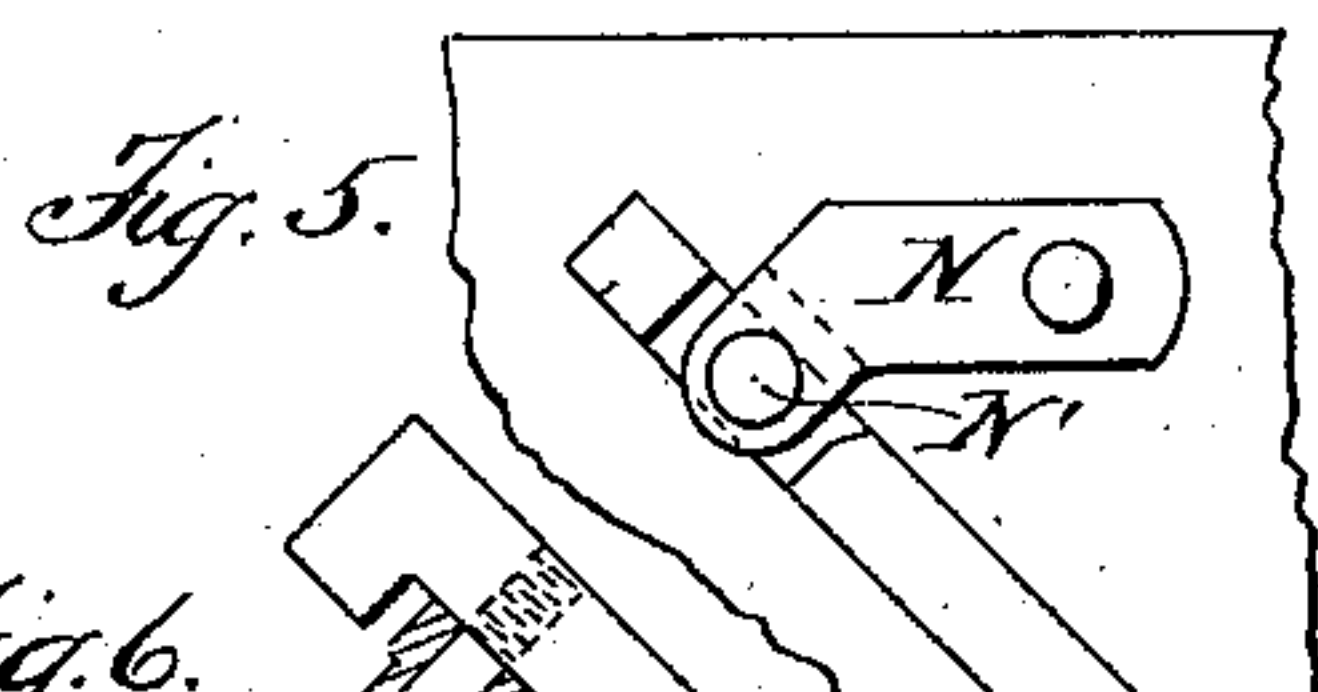


Fig. 5.

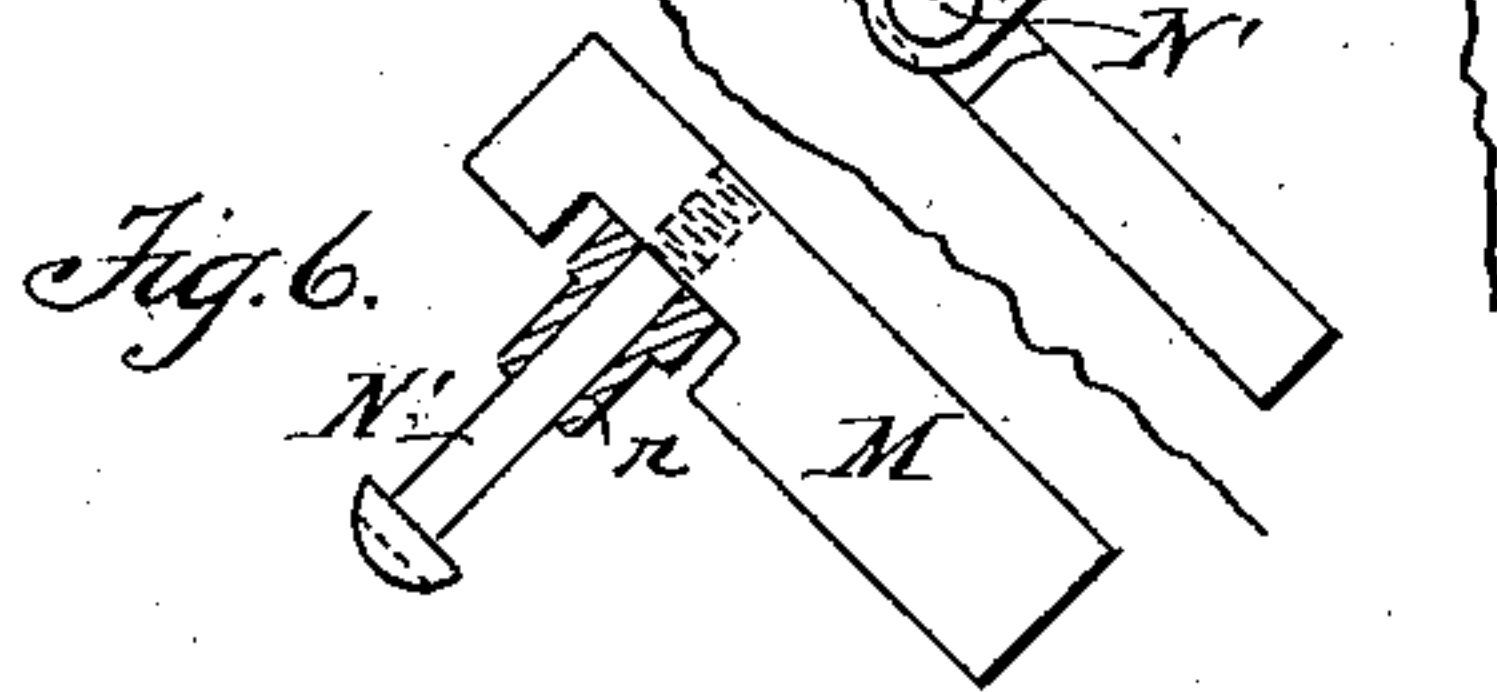


Fig. 6.

Fig. 8.

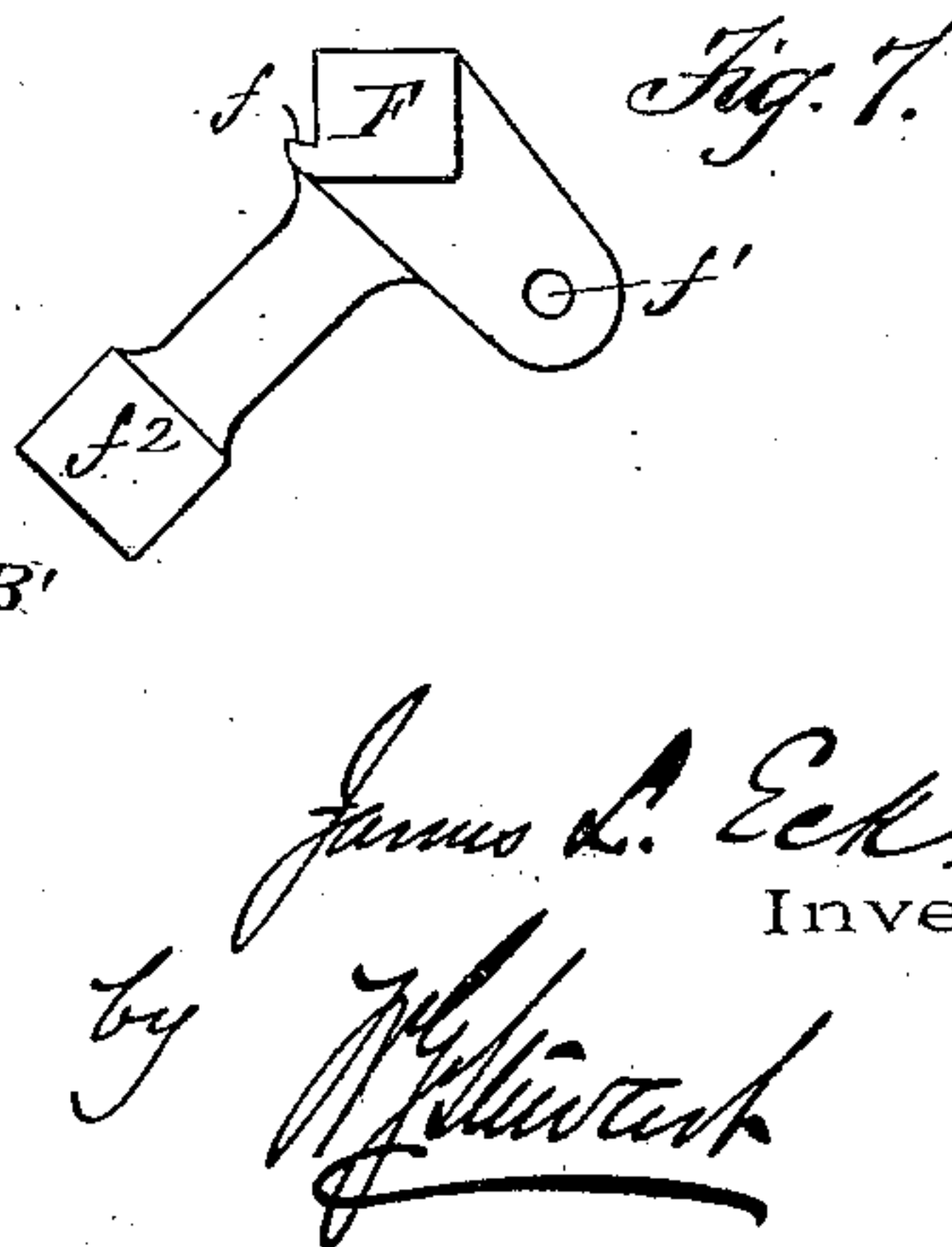
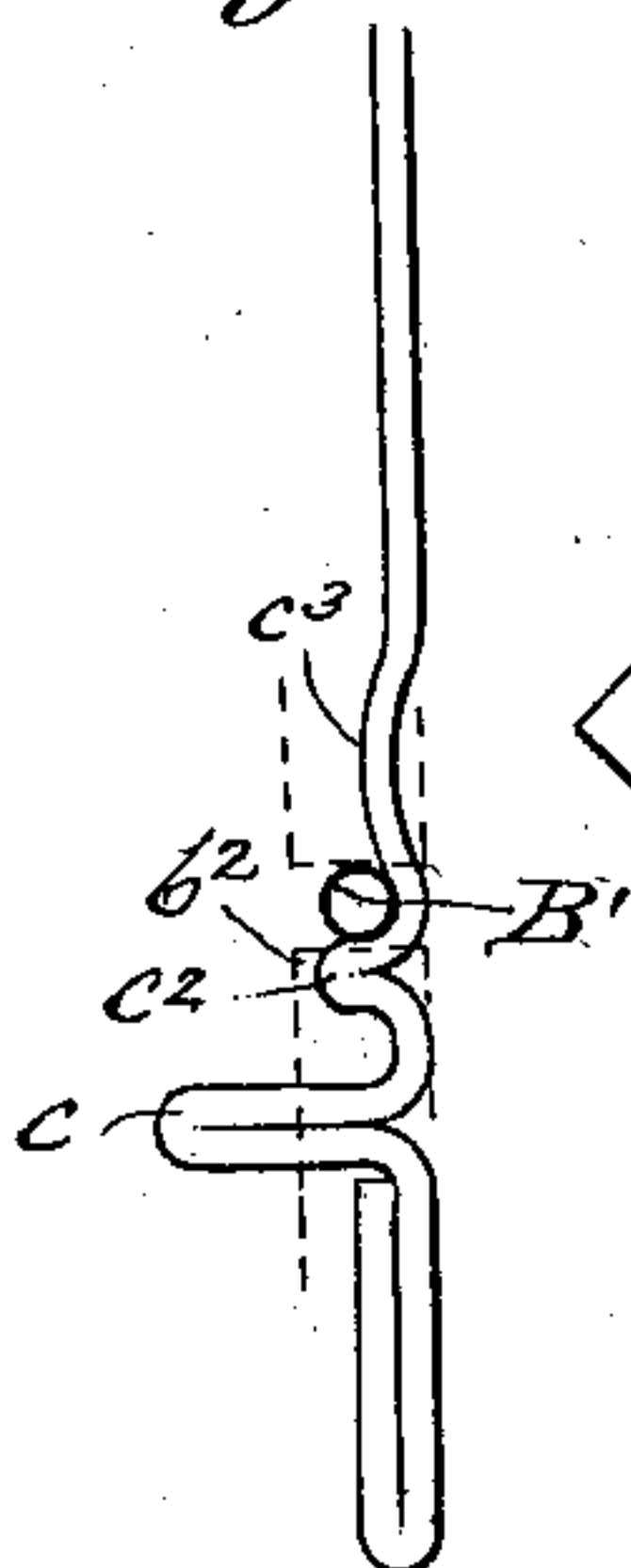


Fig. 7.

Witnesses:

Calvin J. Richer  
David Levan

James L. Eck,  
Inventor.

by *W. H. H. H.*

Attorney.



# UNITED STATES PATENT OFFICE.

JAMES L. ECK, OF READING, PENNSYLVANIA.

## CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 592,134, dated October 19, 1897.

Application filed May 17, 1895. Serial No. 549,640. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES L. ECK, a citizen of the United States, residing at Reading, county of Berks, State of Pennsylvania, have  
5 invented certain Improvements in Circular-Knitting Machines, of which the following is a specification.

My invention relates to circular-knitting machines; and it consists, first, in improved  
10 mechanism for raising out of service the "half-back" needles, as required preparatory to the formation of the heel of a stocking, for instance, and for again lowering said needles after the heel has been formed, second, in  
15 providing for the lowering of two of the raised needles together in the narrowing operation and the reraising of one of them, whereby the formation of the heel is more satisfactorily effected.

20 The features of the invention are fully described in connection with the accompanying drawings, and are particularly pointed out in the claims.

Figure 1 is an elevation partly in section  
25 of the needle-cylinder of the machine. Fig. 2 is an inside view of a portion of the cam-cylinder developed. Fig. 3 is a plan view of a portion of the cam-cylinder, having the switch-cam mechanism attached thereto; and  
30 Fig. 4 is a sectional elevation of the same on the line  $x x$  of Fig. 1. Figs. 5, 6, 7, and 8 are separate views of several parts of the machine.

My present invention relates particularly to the form of machine for which Letters Patent  
35 were issued to me July 17, 1894, No. 523,111; and in the accompanying drawings I have only shown so much of the general construction as is required to clearly explain the application and effect of my improvements.

40 The cam-cylinder A is arranged to turn upon the inclosed needle-cylinder B with either a rotary or reciprocating motion, as desired for different work, in the usual manner, and is shown provided with a cam mechanism similar in the main to that which is particularly described and claimed in my prior  
45 patent referred to. This mechanism consists, essentially, of separate throwing-down and throwing-up cams adapted to operate, respectively, upon the raised and lowered series of  
50 needles in widening and narrowing. The throwing-down cams D D are each carried by

an exterior arm D', pivoted at  $d^2$  to the cam-cylinder, the cam being adapted to turn in one direction upon its pivotal connection  $d^5$  55 to the arm, (against the tension of a spring not shown in the drawings,) but rendered rigid therewith as to strains in the opposite direction by means of stops  $d^3 d^4$ . The throwing-up cams F F' are pivoted at  $f' f'$  to the 60 cam-cylinder and are weighted so as to normally fall into lowered position. The only difference to be noted in these two sets of cams, as compared with those shown in my previous patent, are, first, that the hooked 65 ends  $d$  of the throwing-down cams are lengthened so as to engage the heels of two needles instead of one, and, second, that the throwing-up cams are independent of the cross-arms E and connected mechanism whereby 70 the throwing-down cams are moved into operative or inoperative position, instead of being arranged to engage therewith. The effect of these differences will be described later.

The central pivoted cam H, fixed cams H' 75 H' H<sup>2</sup> and K K, and pivoted cams G G form jointly, as heretofore, the upper and lower courses of the needles required to form the stitches in ordinary knitting.

In my prior patent no special provision 80 was made for raising out of action about one-half of the needles, technically called the "half-back needles," as is required preparatory to the operation of forming the heel or toe of a stocking. To accomplish this and 85 the subsequent lowering of the same automatically, I now provide a novel mechanism comprising a pair of switch-cams M M', which are mounted in oppositely-inclined position in openings in the wall of the cam-cylinder 90 and are capable of radial movement, and a lever mechanism whereby one or other of said cams is caused to project inwardly into the path of the needles and engage such of the latter as are intended to be operated by 95 them. A guide-bracket N is provided for the headed shank N', forming part of each cam, and a spring  $n'$  (one of which is shown on the left-hand shank in Fig. 3) is arranged to normally retract the cam, while a lever Q, pivoted at  $q^3$  to a bracket O on the cam-cylinder, is adapted when rocked to bear at one or other of its opposite ends  $q' q^2$  against a cam-shank N', so as to press the cam inwardly 100



until it projects it sufficiently into the path of the needles to engage such of the latter as are provided with long heels  $c$ , while permitting those with short heels  $c'$ , Fig. 1, to pass freely. The cam  $M'$  is set low down, so that the heels of the needles cannot pass under its lower ends when it is projected, but are forced to raise up the ineline and pass over the top end, while the cam  $M$  is set high, so as to cause the heels of the raised needles to come in contact with it, when it is projected, and to ride down its inclined side and under its end into the lower course. To operate the lever  $Q$ , I employ a shaft  $P$ , mounted vertically in the bracket  $O$  and provided at its upper end with a cam or tooth  $R$ , arranged to engage teeth or projections  $q$  on the rocking lever, and at its lower end with an arm  $S$  of any suitable form whereby the shaft may be turned. The tooth  $R$  is so shaped as to rock the lever  $Q$  a sufficient distance to properly project the switch-cam and to hold it in such position against any strain upon the cam.

For convenience in assembling and disconnecting the parts, the shanks  $N'$  are preferably detachably secured to their respective cams and cam  $R$  is removably secured by any suitable means to its shaft  $P$ . The manner preferred of securing the shanks to the cams is by screw-threads, as shown. Each shank is shown as encircled by a collar  $n$ , having an enlarged end, which is let into a recess in the contiguous cam and provides an abutment for the end of the coiled spring  $n'$ , said collar being formed on the end of bracket  $N$ .

The use of two series of needles having heels  $c'$  or  $c$  of different lengths is not new, but I have provided the shank of each needle with an additional heel or stop  $c^2$  adjacent to the main heel, but nearer the hook of the needle, said supplemental heel serving as a positive stop for the needle, and thereby permanently relieving the main shank of its function as a stop against the needle-band. The needle is preferably formed with a compound curve, as shown at  $c^2$ , above said supplemental heel to provide a pocket contiguous to the latter for the band  $B'$ . The purpose and effect of this improvement are, first, to greatly reduce the liability of breakage both of the needles and the ribs  $b$  between the needle-grooves, and, second, to increase the guiding and wearing surface of the needles in said grooves. It is evident that the circular groove  $b'$  in the periphery of the needle-cylinder for the spring-band  $B'$  makes the corner  $b^2$ , Fig. 8, of each rib so weak that any considerable side strain is likely to break it off. I have found that in practice such strains are brought against the needle-heels  $c$ , and that in the construction of needles heretofore used this strain comes directly upon the weak corner  $b^2$  of the rib and results in breakage both of the ribs and needles. By providing the additional heel  $c^2$  instead

of making the main heel  $C$  serve as a stop against the spring-band  $B'$ , the strain brought upon the main heel is taken by the rib a considerable distance below the weak upper corner and no breakage is likely to occur, while at the same time the stop  $c^2$  furnishes an additional bearing and prevents rapid side wear on the needle, thus considerably increasing its life.

In the operation of the machine for circular knitting the needles take the course marked 3 in Fig. 2, the needle-heels passing under the throwing-up cam  $F'$ , which has been raised from its natural lowered position by the first needle contacting with it, as indicated by the arrow 4, this needle being subsequently lowered again by the throwing into action of the switch-cam  $M$ . Thus the cam  $F'$  is held in raised position by the needles passing under it instead of being independently supported, as in my prior construction referred to, and falls freely into the lowered position indicated in the drawings when a series of needles are raised out of the course 3. When the heel of a stocking is reached, for instance, about one-half of the needles must be raised and the motion of the cam-cylinder changed from rotary to reciprocating. To effect the former action, the switch-cam  $M'$  is thrown into service, as before described, and the long-heeled needles are raised, as indicated by the dotted line 1. The narrowing is then effected by the action of the cams  $F'$  and  $F$ , which alternately raise the end needles out of service, the throwing-down cams being lowered so as to permit the passage of the raised needles over them, all as in my prior construction referred to. The widening is then effected by raising the cams  $D$   $D'$  to the position shown. This brings two of the raised needles under the hook  $d$  of the cam, as indicated by dotted lines, and they are both thrown down by the movement of the latter and pass under the cam  $F'$ , which is held in raised position by the preceding lowered needles with which they follow the course 3. On the return stroke one of these needles (marked  $C^x$ ) is again raised by the cam  $F$ , so that each double movement of the cam-cylinder widens only one needle at each end, as heretofore.

Having thus fully explained my invention and distinguished the same from what has heretofore been done, what I desire to claim is—

1. In a knitting-machine, the combination with the cam-cylinder, of two oppositely-inclined switch-cams radially movable through openings in the cylinder-wall, shanks projecting through said wall from said cams, retracting-springs on said shanks for holding said cams normally out of the needle-path, a rocking lever arranged to engage one or the other of said shanks when moved from its central position, for projecting said cams one at a time into the needle-path, and means for operating said lever.



2. In a knitting-machine the combination with the cam-cylinder of two oppositely-inclined switch-cams radially movable through openings in the cylinder-wall exterior shanks on said cams provided with retracting-springs, a rocking lever adapted to engage one or other of said cam-shanks when moved from its central position, and a vertically-arranged shaft, provided with a cam engaging said rocking lever and adapted to operate the same, substantially as set forth.

3. In a knitting-machine, the combination with the cam-cylinder of two oppositely-inclined switch-cams radially movable through openings in the cylinder-wall, exterior shanks in said cams provided with retracting-springs, a rocking lever adapted to engage one or other of said cam-shanks when moved from its central position, a vertical shaft, carrying a cam or tooth R adapted to operate and lock said rocking lever, and means for turning said cam-shaft, substantially as set forth.

4. In a knitting-machine, the combination with the cam-cylinder of two oppositely-inclined switch-cams radially movable through openings in the cylinder-wall and having exteriorly-projecting shanks, guides for said shanks having springs thereon arranged to retract the cams, a lever-bracket with rocking lever and cam-shaft mounted thereon for operating the switching-cams, and means for turning the shaft, substantially as set forth.

5. In a knitting-machine, the combination with the cam-cylinder, and the radially-movable switch-cams having shanks, of a rocking lever having its ends arranged to engage and move said shanks inward, and a cam engaging said lever and rocking the same, for the purpose specified.

6. In a knitting-machine, the combination with the cam-cylinder, and the radially-movable switch-cams having shanks, of a rocking lever having its ends arranged to engage and move said shanks inward, said lever being formed with an opening between said ends, a cam within said opening, operating upon the walls thereof to rock said lever and lock the same, and a shaft carrying said cam, substantially as described.

7. In a knitting-machine, the combination with the cam-cylinder, the radially-movable switch-cams having shanks, and springs encircling said shanks for holding the cams normally in their outermost positions, of a rocking lever for projecting said cams one at a time into the needle-path, said lever having its ends arranged to engage said shanks, and being formed with an opening between said ends, a cam within said opening, operating upon the walls thereof to rock said lever, and a shaft carrying said cam.

8. In a knitting machine, the combination with the cam-cylinder, and the fixed cams H' H<sup>2</sup> and K K' and pivoted cams H and G G, of the throwing-down cams, having hooked ends arranged to automatically lower two needles at the end of a raised series, pivoted arms carrying said throwing-down cams, cross-arms E, throwing-up cams arranged to reraise one of said lowered needles, said throwing-up cams being independent of said cross-arms and having weighted ends.

9. In a knitting-machine, the combination of free narrowing-cams with widening-cams constructed and arranged to throw down two needles at once.

10. In a knitting-machine, the combination with the cam-cylinder, of the widening-cams constructed and arranged to throw down at once two needles at the end of a raised series, and a narrowing-cam arranged to reraise one of said lowered needles, substantially as described.

11. In a knitting-machine, the combination of the widening-cams, having hooked ends constructed and arranged automatically to lower at once two needles at the end of a raised series, pivoted arms, carrying said cams, cross-arms E, and narrowing-cams arranged to reraise one of said lowered needles, said narrowing-cams being independent of said cross-arms and having weighted ends, substantially as described and for the purposes specified.

12. The combination of a needle-cylinder, a cam-cylinder, means for operating one of said cylinders, needles disposed in the needle-cylinder, stitch-cams disposed in the cam-cylinder, narrowing-cams for moving individual needles into inoperative position, and widening-cams provided with hooks adapted to engage at once a plurality of inoperative needles to bring them into operative position, each narrowing-cam being movable into and out of operative position independently of the widening-cams.

13. In a knitting-machine the combination of the needles, a needle-engaging cam independent of controlling devices, and a needle-engaging cam constructed to engage two adjacent needles.

14. In a knitting-machine, the combination of the needles, narrowing-cams independent of controlling devices, and widening-cams constructed to engage two adjacent needles.

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

JAMES L. ECK.

Witnesses:

W. G. STEWART,  
CAMERON E. STRAUSS.