

2 Sheets—Sheet 1.

No. 461,358.

Patented Oct. 13, 1891.

Fig. 1.

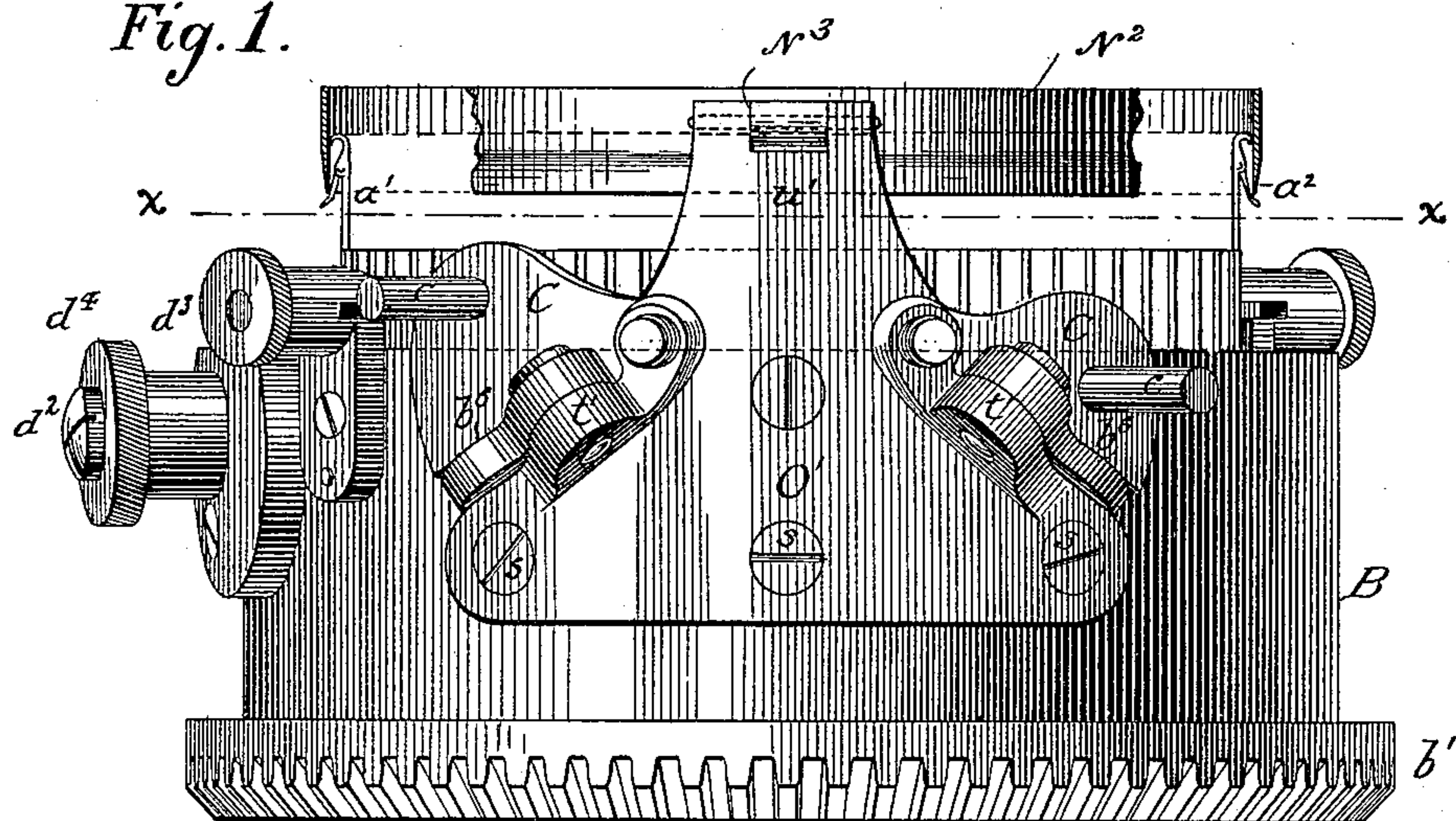
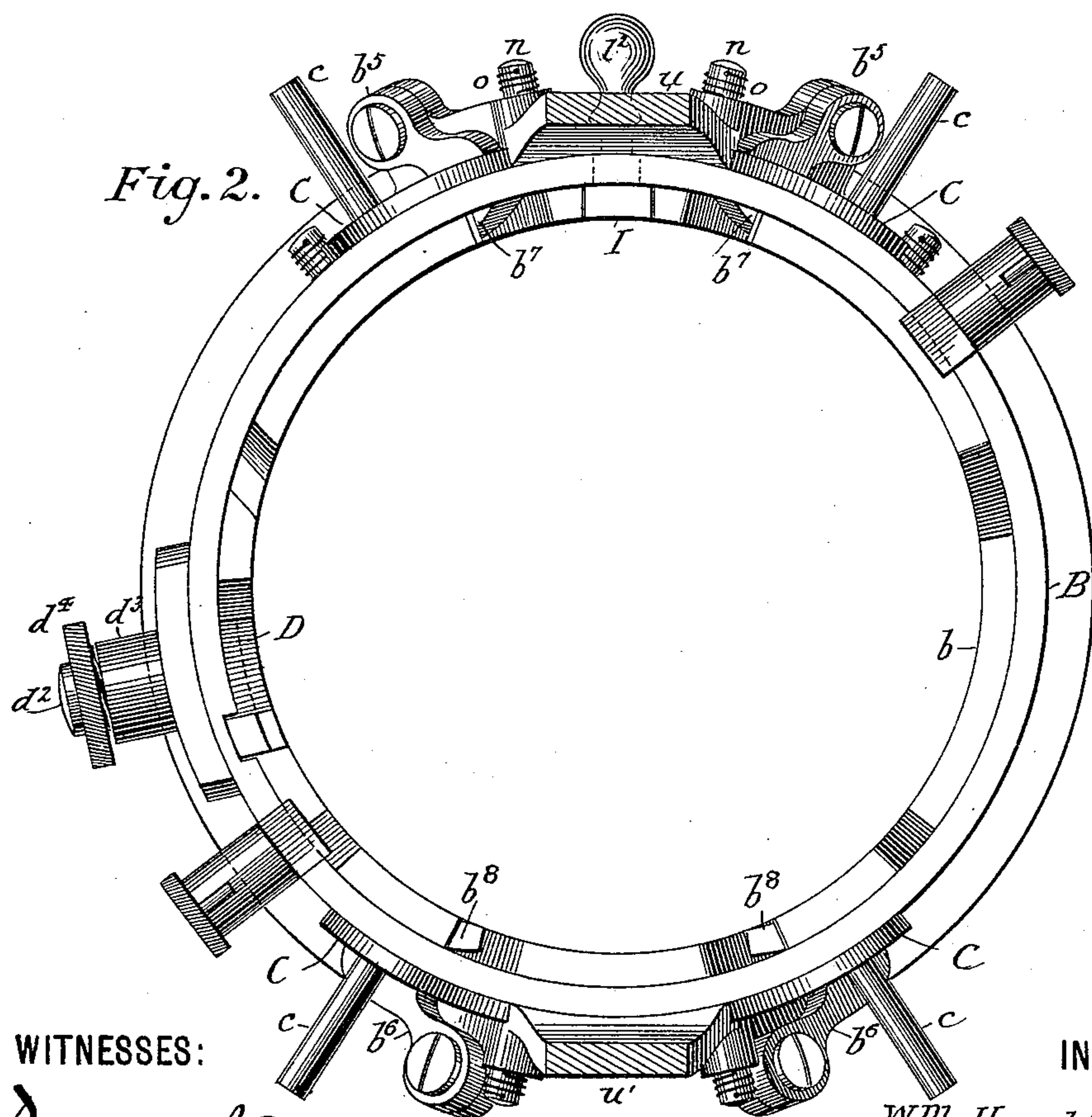


Fig. 2.



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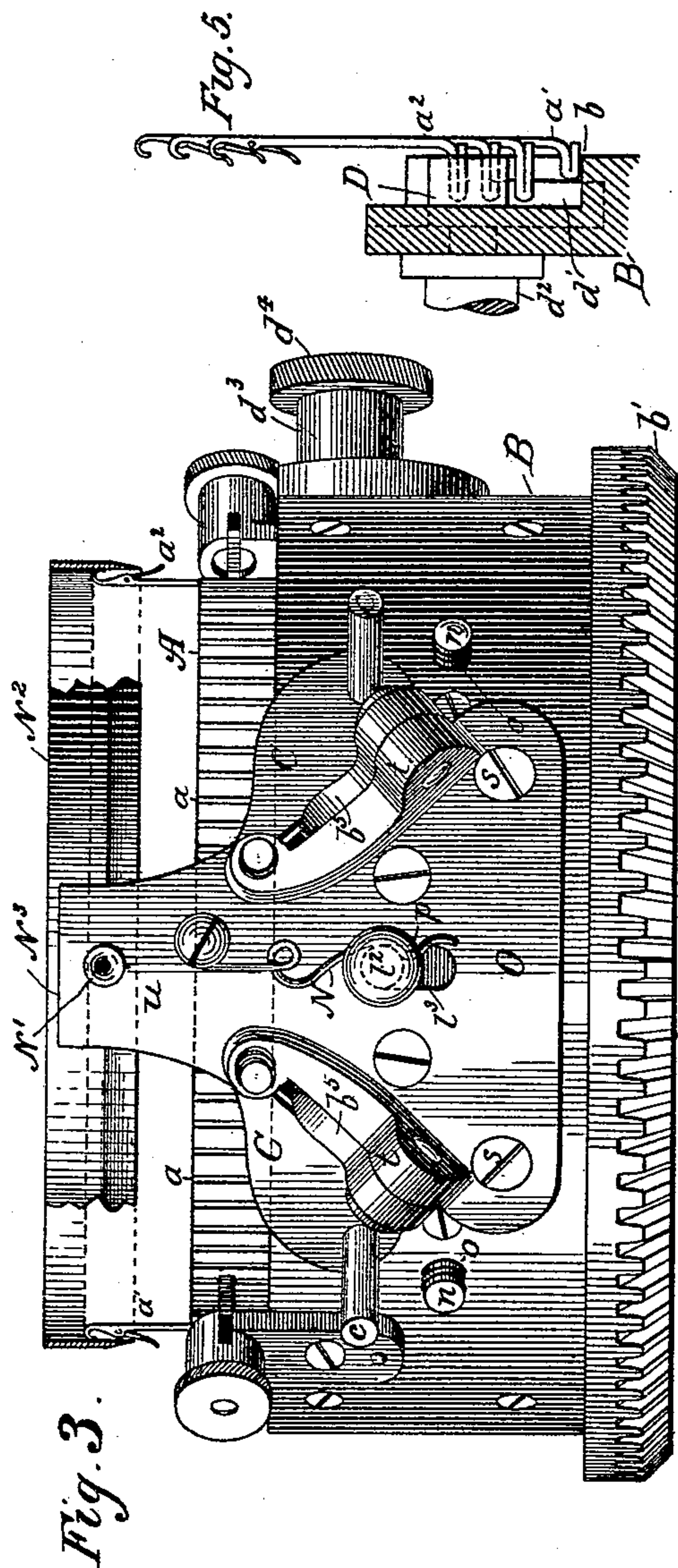
(No Model.)

2 Sheets—Sheet 2.

W. H. & G. D. MAYO.
CIRCULAR KNITTING MACHINE.

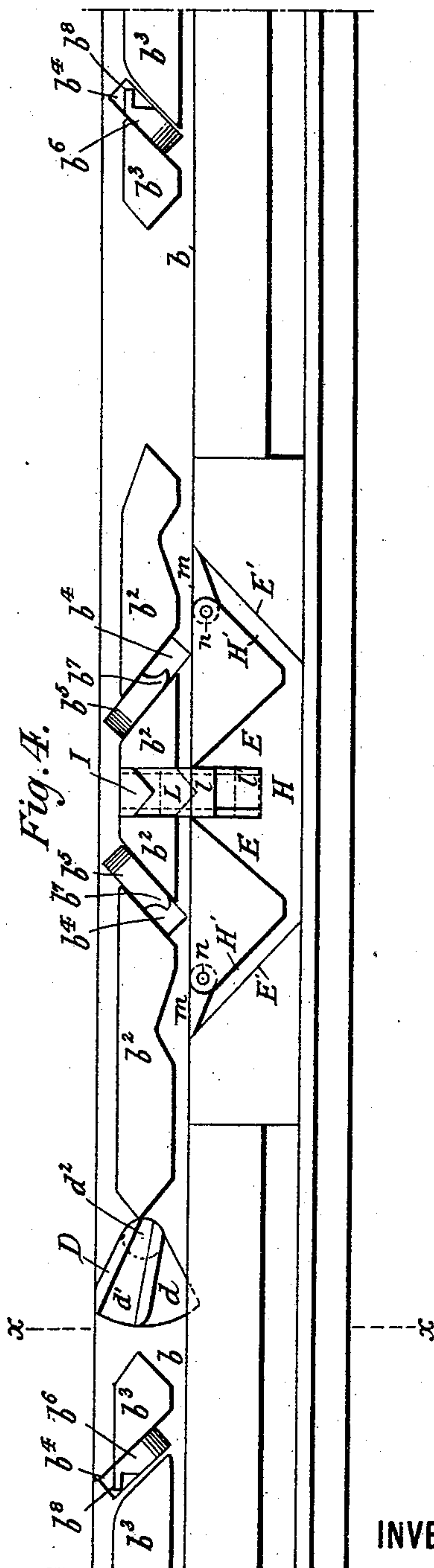
No. 461,358.

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UNITED STATES PATENT OFFICE.

WILLIAM H. MAYO AND GEORGE D. MAYO, OF FRANKLIN, NEW HAMPSHIRE,
ASSIGNORS TO THE SULLOWAY MILLS, OF SAME PLACE.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 461,358, dated October 13, 1891.

Application filed June 17, 1890. Serial No. 355,741. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM H. MAYO and GEORGE D. MAYO, citizens of the United States, and residents of Franklin, county of Merrimac, and State of New Hampshire, have invented certain new and useful Improvements in Circular-Knitting Machines, of which the following is a specification.

Our invention, while relating to that class of knitting-machines which employs latch-needles and is made use of in the production of socks and stockings, has reference more particularly to that form of such machine in which the needles concerned in the formation of the heels and toes, in addition to the usual reciprocating movement imparted by the ordinary cam mechanism, are carried out of and brought back into operation in the proper order to effect the necessary narrowing and widening of the fabric to fashion such parts by elevators and depressors, which engage with the heels of said needles and elevate and depress them as the exigencies of the knitting demand, and at the same time are themselves operated thereby.

In an application for Letters Patent filed by us in the United States Patent Office on or about October 3, 1888, Serial No. 287,063, we have shown and described a machine of this character, in which the reciprocation of the needles to effect the knitting operation is accomplished by a V-shaped advancing cam and suitable knitting or stitch cams arranged on opposite sides thereof, and in which the elevators and depressors—called “elevating” and “depressing” cams, respectively, therein—are pivoted to the outside of the cam-cylinder, and, working through slots formed in the walls thereof, are brought into operation at the required times by suitable cam-levers under the control of an appropriate pattern mechanism, the needles made use of in the formation of the heels and toes being provided with heels or butts which are somewhat shorter than those of the remaining needles, whereby to permit of these latter needles, in a body, being all raised out of operation and brought back into the same as the knitting of a flat or tubular fabric, respectively, may be desired.

The construction and arrangement of parts

thus described, while efficient in operation and desirable in some classes of work, are found inconvenient in practice when a work-transferring mechanism is to be employed in connection therewith, principally because of the fact that as the V-shaped advancing cam projects some distance above the ledge upon which the needles normally rest, with no provision made for lowering the same, the bringing of all the needles to the same height at an elevation midway that to which they are depressed when drawing the new loop through the old and that occupied by them when carried out of action in the narrowing operation is impossible.

Our present invention has for its objects, first, to obviate this inconvenience and to provide means whereby the needles may all be brought to the same height, which shall be substantially that occupied by them when in their normal position; second, to provide cam mechanism for reciprocating the needles, which shall be wholly located below the elevators and depressors, and, third, to simplify the construction of parts, and thereby render the machine more efficient in operation.

To these ends our invention consists in certain peculiarities of construction and combination of parts, the distinguishing characteristics of which will be best understood by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of a needle-cylinder and a cam-cylinder constructed in accordance with our invention, the latch-opener being broken away for convenience of illustration; Fig. 2, a plan of the cam-cylinder, taken in the plane xx of Fig. 1; Fig. 3, a rear elevation of the parts shown in Fig. 1; Fig. 4, an elevation of the interior of the cam-cylinder developed on a plane, and Fig. 5 a sectional detail showing the needle elevating and depressing switch and the needles having heels or butts of different lengths.

In all the figures like letters are employed to designate corresponding parts.

A indicates the needle cylinder or bed, having the usual needle-grooves a for reception of the needles a' a^2 , which are arranged therein, and B indicates the cam-cylinder, surrounding the same and provided on its interior

with a circumferential ledge b , upon which the needles rest when in their normal position, and also with a bevel-gear b' at its lower end, by means of which it may be operated.

5 Located in the interior of the latter cylinder, above the ledge b , are guide-plates $b^2 b^3$, above and below which the heels of the needles are carried as they are respectively retired from and brought back into operation, while

10 to the outside of said cylinder and working through slots b^4 , formed in the walls thereof, are pivoted the elevators and depressors $b^5 b^6$, by means of which the needles concerned in the narrowing and widening operations are

15 respectively carried out of or brought back into action as one or the other of these operations is being effected. In their normal position these elevators and depressors rest with their respective free or hooked ends $b^7 b^8$ in line

20 with the heels of the needles in connection with which they are to co-operate, and when carried out of operation by the elevation or depression of such needles they are engaged by latches $C C$, also pivoted to the outside of the

25 cam-cylinder, and by them prevented from returning thereinto until again released by removing the latches from engagement therewith. At all times when the narrowing and widening operations are not being effected the

30 elevators and depressors are held out of action, or in the position shown in Fig. 4, by the latches aforesaid; but when one or the other of these operations is to be accomplished either the elevators or the depressors, or both,

35 as the case may be, will be released from the latches and allowed to return into action ready for engagement with their appropriate needles as the cam cylinder is reciprocated in the operation of the machine.

40 In all cases when the narrowing of the fabric is to be effected the elevators alone will be released from their latches and returned into operation. On the other hand, when the widening of the fabric is to be accomplished the

45 depressors will be released from their latches and similarly returned into action, the elevators in some cases being retired from operation when the depressors are brought into action and in others retained in operation therewith. When the elevators are retired

50 from operation at the same time that the depressors are brought into action, the hooks b^8 of the depressors will be made of the same length as the hooks b^7 of the elevators, and

55 each will at each reciprocation of the cam-cylinder engage the heel of but a single needle; but when both the elevators and depressors are retained in action the hooks b^8 will be made of a length to engage the heels of two

60 needles, while the hooks b^7 will be made of a length to engage the heel of but a single needle, whereby during the widening operation the depressors will at each reciprocation of the cam-cylinder bring down into operation

65 two needles, and the elevators at the next reciprocation thereof carry one of the needles thus brought down out of operation, and so

on throughout the entire operation of widening.

In the drawings I have shown the hooks b^8 70 of a length to engage the heels of two needles and the hooks b^7 of a length to engage the heel of but a single needle; but it will be understood that such hooks b^8 may be so proportioned as to engage the heel of but a single 75 needle without in any way changing their essential characteristics.

To provide for releasing the elevators and depressors at the proper times to effect the narrowing and widening operations, the 80 latches $C C$ are each equipped with a pin or stud c , extending outward therefrom, with which suitably-arranged cam-surfaces under the control of an appropriate pattern mechanism co-operate. 85

The parts as thus far alluded to, with the needles, the cam-surfaces for acting upon the studs c , the pattern mechanism, and the devices made use of for operating the cam-cylinder are or may be the same as the corre- 90 sponding parts shown and described in the application aforesaid, to which reference may be had, and require no further elucidation herein.

Disposed in a suitable recess d , formed in 95 the interior of the cam-cylinder, above the ledge b , in proper relation to the guide-plates $b^2 b^3$, is the switch D , by means of which the long-heeled needles, or those not concerned in the narrowing and widening operations, may 100 in a body be retired from and, with such short-heeled needles as may have been likewise retired, returned into action at the will of the operator. In our preferred form of construction this switch consists of a suitable 105 body having formed in its inner face a longitudinal groove d' , which, extending throughout its entire length and tapering gradually from its outer to its inner end, has its under walls cut away to such an extent as to permit 110 of their engagement only with the long-heeled needles, while its upper walls are extended inward toward the needle-cylinder sufficiently far to engage not only with the long-heeled needles, but with the short-heeled needles as 115 well. As thus constructed, this body is mounted upon the inner end of a shaft or pivot d^2 , that is fitted to oscillate in a sleeve d^3 , secured to the outer side of the cam-cylinder, a milled or gnarled head d^4 , secured to 120 the outer end of the pivot, affording a convenient means whereby it may be operated. When it is desired to retire the long-heeled needles from operation, as when the bulged portion of a sock or stocking is to be knit, the 125 switch will be turned downward until the outer end of the groove d' is brought into line with their heels as they rest upon the ledge b , in which position its under walls will, as the cam-cylinder is rotated, engage such heels 130 alone and deflect them upward above the guide-plates $b^2 b^3$, thereby carrying them with the respective needles out of action. The long-heeled needles having been thus re-

tired, their return into operation with such short-heeled needles as may have been carried out of action will be effected, as when the tubular portion of a sock or stocking is to be knit, by simply turning the switch into the position shown in the drawings, when the outer end of its groove will be brought into line with their heels as they rest upon the upper side of the guide-plates aforesaid, and their deflection therefrom down upon the ledge *b* and into operation will be accomplished by the upper walls thereof upon turning the cam-cylinder in the proper direction.

The means whereby the reciprocation of the needles to effect the knitting operation is accomplished and provision made for bringing them all to the same height at a point midway the limits of their movements is best shown in Fig. 4. In these devices we dispense with the usual V-shaped advancing cam and its accompanying movable stitch-cams, as illustrated, for instance, at *F* and *C'* *C'*, in the application above referred to, and make use of the depressing and elevating cam-surfaces *E* *E'*. The cam-surfaces *E* are preferably formed by the walls of the inverted-V-shaped recess *H* and incline downwardly and outwardly at the proper angle from the ledge *b* to their lower ends, while the cam-surfaces *E'* are formed by the outer walls of the grooves *H'*, leading from the lower outer corners of the recess *H* upward and outward at the proper inclination to said ledge, the result of which construction is to bring the cam-surfaces as a whole not only below the ledge, but below the elevators and depressors as well, and permit of the rotation of the cam-cylinder in either direction to effect the knitting operation.

As thus constructed, when the cam-cylinder is rotated the heels of the needles *a' a'*², when deflected downward into the top of the recess *H*, will be successively engaged by one or the other of the depressing cam-surfaces *E*, depending upon the direction in which the cam-cylinder is rotated, and caused to travel down along the same until they pass its lower end, when they will enter the appropriate groove *H'* and travel up the elevating cam-surface *E'* to the point of starting, where they will remain until again depressed or retired from operation in the further movements of the machine, swinging gates *m m*, carried by pivots *n n* and kept normally closed by light coiled springs *o o*, surrounding said pivots, preventing such heels from either dropping back or being carried down into said grooves, while yielding to their action in an opposite direction and permitting of their free upward movement therein.

To provide for the deflection of the heels of the needles down into the upper end of the recess *H*, various means may be employed. We prefer, however, to make use of a wedge-shaped deflector *I*, and to secure it either pivotally or fixedly to a stop *L*, which, in addition to carrying a lug or gate *l*, is made ver-

tically adjustable in a guideway *l'* by a handle or thumb-piece *l'*², working through a slot *l'*³, formed in the walls of the cam-cylinder, as shown.

When it is desired to bring all the needles to the same elevation, which shall be substantially that occupied by them when their heels rest upon the ledge *b*, and retain them in that position without reciprocation—as, for instance, when a work-transferring mechanism is to be applied in connection therewith—the deflector and gate carried by its stock will be adjusted to the position shown by full lines in the drawings, in which situation the deflector will be elevated wholly above and out of engagement with the heels of the needles and the upper end of the recess *H* closed by the gate *l*, which will be raised into the same. With the parts in the adjustment thus described the support for the needles, embracing the ledge *b* and the gates *l* and *m*, will be practically continuous and unbroken throughout and the needles held thereby from all downward movement. When, on the other hand, it is desired to reciprocate the needles to effect the knitting operation, the deflector *I* and gate *l* will be adjusted to the position shown by dotted lines in said drawings by simply moving down their supporting-stock *L* by its handle or thumb-piece *l'*², by which operation the upper end of the recess *H* will be opened and the deflector brought down into engagement with the heels of the needles, deflecting them downward into engagement with the depressing cam-surfaces *E* as the cam-cylinder is rotated, and thereby insuring their reciprocation, the adjustment of the deflector and its accompanying gate from one of their positions to the other thus serving either to bring all the needles to the same height and maintain them thereat or to cause their reciprocation, as may be desired.

To hold the deflector *I* and gate *l* in their adjusted positions, we employ the locking-spring *N*, which, through the instrumentality of the bent portion *p*, engages with the handle or thumb-piece *l'*², and while permitting of a vertical movement being imparted thereto securely holds it with the deflector and gate in either of the positions to which they may be adjusted.

Located on the outside of the cam-cylinder are the several devices in which the elevators *b*⁵ and depressors *b*⁶, with their co-operating latches *C*, are respectively pivoted and the yarn-guide and latch-opener, with the locking-spring *N* for the deflector *I* and its accompanying gate *l*, properly supported. These several devices, instead of being made separate, as heretofore, are combined in groups and respectively make up the stands *O O'*, which are integral throughout and secured to the outside of said cylinder by screws *s s* or otherwise. The stand *O* (see Fig. 3) is provided with suitable ears or flanges *t*, to which the elevators *b*⁵ and their locking devices *C* are pivoted, and also with an upwardly-ex-

tending arm *u* for supporting the locking-spring *N*, the yarn-guide *N'*, and assisting in the support of the latch-opener *N*², which latter, in the construction shown in the drawings, is made in the form of a ring, while the stand *O'* (see Fig. 1) is similarly constructed and is likewise equipped with ears or flanges *t'*, in which the depressors *b*⁶ and their co-operating latches *C* are pivoted, and with an upwardly-projecting arm *u'* for assisting in the support of the latch-opener, which in practice may be hinged to the upper end thereof, as shown at *N*³.

By this construction, as will be seen, simplification of parts is accomplished and a greater permanence of adjustment obtained than has been possible heretofore. The parts composing each stand, being united integrally-prevent any and all movement of the one with respect to the other or others and thereby insure their constant maintenance in their adjusted positions. Moreover, the stands, being thus each composed of but a single piece, permit of their being made interchangeable, and the replacement of one by another on the machine, in case of breakage or otherwise, is not only greatly simplified, but brought within the capabilities of the ordinary operative.

With the cams for reciprocating the needles arranged wholly below the ledge *b* the needles during the regular knitting operation never rise above the position they occupy when resting thereon, and in this position the yarn will be delivered to them just before their descent at a point slightly in advance of the upper end of the recess *H* in whichever of the two directions the cam-cylinder may be rotated.

The construction of the machine and its mode of operation having been thus set forth, the results and advantages flowing therefrom are obvious and will be readily understood without further comment.

In the foregoing we have described the best means contemplated by us for carrying our invention into practice; but we wish it distinctly understood that we do not limit ourselves strictly thereto, since it is obvious that the same may be modified in various ways without departing from the spirit thereof—as, for instance, instead of employing the respective forms of yarn-guide and latch-opener shown and described herein, I may substitute in place of them any of the well-known forms of these devices and still be within the scope of my invention.

Again, we have described our invention as applied to the machine shown and described in the application before referred to; but it is obvious that the same may be applied in connection with any of the other forms of circular-knitting machines in which latch-needles are employed, and that the cam mechanism and elevators and depressors may be used with various forms of straight-knitting machines in which such latch-needles are also employed.

While in the foregoing we have described

and in the drawings we have illustrated a special form of deflector for co-operating with the needles, whereby certain of them may be deflected upward from the circumferential ledge to the upper side of the guide-plates, or, resting upon such guide-plates, may be deflected downward therefrom to the circumferential ledge, we make no claim herein, broadly, to a deflector or to the combination of such device with long and short heeled needles and a cam-cylinder provided with both a circumferential ledge and guide-plates secured to its interior irrespective of the particular form of the deflector, as such device and its combination with the parts mentioned, when broadly considered, are shown and described in our earlier application, to which reference has heretofore been made.

Having described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination, with a cam-cylinder provided with a circumferential ledge in its interior and needle-operating cam-surfaces located below such ledge, of a deflector and gate and means for raising and lowering them, whereby to bring the deflector into operation when it is desired to reciprocate the needles or to carry it above and out of contact with them and bring the gate into operation when it is desired to raise such needles all to the same height and prevent their reciprocation, substantially as described.

2. The combination, with a cam-cylinder provided with a circumferential ledge in its interior and needle-operating cam-surfaces located below such ledge, of a deflector for the needles, a stock to which such deflector is secured, and means for imparting to such stock and through it to the deflector a vertical adjustment, whereby to bring such deflector into operation when it is desired to effect the reciprocation of the needles or to carry it above and out of contact with them when their reciprocation is not required, substantially as described.

3. The combination, with the cam-cylinder provided with a circumferential ledge in its interior and needle-operating cam-surfaces located below such ledge, of a deflector, a gate, a stock to which such deflector and gate are secured, and mechanism for imparting to such stock and through it to the deflector and gate a vertical adjustment, whereby to bring the deflector into operation when it is desired to effect the reciprocation of the needles or to carry it above and out of contact with them and bring the gate into operation when it is desired to raise such needles all to the same height and prevent their reciprocation, substantially as described.

4. The combination, with a cam-cylinder provided with a vertical guideway and a vertical slot, of a stock carrying a deflector and gate arranged in said guideway, a handle or thumb-piece extending outward from the stock through such slot, and a locking-spring

for engaging with the handle or thumb-piece, substantially as described.

5 5. A cam-cylinder provided with a circumferential ledge in its interior, needle-operating cam-surfaces located wholly below such ledge, and elevators and depressors located entirely above the same, substantially as described.

10 6. The combination, with a cam-cylinder provided with a circumferential ledge *b* in its interior, and recess *H*, grooves *H'*; and gates *m m*, located below such ledge, of the elevators and depressors *b⁵ b⁶*, guide-plates *b² b³*, and deflector *I*, located entirely above said
15 ledge, the stock to which such deflector is secured, and means for imparting to the stock and through it to the deflector a vertical adjustment, substantially as described.

20 7. The combination, with a cam-cylinder provided with a circumferential ledge in its interior and with guide-plates located above the same, of needles having heels or butts of different lengths, and a switch consisting of a body provided in its face with a tapering
25 groove, the under walls of which are cut away to reduce their height, whereby the longer

heeled needles resting upon the ledge may be deflected upward upon the guide-plates or, resting upon the guide-plates, both the longer and shorter heeled needles may be deflected
30 downward upon the ledge, substantially as described.

8. The combination, with the stand *O'*, provided with the ears or flanges *t* and with an upwardly-extending arm *u*, of the elevators
35 and their latches pivoted in such flanges, and the locking-spring, yarn-guide, and latch-opener supported upon said arm, substantially as described.

9. The combination, with the stand *O'*, provided with the flanges *t'* and with an upwardly-extending arm *u'*, of the depressors and their latches pivoted in said flanges, and the latch-opener hinged to said arm, substantially
40 as described.

In testimony whereof we have hereunto set our hands this 13th day of June, 1890.

WM. H. MAYO.

GEORGE D. MAYO.

Witnesses:

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JAMES E. BARNARD.