

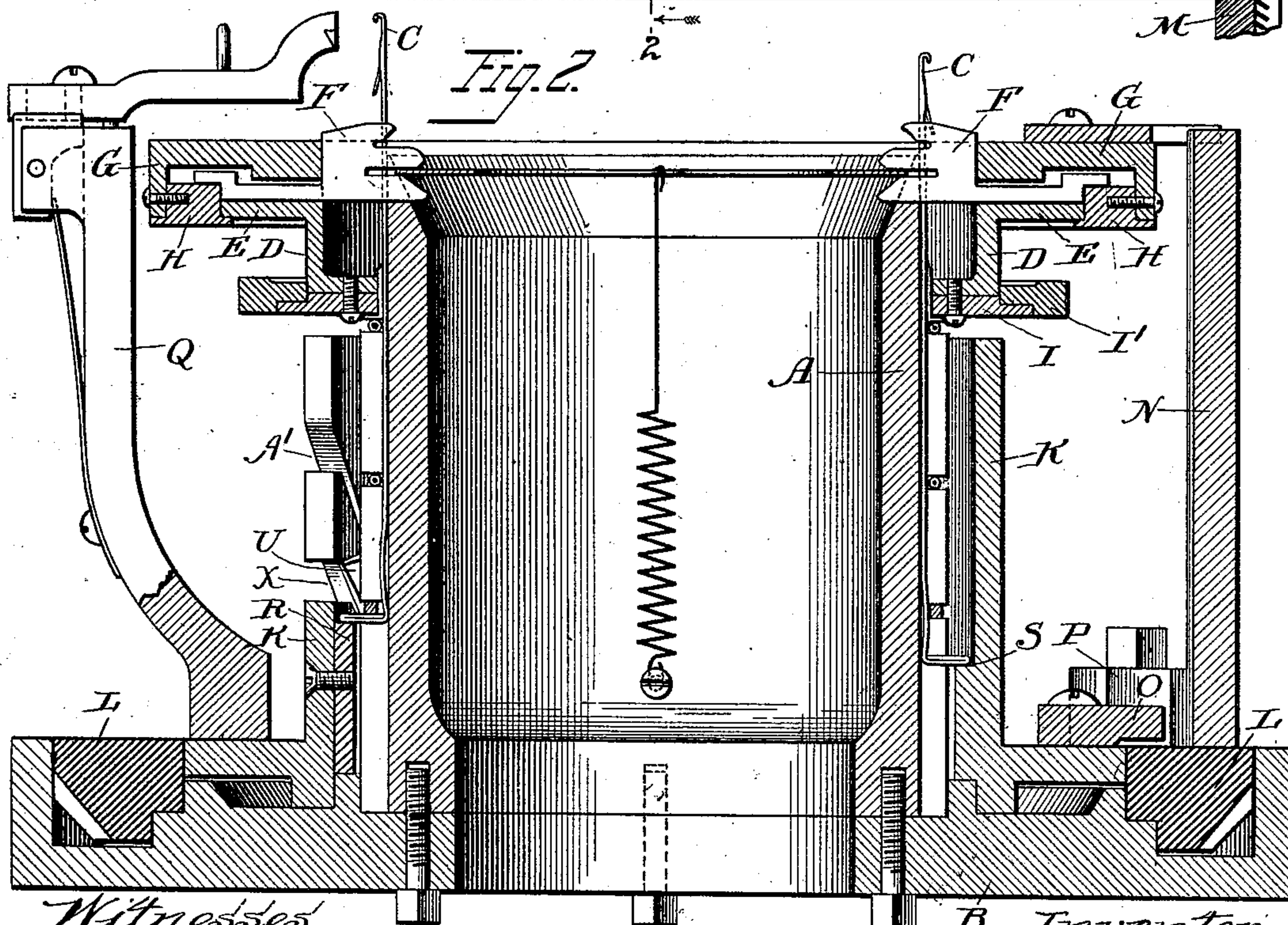
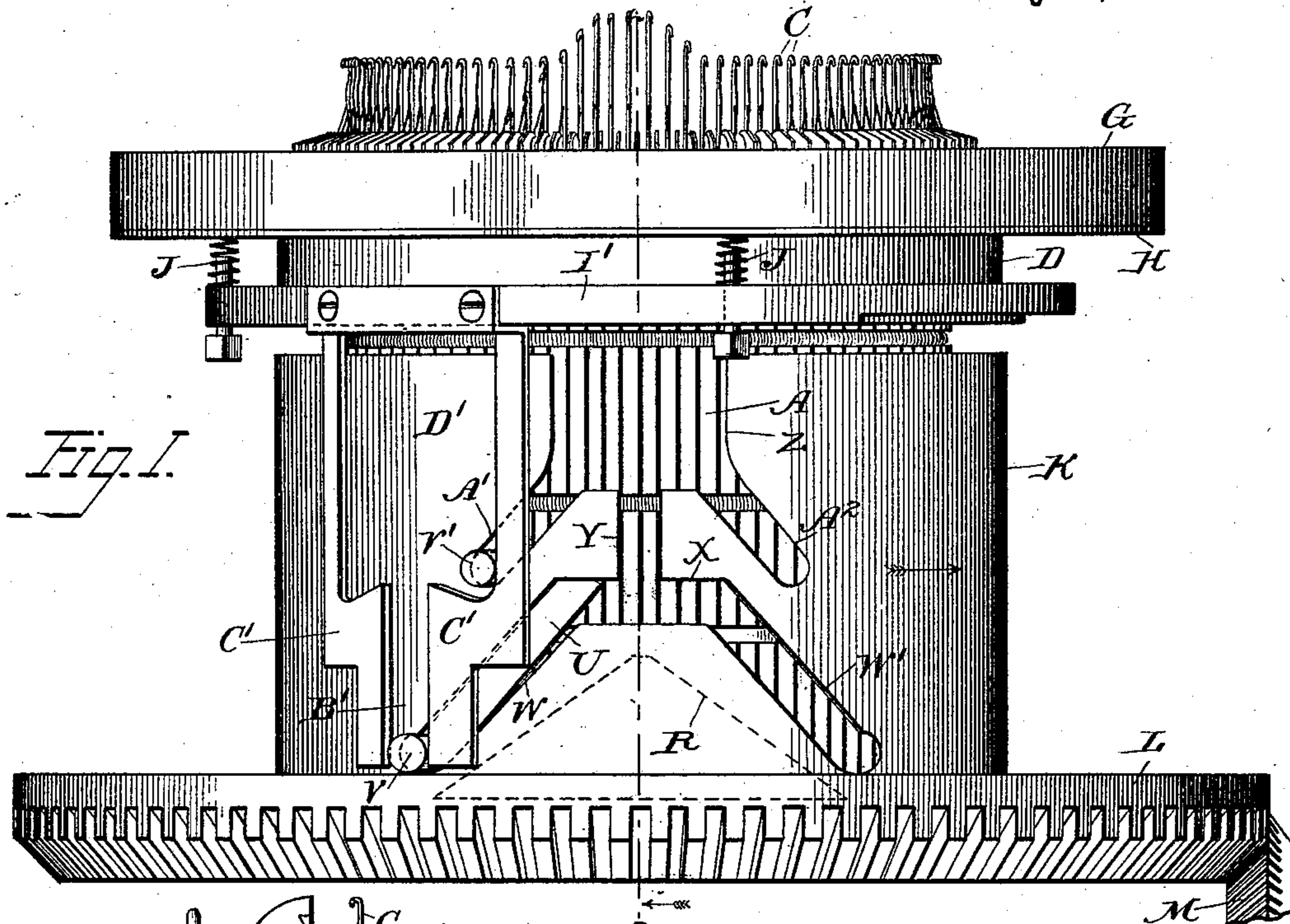
(No Model.)

2 Sheets—Sheet 1.

E. E. RANDALL.
KNITTING MACHINE.

No. 542,311.

Patented July 9, 1895.



Witnesses
Martin H. Olsen.
Henry D. Meads

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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

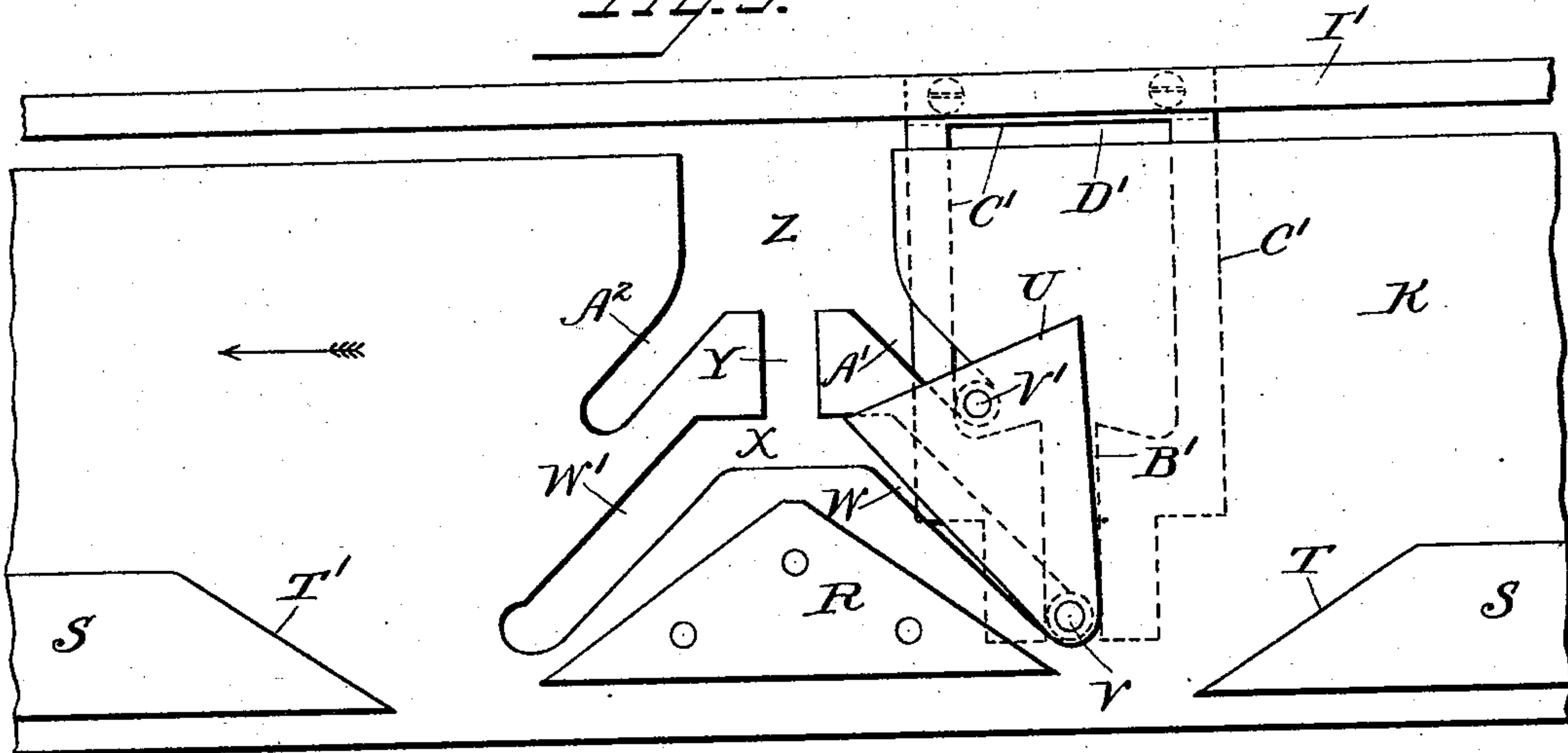


Fig. 4.

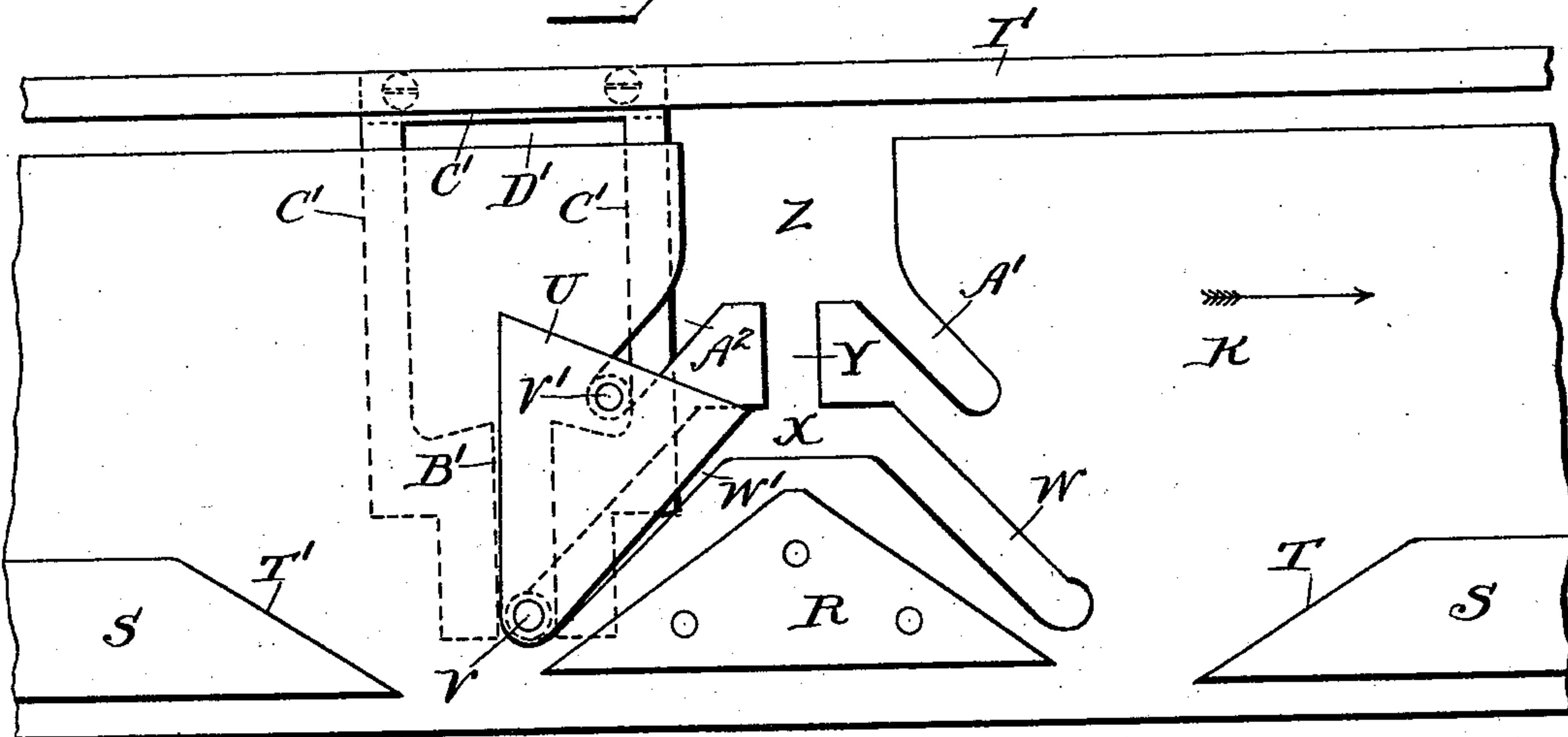


Fig. 5.

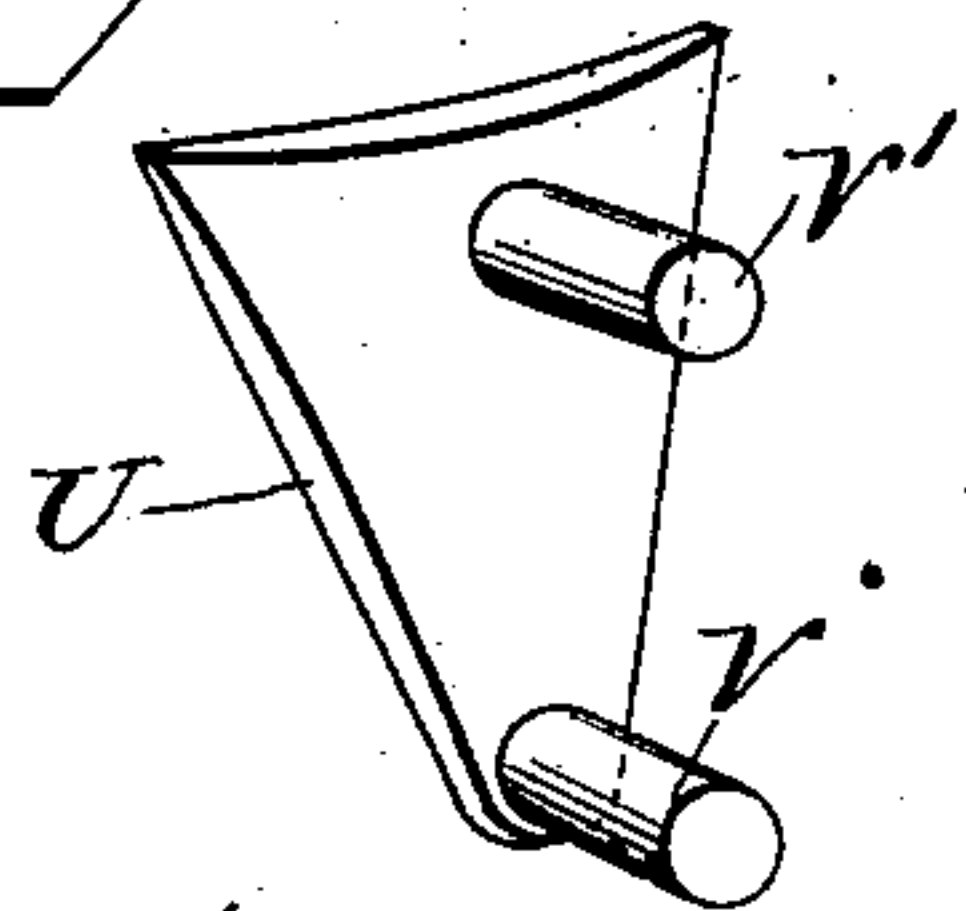
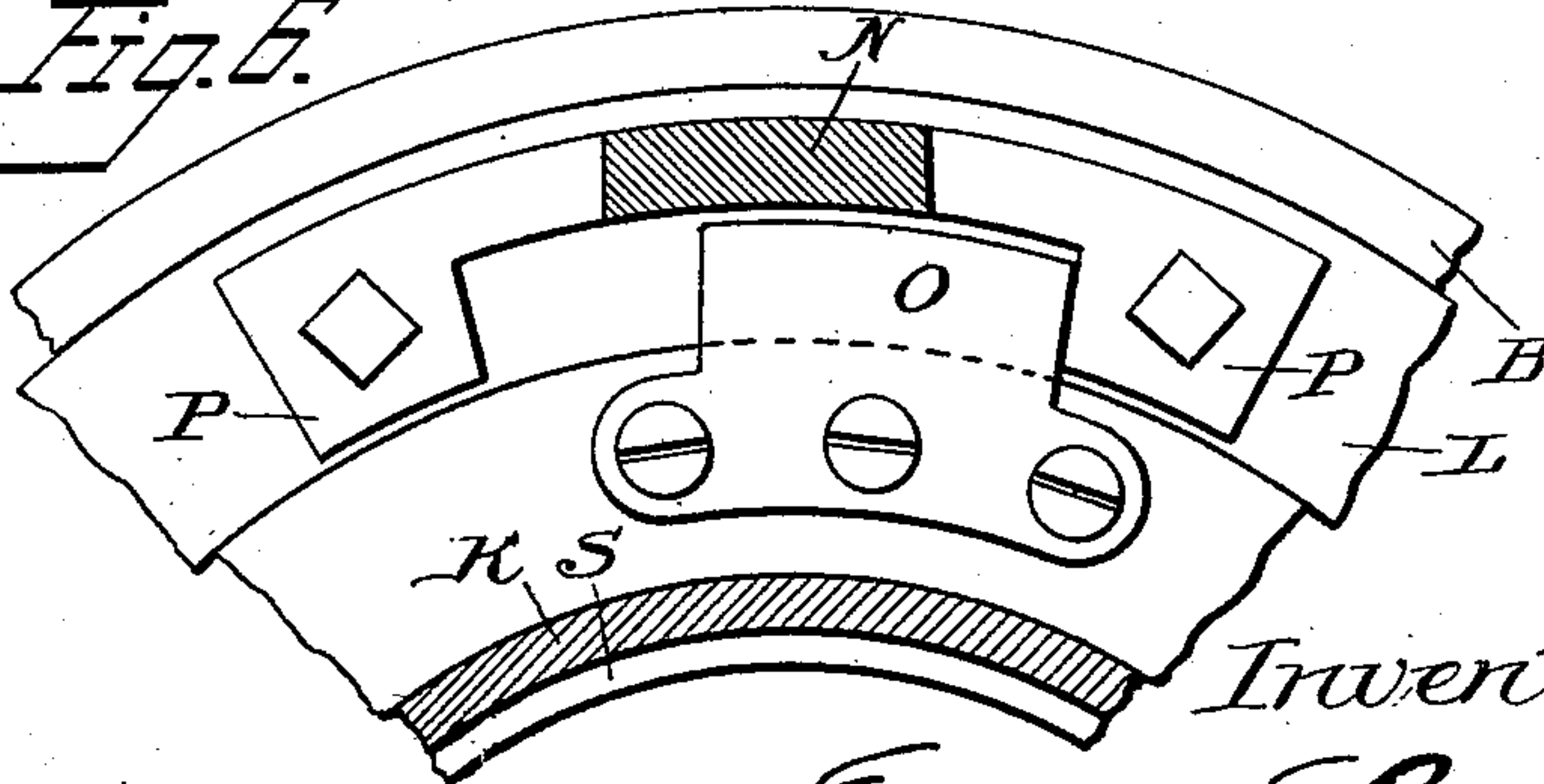


Fig. 6.



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UNITED STATES PATENT OFFICE.

EDISON E. RANDALL, OF JOLIET, ASSIGNOR OF ONE-HALF TO HENRY POPE,
OF CHICAGO, ILLINOIS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 542,311, dated July 9, 1895.

Application filed March 25, 1895. Serial No. 543,092. (No model.)

To all whom it may concern:

Be it known that I, EDISON E. RANDALL, a citizen of the United States, residing at Joliet, in the county of Will and State of Illinois, have invented a certain new and useful Improvement in Knitting-Machines, of which the following is a description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates more particularly to circular-knitting machines for knitting hosiery, though applicable to other styles of machines; and it consists in a novel means for operating such machines to form the heels and toes of the work. Heretofore in machines of this class, in forming the heel, for instance, it has been necessary at the beginning of the reciprocating movements of the machine for that purpose and in order to permit such reciprocating movements to move about one-half of the needles out of the path of the cams on the cam-cylinder either by hand or automatically, after which at the successive reciprocations of the machine additional needles had to be thrown out of operation one by one until the point of the heel was reached. Then the needles which had been thrown out of operation in forming the first half of the heel had to be thrown into operation again one by one at successive reciprocations of the machine until the full number with which the heel was started had been reached, whereupon the continuous rotary movement of the machine was resumed and continued until the toe was reached. Under the novel mode of operation embodied in my machine it is not necessary to move any of the needles out of the path of the cams preparatory to forming the heel nor to throw them back into the path thereof. The movement of the machine can be reversed at any time and at any point and the machine be reciprocated back and forth through any desired portion of a revolution without regard to the position of the needles. In this manner by simply regulating the lengths of the reciprocating strokes of the machine, gradually decreasing them from a half-revolution, at which the heel is started, until the point of the heel is reached and then gradually increasing them to a half-revolution again, the complete heel may be formed

without any attention whatever to the needles themselves. I accomplish this result and give my machine this capability and novel mode of operation chiefly by the employment of a shifting cam for depressing the needles to form the stitches instead of the cams mounted in fixed position upon the cam-cylinder heretofore used for that purpose. This movable draft or stitch cam is suitably mounted upon the cam cylinder and automatically shifted from one position thereon to another by simply reversing the movement of the machine. In one position it stands on one side of the lifting-cam and in the other upon its opposite side, so that it follows immediately after said cam when the latter is moved in either direction and depresses the needles which have been elevated by the lifting-cam to form the stitches.

So far as I am aware I am the first in the art to produce a knitting-machine having the capability and mode of operation referred to in which the number of needles in operation may be controlled and gradually decreased and increased by the mere reciprocations of the machine; also the first to employ in a knitting-machine a draft or stitch cam of any sort movably mounted upon the cam-cylinder and arranged to be automatically shifted to opposite sides of the lifting-cam by reversing the movements of the machine. Such being the case, it will be understood that my invention is in no wise restricted to the construction, arrangement, and specific mode of operation shown in the drawings and herein-after described, those being merely illustrations of one form in which my invention may be embodied and by which it may be here explained.

In said drawings, Figure 1 is an elevation of so much of a knitting-machine as is necessary to illustrate my invention, with the yarn-carrier removed to show the slots in the cam-cylinder which co-operate with the shifting draft-cam, said cam appearing mainly in dotted lines; Fig. 2, a vertical section approximately on the line 2 2 of Fig. 1, with the yarn-carrier in place; Fig. 3, a developed elevation of the inner side of the portion of the cam-cylinder shown in Fig. 1, with the parts in the same position as in the latter

figure; Fig. 4, a view corresponding to Fig. 3, with the draft-cam shifted to its opposite position by a reverse movement of the machine; Fig. 5, a detail perspective view of the shifting cam, and Fig. 6 a detail view showing the connection between the cam-cylinder and driving-gear.

The same letters of reference are used to represent identical parts in all the drawings.

10 A is the needle-cylinder, fixed at its lower end to the bed-plate B, around the circular opening in the latter, Fig. 2, and having in its outer surface the vertical slots containing the needles C. Encircling the upper end
15 of the needle-cylinder and firmly secured thereto is the annular sinker-bed, consisting of the ring or body portion D, by which it is fastened to the needle-cylinder, and the projecting flange E around its upper edge, containing the radial slots, in which fit and slide
20 the sinkers F, which co-operate with the needles in forming the stitches. The sinkers are operated by the usual cam-plate G, which at the same time forms a covering-plate for
25 them and has a depending flange fitting over and secured to a ring H, which snugly fits the periphery of the flange E and has an internal annular flange bearing against the underside of the flange E. The cam covering-plate G
30 and ring H thus form a housing inclosing the outer ends of the sinkers and are free to turn about the sinker-bed.

Secured to the under side of the body portion D of the sinker-bed is a ring I, whose
35 periphery forms a projecting annular flange about the lower edge of the part D. Seated upon this flange is a ring I', free to turn independently, but frictionally held from turning by springs J interposed between its upper
40 side and the under side of the flange E, said springs pressing it against its seat. The purpose of this friction-ring will be hereinafter explained.

Surrounding the needle-cylinder beneath
45 the rings I I' is the cam-cylinder K, having a flanged base fitting within the annular gear L and resting upon the bed-plate B and having a ring formed upon its under side, which fits around a guide-ring formed upon the upper
50 side of said plate. The gear L also rests and has its bearing upon the plate B and meshes with a second gear M, Fig. 1, fast upon the driving-shaft of the machine. (Not shown.) A vertical post N, secured at its lower end
55 to the gear L, connects the latter with the cam-plate G, which covers and operates the sinkers, so said plate and the gear turn together. The gear is connected to the cam-cylinder K, with lost motion between them,
60 by a plate or lug O upon the base of the cam-cylinder, projecting between two lugs P P upon the upper side of the gear, Fig. 6. This lost motion between the gear and cylinder permits the gear, and consequently cam-plate
65 G, operating the sinkers, to move in advance of the cam-cylinder when the movement of the gear is reversed, so that the sinkers may

be properly operated by such reverse movement.

The yarn-carrier Q is secured upon the
70 flanged base of the cam-cylinder at the opposite side of the machine from the post N, Fig. 2.

Referring now to Figs. 3 and 4, R represents the lifting-cam, secured upon the inner
75 face of the cam-cylinder, by which the needles are thrown upward to operative position opposite the yarn-carrier. This cam occupies a position midway between the opposite ends of the needle-rest S, upon which the heels of
80 the needles normally rest and which terminates at its ends in the inclined surfaces or cams T T' at opposite sides of the cam R and some distance removed therefrom. Now, instead of the usual fixed draft or needle-de-
85 pressing cams at opposite sides of the lifting-cam R, I employ my novel shifting cam, heretofore referred to. In the particular form shown in the drawings it consists of a triangular plate U, Fig. 5, slightly curved in cross-
90 section to conform to the thin annular space between the needle-cylinder and cam-cylinder, in which space it fits and moves, Figs. 2, 3, and 4. At its lower end it is provided with an outwardly-projecting stud or pin V, preferably covered by an antifriction-sleeve, and
95 near its upper end, about midway of its width, with a second similar pin V'. These pins extend outwardly through slots in the cam-cylinder, Fig. 1, and co-operate therewith and
100 with a shifter at the outer side of the cam-cylinder, by which means the cam U is shifted from one position to another.

The two lower slots W W' in the cam-cylinder are located upon opposite sides of the
105 fixed lifting-cam R and incline upwardly toward each other from the base of the cylinder on lines approximately parallel with the opposite sides of said cam. The upper ends of the slots are connected by a short horizontal
110 slot X, which in the present instance communicates by a short vertical slot Y with a larger open space Z in the cam-cylinder and extending through its upper edge. Extending from
115 the opposite lower corners of this open space Z are two slots A' A², having approximately the same inclination as the slots W W' below them. The vertical slot Y, connecting the slot X with the space Z, is provided merely for the
120 purpose of permitting the pin V on the cam U to enter the slot X when the cam is slid into place in assembling the parts and is not essential to the operation of the machine, as hereinafter described; nor is it necessary that
125 the open space Z extend through the upper edge of the cylinder.

When the cam U is in one of its operative positions, its lower pin V rests in the lower
130 end of the slot W, as in Figs. 1 and 3, and its upper pin V' in the lower end of the slot A', and when in its opposite operative position its pin V rests in the lower end of the slot W' and its pin V' in the lower end of the slot A², as in Fig. 4; but at all times its lower pin V,

projecting outward through the slots in the cam-cylinder, is confined in a vertical slot B' on the lower end of a plate C', secured at its upper end to the friction-ring I' heretofore described, Fig. 1. At its upper end the slot B' communicates with a wider open space D', formed in the upper part of said plate, in which space D' the upper pin V' of the cam U plays when the cam is shifted from one position to another.

It is not essential that the space B' communicate with the space D', except to admit the pin V to the former in assembling the parts; nor is it essential that the slot B' extend through the lower edge of the plate.

The plate C' constitutes a shifter for shifting the cam U from one operative position to another when the movement of the machine is reversed, as may be now described.

In Figs. 1 and 3 the parts are in the position they occupy when the cam-cylinder is turning in the direction of the arrow in said figures, while in Fig. 4 they are in the position they occupy when it is turning in the direction of the arrow in the latter figure. If the movement indicated in Figs. 1 and 3 be reversed the cam-cylinder will tend to carry the cam U in reverse direction with it; but the cam will be held from bodily movement with the cylinder by the engagement of its pin V with one wall of the slot B' in the plate C', this plate being frictionally held in fixed position by its connection with the ring I' in the manner heretofore described. Since, therefore, the cam U cannot move with the cylinder, but is free to move vertically, the inclined walls of the slots W and A', as they bear against the pins V V' of the cam U, will force the cam upward until the pin V enters the horizontal slot X, connecting the slots W W', and the pin V' enters the open space Z. The cylinder is then free to move onward a short distance independently of the cam U, until the pin V enters the upper end of the slot W' and the pin V' contacts with the wall of the space Z above the slot A². The cam U will then be pressed forward by the cylinder, the walls of the slots in the latter bearing against both pins V and V', held from movement with the cylinder by the confinement of the pin V in the slot B' in the plate C', with the result that the cam U will be drawn downward by the slot W and its upper end be tilted in the direction of movement of the cylinder until the pin V' enters the slot A² and the cam is finally brought to the position shown in Fig. 4. Thereupon the engagement of the pins V V' with the lower ends of the slots W' A² forms a positive unyielding connection between the cylinder and cam, so that the friction which has held the plate C' in fixed position will be overcome and the cylinder will carry the cam and plate C' forward with it, with the parts in the position shown in Fig. 4. Upon reversing the movement of the cam-cylinder the cam U will be shifted

back to the position shown in Figs. 1 and 3, as will be readily understood.

When the parts are in the position shown in Figs. 1 and 3 it will be seen that the cam U stands between the cam or incline T, at one end of the needle-rest S, and the lifting-cam R, with one of its edges overlying one edge of the cam R, thus forming a narrow passage for the heels of the needles from the apex of the cam R downward beneath the cam U and thence upward onto the needle-rest S. With the parts moving in the direction of the arrows in said figures the side of the cam R adjacent the incline T' will ride under the heels of the needles to lift them to operative position opposite the yarn-carrier, and as the cam R clears them they will be engaged by the inclined edge of the cam U and drawn downward through the narrow passage between the cam U and the cam R, until the lower end of the cam U has passed over them, whereupon the cam T will ride under them and lift them onto the rest S again. When the movement of the machine is reversed the cam U will be shifted to the opposite side of the lifting-cam R, Fig. 4, so that, as the parts then move in the direction indicated by the arrow in the latter figure, the side of the cam R adjacent the inclined end T of the needle-rest will ride under the heels of the needles and lift them, and as said cam clears them they will be engaged by the cam U and forced downward beneath the latter, and after they have cleared it they will be lifted onto the needle-rest again by the inclined end T' of said rest. It will thus be seen that when the parts are moved in the direction of the arrow in Fig. 3 the draft or needle-depressing cam follows immediately behind the lifting-cam to depress the lifted needles and form the stitches and that as soon as the movement of the machine is reversed it is automatically shifted to the opposite side of the cam and immediately follows the latter in the reverse movement to depress the lifted needles and form the stitches during such reverse movement. No setting of the needles, automatically or otherwise, is necessary preparatory to reversing the movement of the machine, which can be reversed at any time and point, and the length of the row of stitches knit upon the work depends solely upon the length of the reciprocating strokes given the machine. The two draft or needle-depressing cams heretofore employed upon opposite sides of the lifting-cam, with their latches, tumblers, &c., and all the devices for automatically throwing the needles out of and into operation, are dispensed with and the shifting cam U substituted for them.

It is not essential in my machine, any more than in the usual circular machine, that the part which carries the cams, and which is called the "cam-cylinder," should be a complete cylinder. On the contrary, it may con-

sist simply of a greater or less segment of a cylinder, in which case the needle-rest may be dispensed with if desired, as is sometimes done in machines of this class.

5 Having thus fully described my invention, I claim—

1. In a knitting machine, a shifting draft-cam and means for automatically shifting it from one side of the lifting cam to the other
10 at reverse movements of the machine, for the purpose described.

2. In a knitting machine, a shifting draft-cam movable upon the inner surface of the cam-cylinder, in combination with means
15 upon the exterior of said cylinder for automatically shifting it from one side of the lifting-cam to the other at reverse movements of the machine, for the purpose described.

3. In a knitting machine, the combination,
20 with the cam-cylinder provided with slots, of the shifting draft-cam arranged upon the inner side of the same and having pins projecting through said slots, and a shifter yieldingly held in fixed position upon the exterior of the
25 cam-cylinder and co-operating with the projecting pins of the draft-cam to automatically shift it to opposite sides of the lifting cam at reverse movements of the machine, for the purpose described.

30 4. In a knitting machine, the combination, with the cam-cylinder provided with slots, of the shifting draft-cam arranged upon the inner side of the same and having pins projecting through said slots, a friction ring supported upon the needle-cylinder, and a shifter
35 carried by said ring and co-operating with the projecting pins of the draft-cam, for the purpose described.

5. In a knitting machine, a movable draft-
40 cam and provisions in virtue of which it is caused to automatically rise out of the path of the needle-heels when the machine is turned in a direction to move it in advance of the lifting cam, and to remain in its lower position and depress the needles when the machine
45 is turned in the direction to cause it to follow the lifting cam.

6. In a knitting machine, the combination,
50 with the lifting-cam, of a draft-cam movable relatively thereto and means by which when the lifting-cam is moved in advance of the draft-cam the latter will operate to depress the needles which have been elevated by the lifting-cam, and when the movement is re-

versed the draft-cam will yield and rise to permit the needle-heels to pass under it and over the lifting-cam.

7. A knitting machine having provisions in virtue of which the lengths of reciprocating movements of the machine determine the number of needles operating, whereby the number of needles operating may be gradually decreased by decreasing the lengths of the strokes, and increased by increasing the lengths of the strokes, substantially as described.

8. A rotary and reversible knitting machine having provisions in virtue of which the number of needles operating during its reciprocating movements is determined by the lengths of the strokes of the machine, substantially as and for the purpose described.

9. In a knitting machine, the combination, with the slotted cam-cylinder, of the shifting cam U having the pins V V' projecting through the slots of the cylinder, and the shifter-plate C' co-operating with said pins, substantially as described.

10. In a knitting machine, the combination, with the needle-cylinder A and the slotted cam-cylinder K, of the cam-plate U movably mounted between the two cylinders and having the pins V V' projecting through the slots in the cam-cylinder, the friction ring I' supported on the needle-cylinder, and the shifter-plate C' carried by said ring and co-operating with the pins V V' of the cam-plate U, substantially as described.

11. In a knitting machine, the combination, with the needle-cylinder A and the cam-cylinder K having the inclined slots W W' on opposite sides of the lifting-cam and connected at their upper ends by the slot X, and the open space Z above the slot X with the inclined slots A' A² diverging from its lower corners, of the cam-plate U interposed between the cylinders and having the pins V V' co-operating with the slots in the cam-cylinder, the friction ring I' supported on the needle-cylinder, and the shifter-plate C' having the open space D' and the slot B' co-operating with the pin V of the cam-plate U, substantially as described.

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