

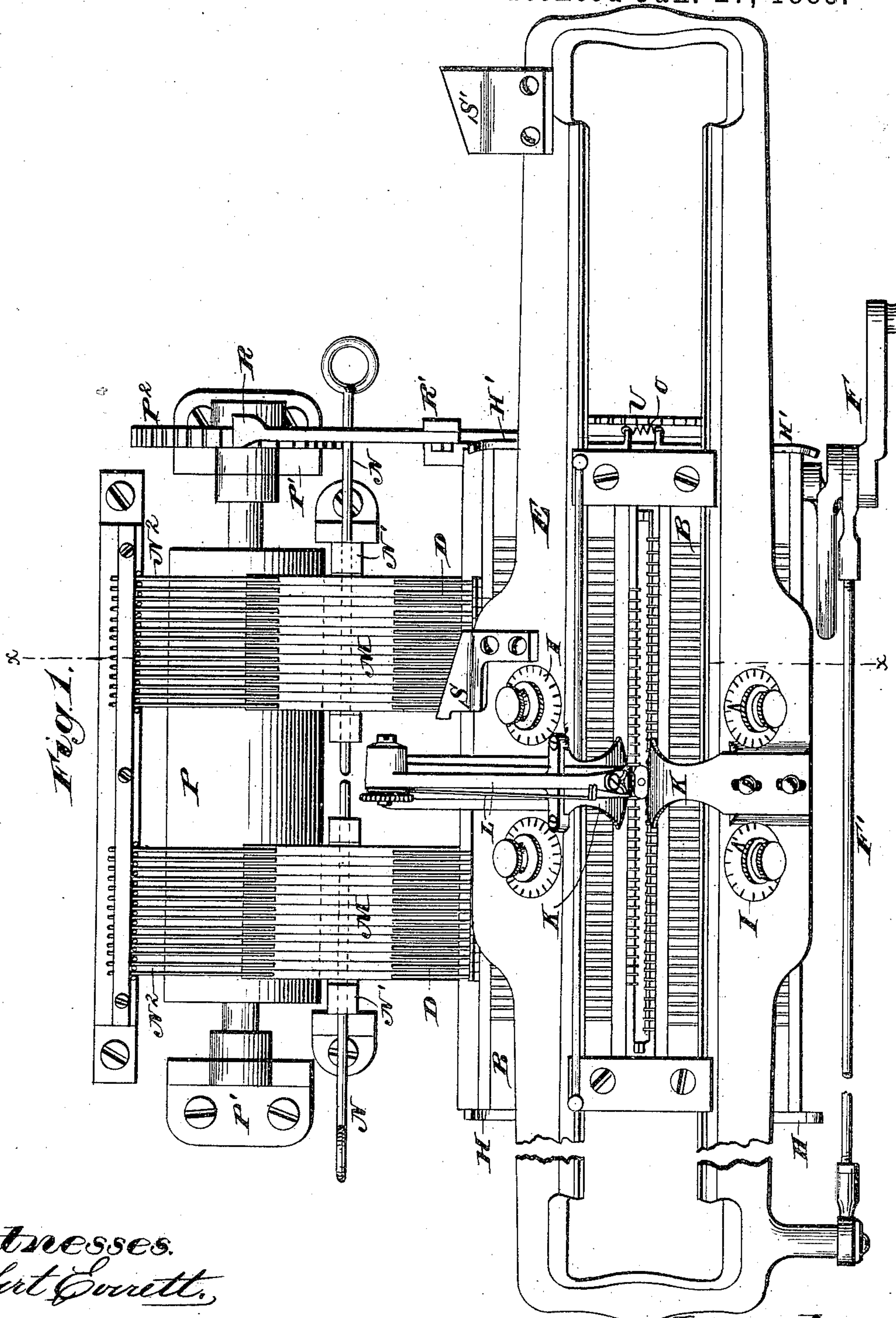
(No Model.)

5 Sheets—Sheet 1.

C. E. NORRIS.
KNITTING MACHINE.

No. 311,357.

Patented Jan. 27, 1885.



Witnesses.
Robert Everett.
George W. Rea

Inventor.
Charles E. Norris.
By *James L. Norris.*
Atty.

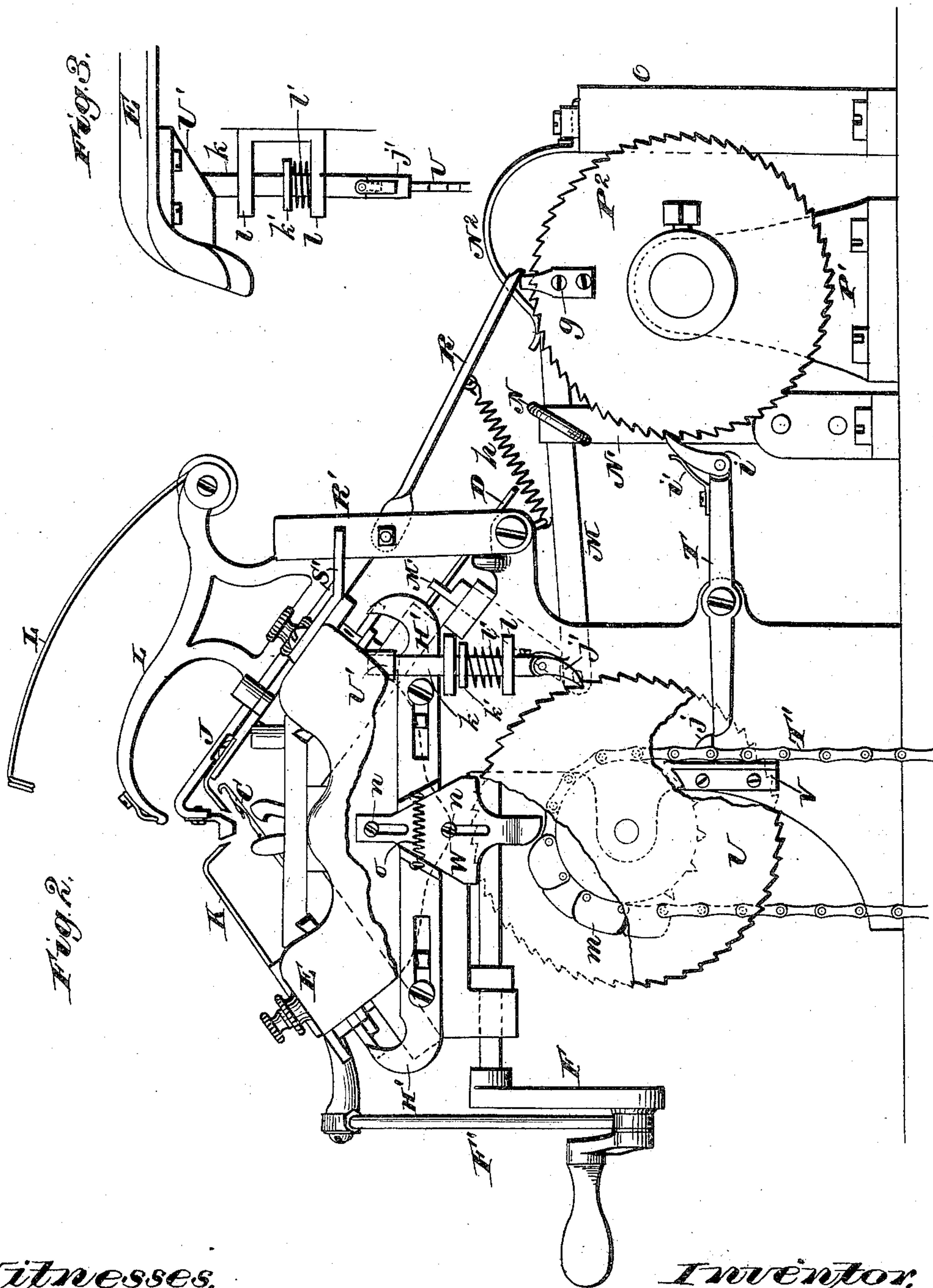
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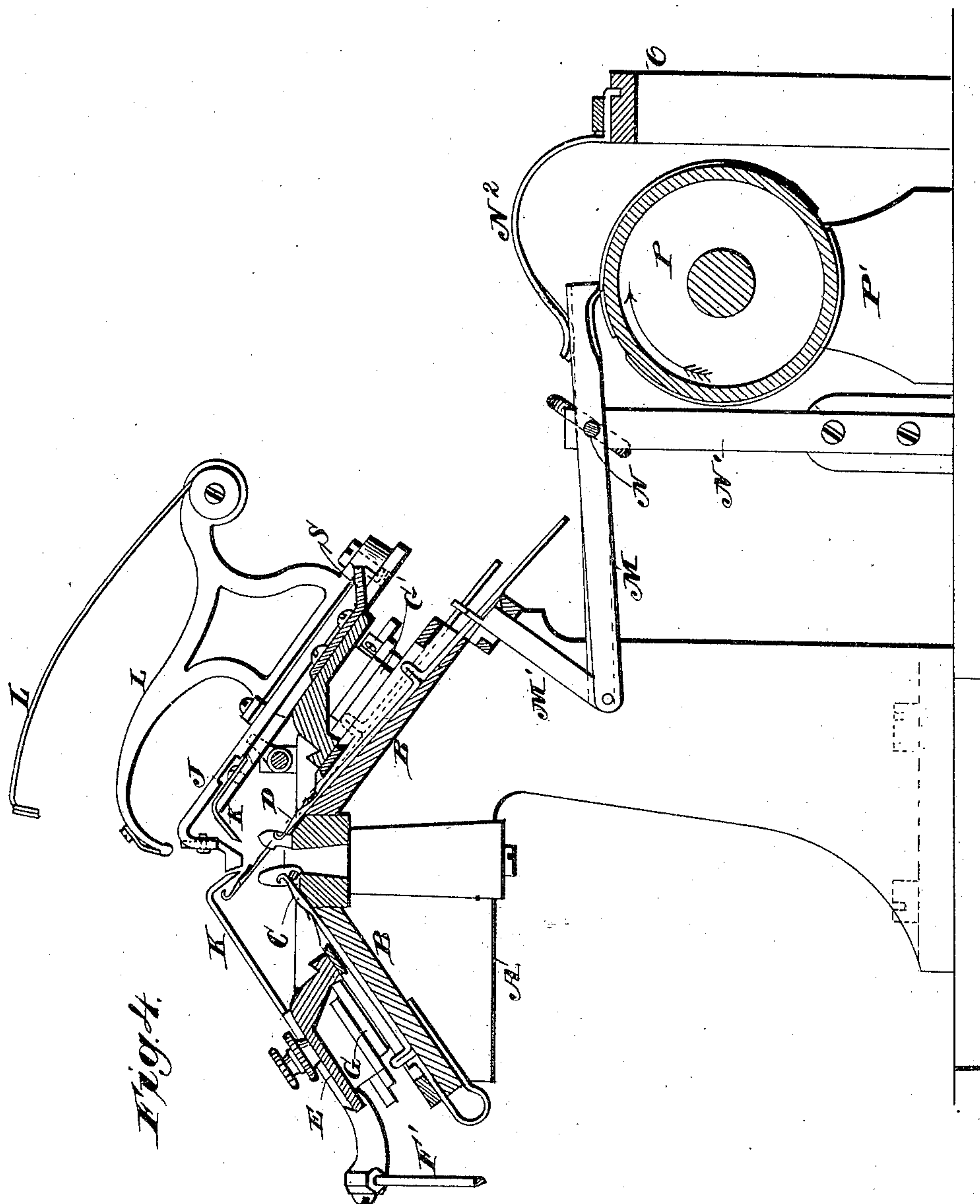
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Fig. 5.

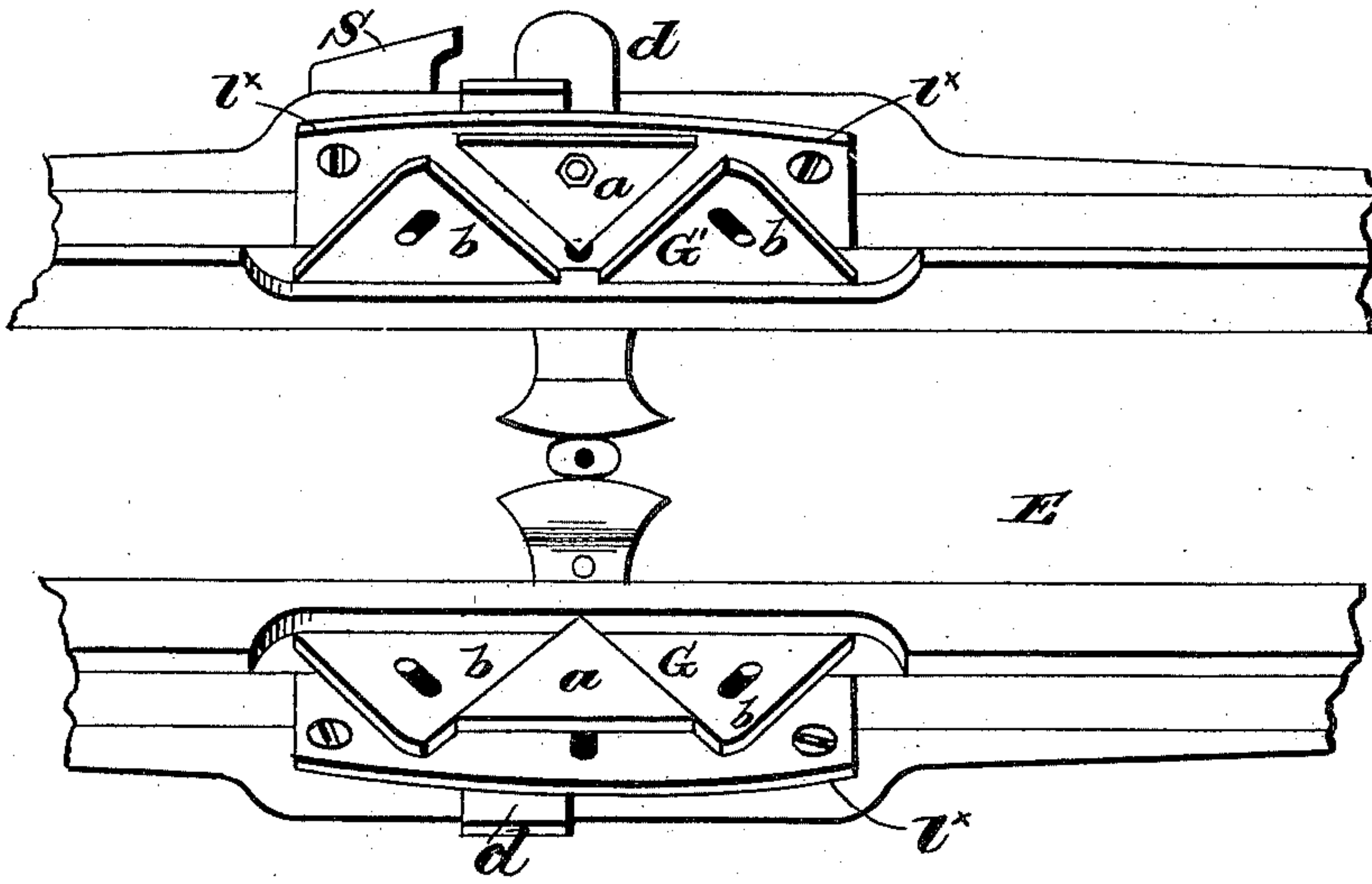


Fig. 6.

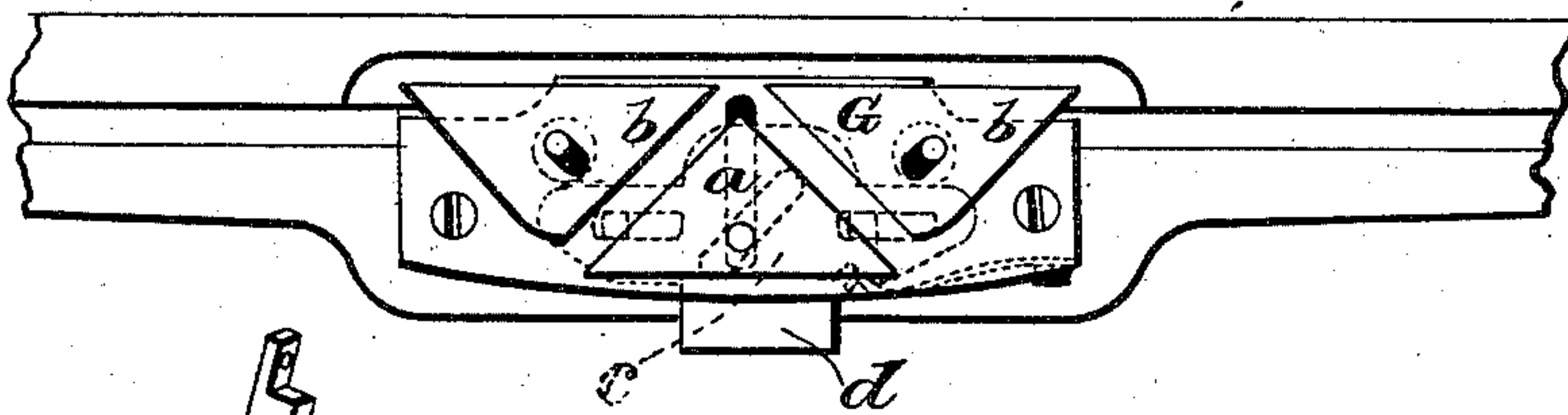


Fig. 7.

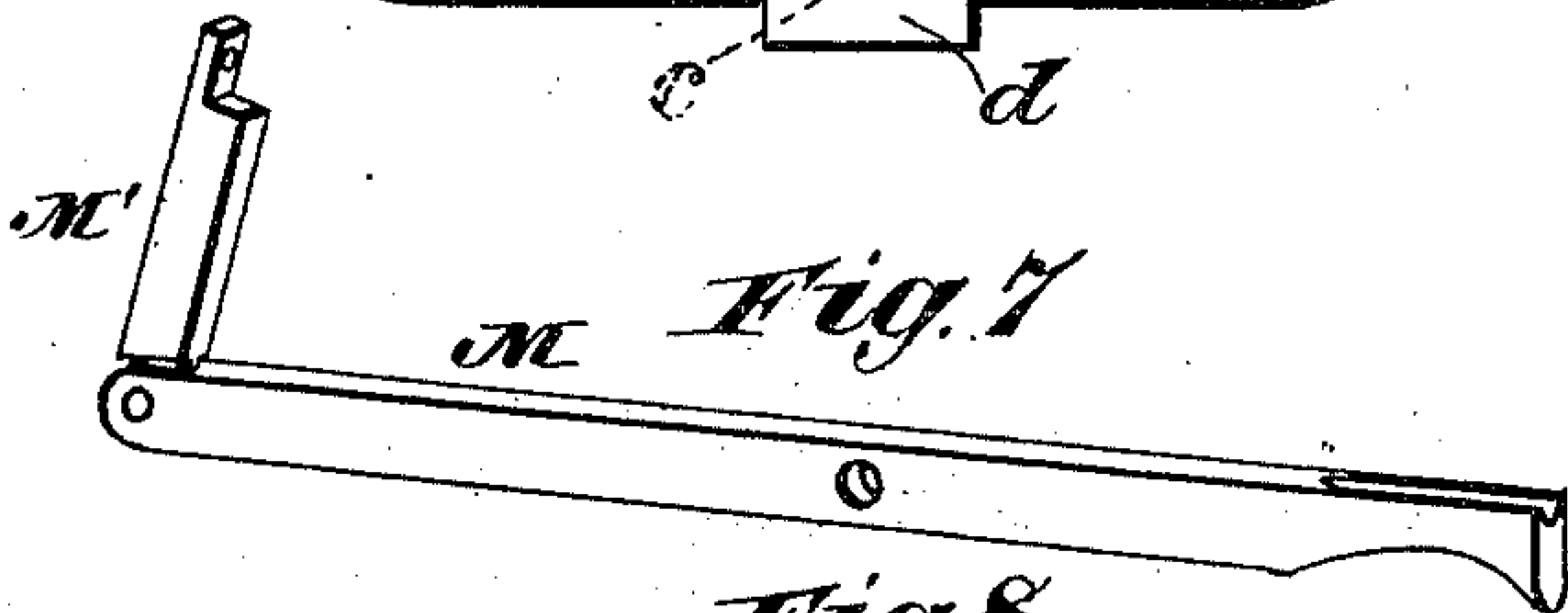


Fig. 8.

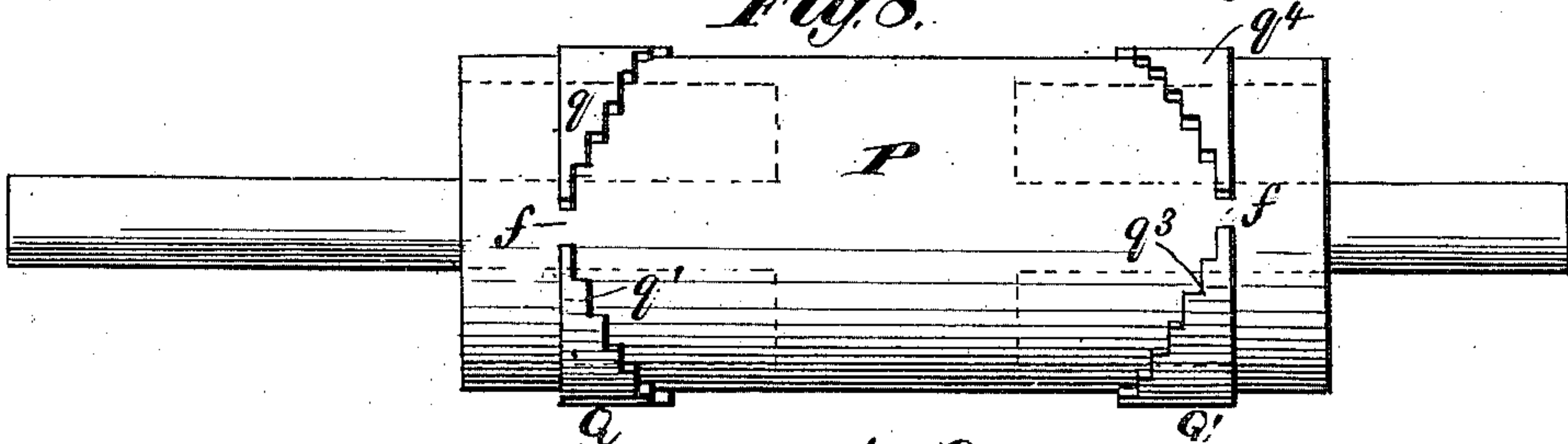
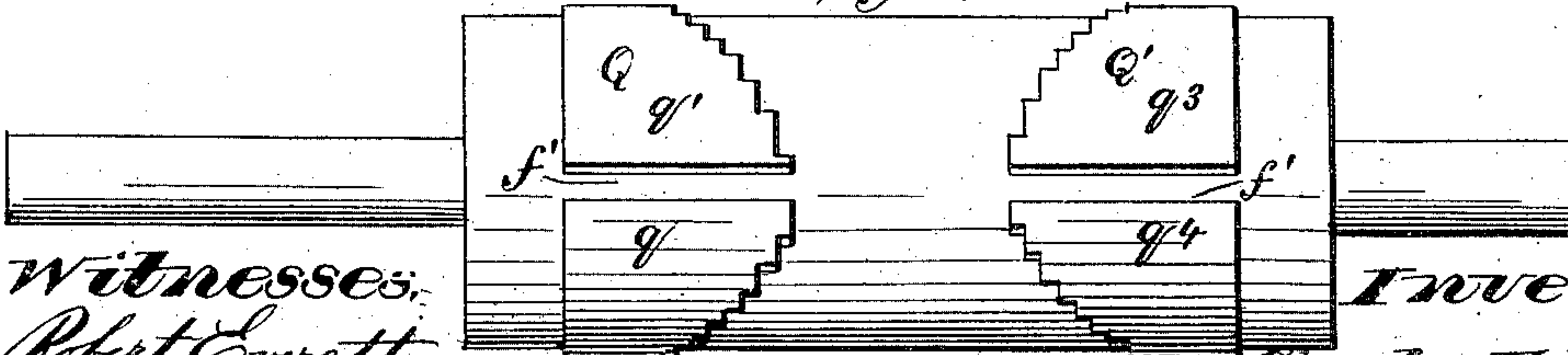


Fig. 9.



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(No Model.)

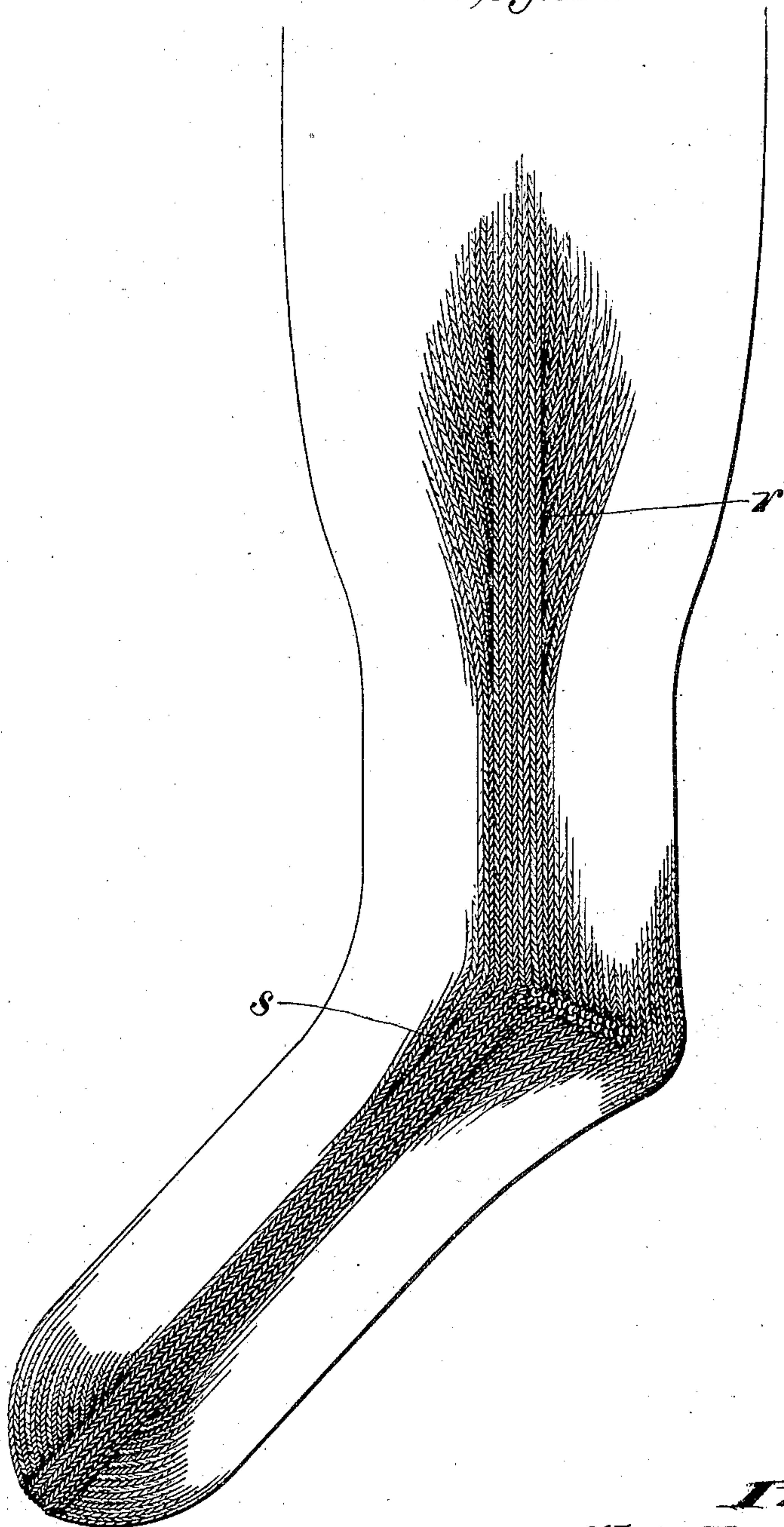
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Fig. 10.



Witnesses,
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George W. Ren.

Inventor,
Charles E. Norris.
By James L. Norris,
Att'y.

UNITED STATES PATENT OFFICE.

CHARLES E. NORRIS, OF LACONIA, NEW HAMPSHIRE, ASSIGNOR OF THREE-FOURTHS TO EUGENE VERMILYEA, OF WATERFORD, AND LE ROY VERMILYEA AND ANSON TABOR, BOTH OF COHOES, NEW YORK.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 311,357, dated January 27, 1885.

Application filed March 28, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. NORRIS, a citizen of the United States, residing at Laconia, Belknap county, New Hampshire, have invented new and useful Improvements in Knitting-Machines, of which the following is a specification.

My invention relates to knitting-machines, and has for its objects to knit a seamless-heel stocking on a "Lamb" or straight knitting machine, and to form narrowings in the opposite sides of the stocking, instead of in the back, as usual heretofore, whereby a neater-looking and a neater-fitting stocking is obtained; and to the accomplishment of the foregoing ends a full description of means suitable therefor will be hereinafter given, and particularly pointed out, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of the machine embodying my invention. Fig. 2 is an end elevation with parts broken away. Fig. 3 is a detached side view of a part of the machine, showing the cam which operates the pawl by which a ratchet-wheel, hereinafter described, is moved. Fig. 4 is a transverse section through the machine on the line *xx* of Fig. 1. Fig. 5 is a bottom view of a part of the frame, showing the position of the needle-operating cams, one being opened and the other closed. Fig. 6 is a bottom view of one side of the frame, showing in dotted lines means for shifting the cams. Fig. 7 is a perspective view of one of the needle elevating and lowering levers. Fig. 8 is a side view of the pattern-cylinder. Fig. 9 is a similar view from the other side of the same cylinder. Fig. 10 is a side view showing the narrowings in one side of the leg and foot of a stocking knit on my machine, the other side being like it.

In the said drawings, the letter A indicates the frame of the machine, provided with grooved bed B, constructed to receive the needles C and D, the side for the needles C being constructed as usual in the Lamb machine, while the side for the needles D has the grooves for the needles, or some of them, cut on a taper longitudinally, the groove increas-

ing in depth from top to bottom, as seen in Fig. 4, so as to permit the needles to be raised and dropped in the manner and by means hereinafter described, so that when necessary they may be thrown into and out of the line of the actuating-cams. A carriage, E, rests upon the bed and is reciprocated over the same in the manner usual in the Lamb machine, any suitable power being employed therefor—for instance, a crank-lever, F, and pitman F'; and it is provided on its under face with cams G and G', both being formed alike, and composed of the cams *a*, movable cam *b*, sliding plate *c*, (illustrated by dotted lines in Fig. 6,) and provided with lug *d*, and the plate *l*, the several parts being formed as illustrated in full and dotted lines in Fig. 6, the same being the usual construction of such parts in the Lamb machine, and arranged to operate so that one cam will be closed while the other is open. The cams are shifted, as usual, when it is desired to throw one row of needles out of operation and the other into operation, by means of the cam-shifters H H' at the end of the bed-plate. The carriage is also provided with the usual dial-plates, I, for adjusting the cams *b*, the yarn-guide J, the latch-openers K, and yarn-tension device L. Some of the needles D have their shanks extended and passed through eyes in the ends of the short arms M' of the levers M, to which the short arms are pivoted at one end, the levers being fulcrumed on rods N, supported by standards N', and passed through the levers. The levers M, at their rear ends, are preferably formed with a head by cutting away a portion of their lower faces, as shown in Fig. 7, so that they will drop from off the raised portion of the pattern-plate, as hereinafter described, and with a longitudinal groove in their upper faces to receive and guide the ends of springs N², secured to a suitable support, O, and designed to press the ends of the levers down into contact with the pattern-plate.

I have illustrated two sets of the levers M, arranged to receive the needles toward the two ends of the bed, fourteen levers being in each

set; but it will be understood that I do not limit myself to two sets, nor to any number of levers in each set, as the number may be varied to suit the circumstances. It will also be understood that the needles that do not connect with the levers need not have the extended shanks, and that the grooves in the bed to receive the needles need be tapered as described only when the needles fitting therein are to connect with the levers, the other grooves being formed in the ordinary way.

The pattern-plate consists of a cylinder, P, journaled in standards P' at the rear of the machine, and on its periphery are formed the raised plates Q and Q', made of a series of strips set side by side, or of one piece, having their adjacent faces notched or stepped in opposite directions in a descending scale toward the ends of the roll, with the steps of one plate out of line with the steps of the other plate, so as to drop or raise the needles alternately, as hereinafter described, as illustrated in Figs. 8 and 9, the said plates being divided transversely to their length, or in the direction of the axis of the cylinder, so as to separate each of the plates into two parts, q q' and q^3 q^4 , and form transverse channels or ways f f' between the parts, as shown in Figs. 8 and 9.

On one end of the shaft of the cylinder P there is keyed a ratchet-wheel, P², provided on its side with a lug, g , extending above the periphery of the wheel. A pawl-lever, R, pivoted at one end to the arm R', hinged to the bed-plate or frame, as shown in Fig. 2, engages with the teeth of the wheel P², except when resting on the lug g , and rotates the wheel the distance of one ratchet in every reciprocation of the carriage E by the cams S and S' alternately striking against the edge of arm R' and moving it toward the ratchet-wheel, a spring, h , connected with the pawl-lever and a suitable part of the bed-plate or frame, drawing the pawl and arm back as soon as one cam leaves the arm, in order that the other cam may strike the arm in the reciprocation of the carriage. When the pawl-lever rests upon the lug g , the arm is moved backward and forward and the pawl-lever carried with it; but the lever reciprocates over the lug without moving the ratchet-wheel. The lug is moved from under the pawl-lever, so as to permit the pawl to engage with the ratchet by a partial rotation of the wheel, imparted by a lever, T, pivoted to the side of the frame, as shown in Fig. 2, and having a pawl, i , at its end, which is held in engagement with the teeth of the wheel P² by a spring, i' . The rear end of this lever is depressed, so as to throw the other end up and move the ratchet-wheel by a lug, j , on one side of an endless chain, T', which at its lower end will pass over an idler, (not shown,) and at its upper end passes around a sprocket-hub on the side of a ratchet-wheel, U, which turns in suitable bearings on the side of the frame, as shown in Fig. 2. The ratchet-wheel U is rotated by means of

a pawl, j' , on the end of a rod, k , which passes through brackets l on the side of the frame or bed-plate, as shown in Fig. 2, the said rod being provided with a collar, k' , between which and the lower bracket and around the rod is placed a suitable spring, l' , which serves to hold up the rod and restore it to its normal position after it has been depressed to move the ratchet-wheel. The said rod is depressed by a cam, U', on the under side of the traveling carriage, at or near the end next to said rod, so that in each reciprocation of the carriage the cam strikes and depresses the rod to partially rotate the ratchet-wheel U. The length of the chain, the number of its links, and the number of teeth in the wheel regulate the time of movement of the lever T, the movement of which is so timed that the ratchet-wheel P² is only brought into operation at the proper time to knit the heel of the stocking. A brake or shoe, V, is bolted to the side of the frame opposite the end of the lever T, so that the chain will not be forced back when the lug thereon strikes the lever. The chain T' is provided with a series of links, m , which are wider than the other links, and are designed in the revolution of the chain to strike against the lower end of a cam, W, which has sides converging toward its upper end, and is slotted vertically so that it may slide on the bolts n , which secure said cam to the side of the frame or bed-plate, as illustrated in Fig. 2. This cam, when moved up by the projections which the widened links form on the chain, strikes against the inner beveled ends of the sliding cam-shifters H' and pushes them outward, so that when the carriage is moved to that end of the bed-plate the projecting lugs to the needle-actuating cams will pass the shifters without striking them, and consequently without the cams being moved. The number or extent of the projections on widened links is such that the shifters H' will be held out during the time required to knit the heel. By the time the heel is completed the projections on the chain will have passed from under the cam W, so that the latter will be free to drop by gravity, when a spring, o , which connects the inner ends of the two shifters, will draw the shifters inward, so that in the reciprocation of the carriage the lugs of the needle-actuating cams will strike against the shifters, and the cams thus be shifted alternately at opposite ends of the bed-plate, so as to knit again on both rows of needles. The lug j passes the lower end of the cam W, between it and the side of the frame, so as not to strike against the cam.

In operation, the upper portion of the stocking is knitted, in the ordinary way on a Lamb machine, until such point in the leg is reached where it is desired to narrow, when the stitches, one or more, are taken from the end needles of both rows and shifted, each one needle inwardly to form narrowings r , and the knitting then proceeded with as before, and continued

through one or more courses until other narrowings r are to be made, when the stitches are farther moved inwardly as before, and such method of narrowing pursued until the desired shape is given to the leg, when the knitting will continue in courses of equal or unequal length till the beginning of the heel portion is reached and the needle-actuating cam on the front of the machines is closed and that on the rear is opened and the shifters H' are thrown out, simultaneously with which the pawl-lever R is thrown into contact with the teeth of the ratchet-wheel P^2 by the operation of the lever T and pawl i , as aforesaid.

At such time the heads of the needle dropping and elevating levers are resting in the way f , and the needles D are raised so as to be acted on by the cam. Now, as the carriage is reciprocated toward the cam-shifters H' , the stitches are knit by the needles D on the rear side of the machine only, and as the cam-shifter is passed and the cam S strikes the arm R' the ratchet-wheel P^2 is moved to the extent of one tooth, and the pattern-cylinder moved so as to bring the lowermost step of the pattern part q under the head of the needle elevating and dropping lever nearest to the ratchet-wheel P^2 , so as to drop the needle connected therewith, and thus move it out of reach of the actuating cam. By the time that the cam S' comes in contact with the arm R' the needle-actuating cam has reached the opposite end of the bed, and the pattern-cylinder is then moved to the extent of another tooth, so as to bring the lowermost step of the pattern part q^4 under the head of the needle elevating and dropping lever next to that end of the cylinder, whereby the needle at that end is dropped, and so the operation of dropping the needles inwardly from each end of the bed alternately continues until they have all been dropped, during which time the knitting has been proceeding on only one row of the needles and gradually tapering from both sides toward the center. During this tapering method the strain on the yarn on the end needles has been slowly increasing, and by the time that all the needles have been dropped and the first half of the heel thus completed the strain has become considerable. In order to relieve this strain and also to close or prevent the formation of openings between the stitches that would otherwise be formed, the levers are all simultaneously dropped from the parts q q^2 into the way f' , whereby all the needles are raised together, and two rows of stitching are then run across the heel, one from the end next to the shifters H' to the opposite end and the other back to the starting-point, whereby the strain is taken from off the end needles and the completion of the other half of the heel can be proceeded with. By the time that the second row of stitching has been finished the pattern-cylinder has been rotated the distance of one tooth of the ratchet-wheel, which is equal to the width of the way f' , and

then immediately upon the completion of such second row of stitching the cam S' strikes the arm R' and moves the cylinder the distance of one tooth, and raises the levers so as to drop all the needles whose levers rested in the way f' and simultaneously carry the lever next to the shortest step of the part q' over the step, thereby lowering that lever and raising its needle. The carriage now travels to the end of the bed farthest removed from the shifters H' , and the cam S' then strikes the arm R' and moves the cylinder the distance of one tooth, thereby dropping the needle-lever from the shortest step of the part q^3 and raising its needle, and thus the raising of the needle continues alternately at opposite ends until they have all been raised. Simultaneously with the raising of the last needle the lug g on the ratchet-wheel P' is carried under the pawl-lever R' and the same raised from engagement with the ratchet. The pattern-cylinder has now made a complete revolution and the heel is completed. The projections or last widened link of the endless chain passes from under the cam W with the last movement of the ratchet-wheel just described, so that the cam W falls and the spring draws the shifters H' toward each other and into the line of travel of the lug d of the plate c of the needle-actuating cams on the carriage, so that henceforth until the completion of the stocking both needle-cams on the carriage will be in operation and the stitches will be knit on both rows of needles. After the completion of the heel I knit, say, two or more rows of stitches, and then proceed to narrow in the same manner as already described for narrowing the leg. The desired number of narrowings s are put in—usually three—and then the knitting proceeds in rows of equal length till time to narrow for the toe, when that narrowing is done in the usual manner. By narrowing as I have described after the completion of the heel, the narrowings are brought both on the upper part of the foot and on the lower part and also on opposite sides. The narrowings thus applied to the foot and applied to the leg, as previously described, form or fashion the stocking so as to give it a better shape and make it fit more neatly to the leg than when otherwise formed.

By the means described I am enabled to knit on a straight-knitting machine a seamless-fashioned stocking with the narrowings in the sides of the leg and foot of the stocking.

The mechanism for raising and lowering the needles is all at the back of the needle-bed out of the way of the attendants. The needles are both dropped and raised alternately from opposite sides during the formation of the heel by a continuously-rotating pattern-cylinder, and the said cylinder is rotated from the carriage in its reciprocation without the employment of shafting and gears.

With regard to the described method of narrowing the stocking it will of course be un-

derstood that if the stocking be knit from the toe instead of from the top the knitting will be performed from the middle needles outward, instead of from the end needles inwardly, as is well understood in the art. In such case the shape will be given to the stocking by widening instead of narrowing, the stitches on both rows of needles being made in the ordinary way for widening, so as to shape the stocking and bring the widenings on both sides thereof instead of in the back, as heretofore.

I do not claim in this application the stocking illustrated and claimed, as the same constitutes the subject-matter of another application filed by me March 26, 1884, No. 125,622.

Having thus described my invention, what I claim is—

1. The combination of the needle-bed, grooved to permit the needles to be raised and dropped, the needles fitting therein, the rotating cylinder provided with the pattern, having on opposite edges the series of steps of a descending scale toward the ends of the cylinder, with the steps at one end of the cylinder out of line with those at the other end, a series of levers connected with said needles and resting on the pattern of the rotating cylinder, a hinged arm, and a lever connecting the same with the rotating cylinder, a reciprocating carriage carrying needle-actuating cams and provided with cams arranged thereon, to be thereby alternately brought into contact with said hinged arm to actuate the rotating pattern-cylinder, whereby the needles are dropped or raised one at a time and alternately from opposite ends of the needle-bed plate, substantially as described.

2. The combination of the needle-bed, grooved to receive the needles, the needles therein, the reciprocating carriage, the needle-actuating cams carried thereby, the cam-shifters at the end of the bed, to alternately open and close the needle-actuating cams, and means, operating substantially as described, for automatically moving said shifters at one end of the bed out of the line of travel of the actuating-cams and holding them out of line therewith while knitting the heel, whereby in the reciprocation of the carriage one of the needle-actuating cams will remain closed and the other open, and the stitches will be formed on one row of needles only, substantially as described.

3. The combination of the needle-bed, grooved to receive the needles, the needles therein, the reciprocating carriage, the needle-actuating cams carried thereby, the cam-shifters at the end of the bed, to alternately open and close the needle-actuating cams, the sliding cam between the cam-shifters at one end of the needle-bed, the wheel at the end of the needle-bed next to said sliding cam, the pattern-chain provided with projections, a hub on said wheel having said chain mounted thereon, the sliding rod connected with said wheel, and a cam on the reciprocating car-

riage to depress said rod and move said wheel, substantially as described.

4. The combination of the needle-bed, grooved to receive the needles, the needles therein, the pattern-cylinder, the reciprocating carriage, the needle-actuating cams carried by said carriage, the endless chain having a lug thereon, a wheel for moving said chain, a rod connected with said wheel, a cam on the reciprocating carriage to impel said rod to move said wheel, and a lever connecting with the pattern-cylinder and acted on by said lug on the endless chain to move the pattern-cylinder, substantially as described.

5. The combination of the double-inclined needle-bed formed with grooves on both inclined faces, the grooves on one face tapering in depth from top to bottom, whereby the needles may be raised and dropped, the needles fitting in the grooves of the bed, the rotary cylinder provided with a pattern having a series of steps in succession from opposite ends of the cylinder, substantially as described, the series of levers resting on said pattern-cylinder and connected with the needles in the tapered grooves of the needle-bed, the reciprocating carriage, the needle-actuating cams carried thereby, the cam-shifters at opposite ends of the bed-plate, means for moving at stated periods the cam-shifters at one end of the bed-plate out of the line of travel of the needle-actuating cams, levers connected with the pattern-cylinder intermediate of it, and the reciprocating carriage to act on said levers to move the pattern-cylinder, substantially as described.

6. The combination, with the needle-bed, grooved to receive the needles, the reciprocating carriage, the needle-actuating cams carried thereby, the cam-shifters at the ends of the needle-bed, the sliding cam intermediate of the cam-shifters at one end of the bed and adapted to be projected against said shifters to move them out of the line of travel of the needle-actuating cams, means for automatically moving said sliding cams, and a spring connected to said shifters to retract them after the sliding cam is restored to its normal position, substantially as described.

7. The combination, with the needle-bed, the needles therein, and the series of levers connected with said needles, of the rotary cylinder provided with the pattern, constructed substantially as described, with a way for one end of the needle-levers to rest in, and a series of ascending and descending steps on opposing faces of the pattern and out of line with each other, the said steps operating to raise the said levers at their ends next to said cylinder one at a time and alternately from opposite ends of the cylinder, and after they have been raised to drop them at the same ends one at a time and alternately from opposite ends of the cylinder, substantially as described.

8. The combination, with the needle-bed, the needles therein, and the series of levers

connected with said needles, of the rotary cylinder provided with the pattern, constructed substantially as described, with steps of a rising and descending scale on opposing faces 5 of the pattern and out of line with each other, and with ways for one end of the needle-levers to rest in at the base and top of said scale-steps, to raise the said levers at their ends next to said cylinder one at a time and 10 alternately from opposite ends of the cylinder, and then, after they have all been raised,

to simultaneously drop all of them, and afterward to raise them all simultaneously, and then drop them one at a time and alternately from opposite ends of the cylinder, substantially as described. 15

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

CHARLES E. NORRIS.

Witnesses:

STEPHEN S. JEWETT,
SAMUEL W. SANDERS.

Correction in Letters Patent No. 311,357.

It is hereby certified that the name of one of the assignees of Letters Patent No. 311,357, granted January 27, 1885, upon the application of Charles E. Norris, for an improvement in "Knitting-Machines," was erroneously written and printed "Anson Tabor," instead of *Amson Tabor*; that the proper correction has been made in the files and records pertaining to the case in the Patent Office, and should be read in the Letters Patent to make it conform thereto.

Signed, countersigned, and sealed this 10th day of February, A. D. 1885.

[SEAL.]

M. L. JOSLYN,
Acting Secretary of the Interior.

Countersigned:

BENJ. BUTTERWORTH,
Commissioner of Patents.