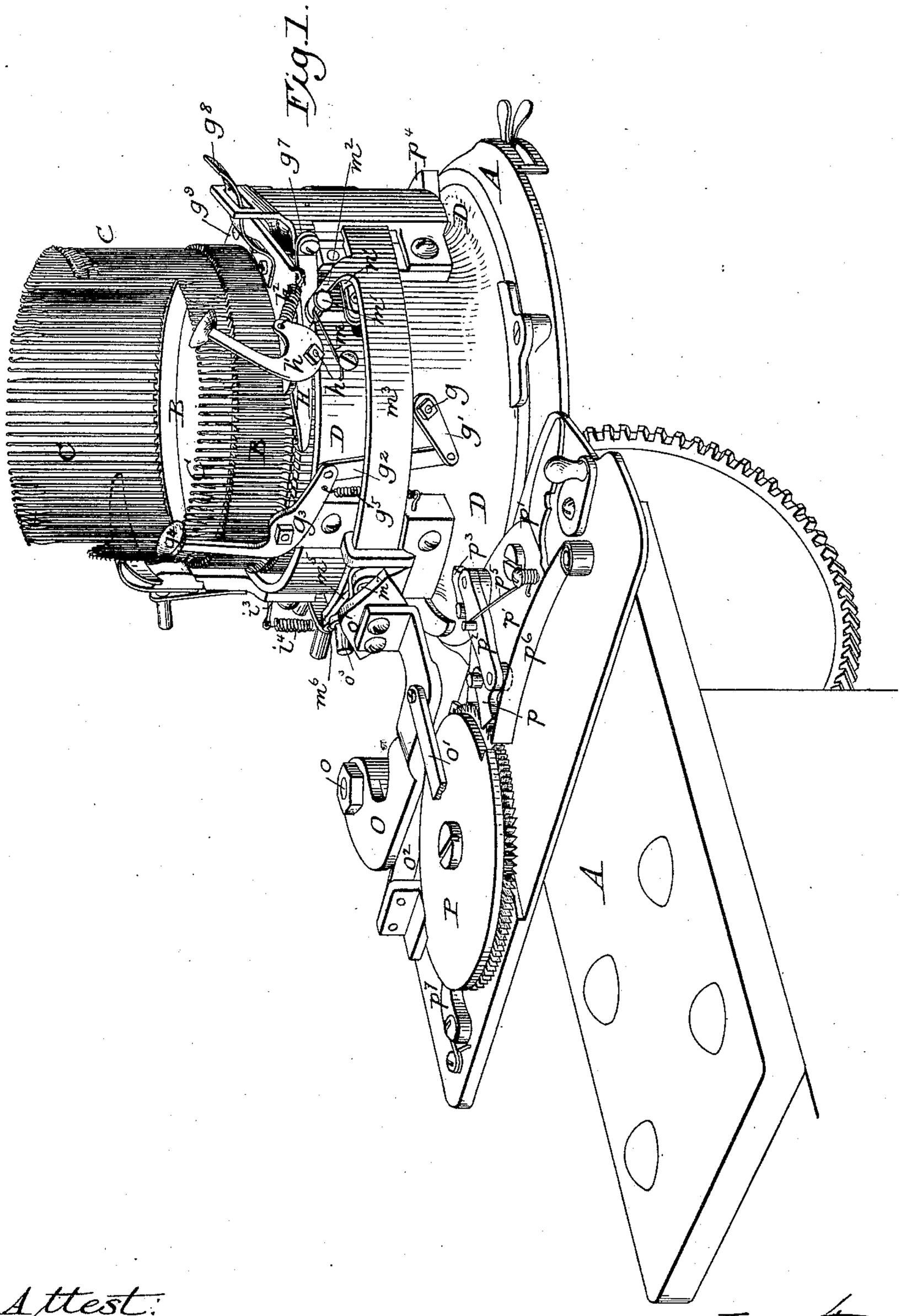
(No Model.) 5 Sheets—Sheet 1.

E. LIPPITT & R. HANSDOERFER.

CIRCULAR KNITTING MACHINE.

No. 429,856. Patented June 10, 1890.

Fig. 1.



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By P. J. Dodge

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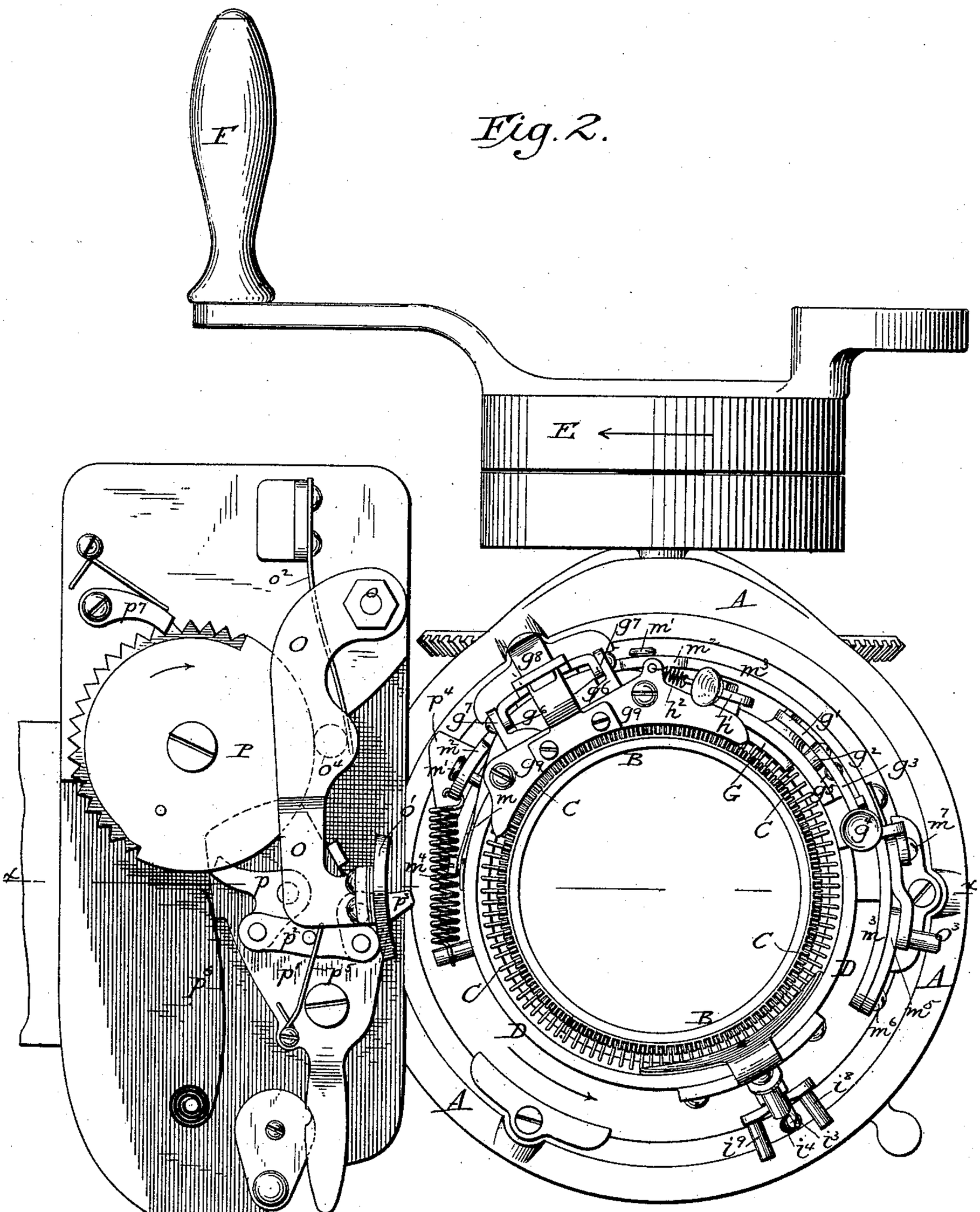
(No Model.) 5 Sheets—Sheet 2.

E. LIPPITT & R. HANSDOERFER.

CIRCULAR KNITTING MACHINE.

No. 429,856. Patented June 10, 1890.

Fig. 2.



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E. LIPPITT & R. HANSDOERFER.

CIRCULAR KNITTING MACHINE.

No. 429,856. Patented June 10, 1890.

Fig. 3.

ON LINE X—X

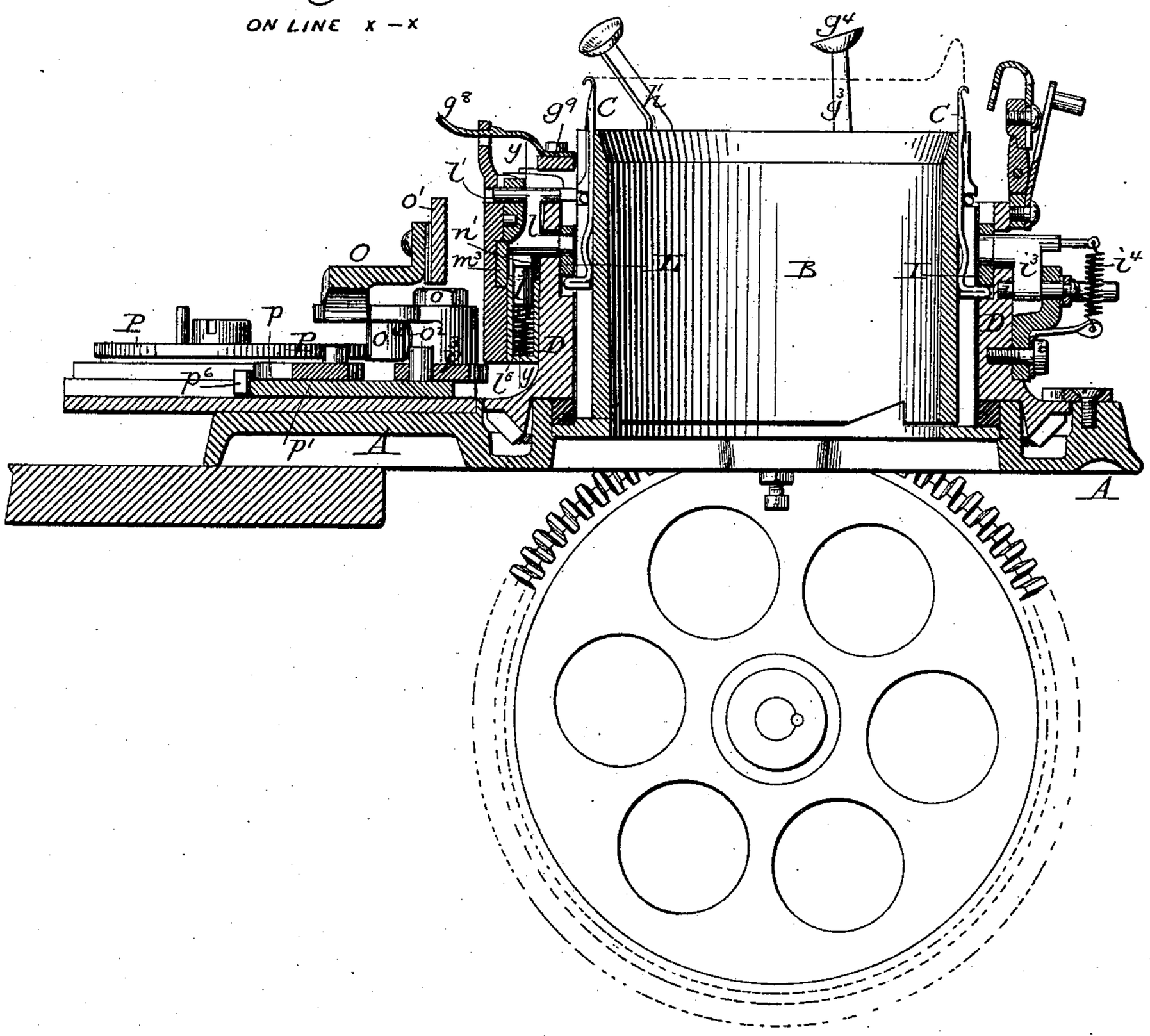
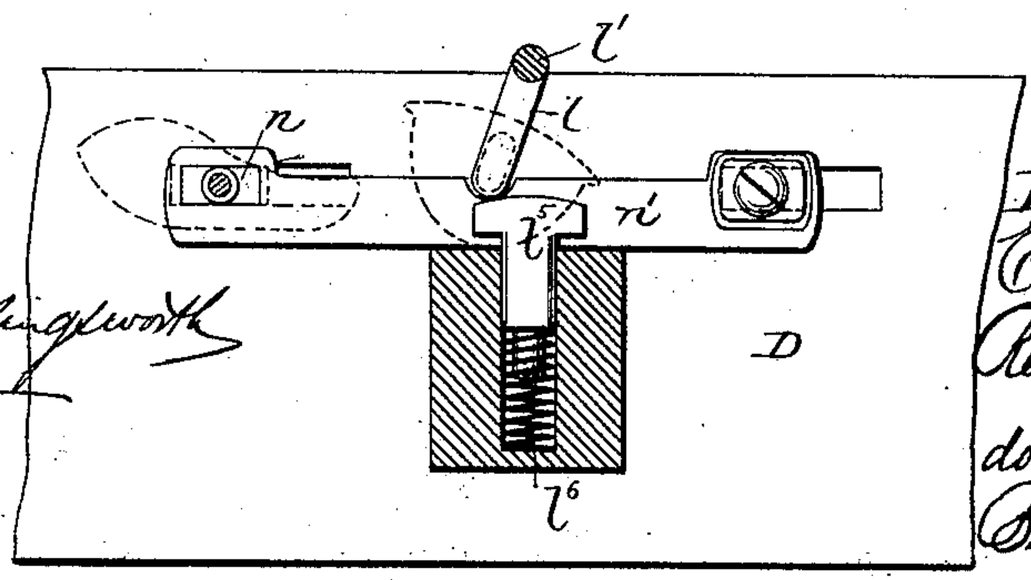


Fig. 4.

ON LINE Y—Y



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E. LIPPITT & R. HANSDOERFER.

CIRCULAR KNITTING MACHINE.

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Fig. 5.

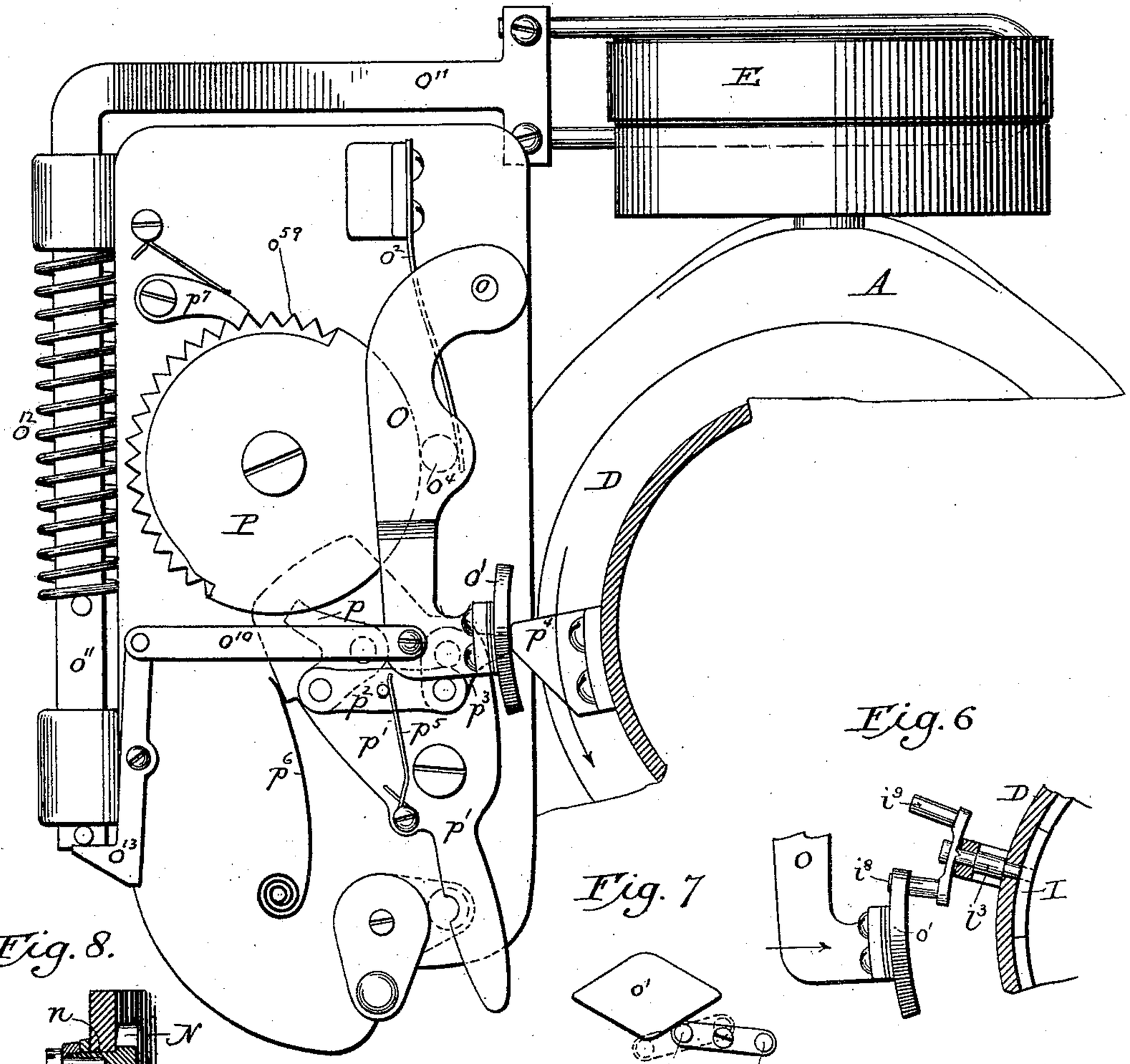


Fig. 6

Fig. 7

Fig. 8.

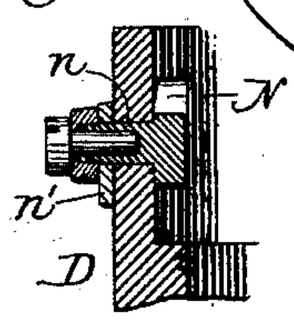
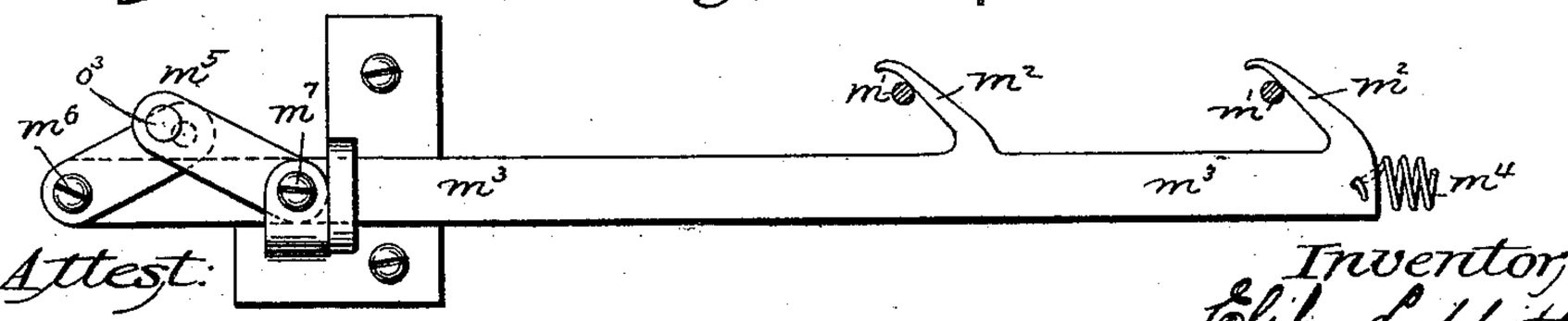


Fig. 16.



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5 Sheets—Sheet 5.

(No Model.)

E. LIPPITT & R. HANSDOERFER.

CIRCULAR KNITTING MACHINE.

No. 429,856. Patented June 10, 1890.

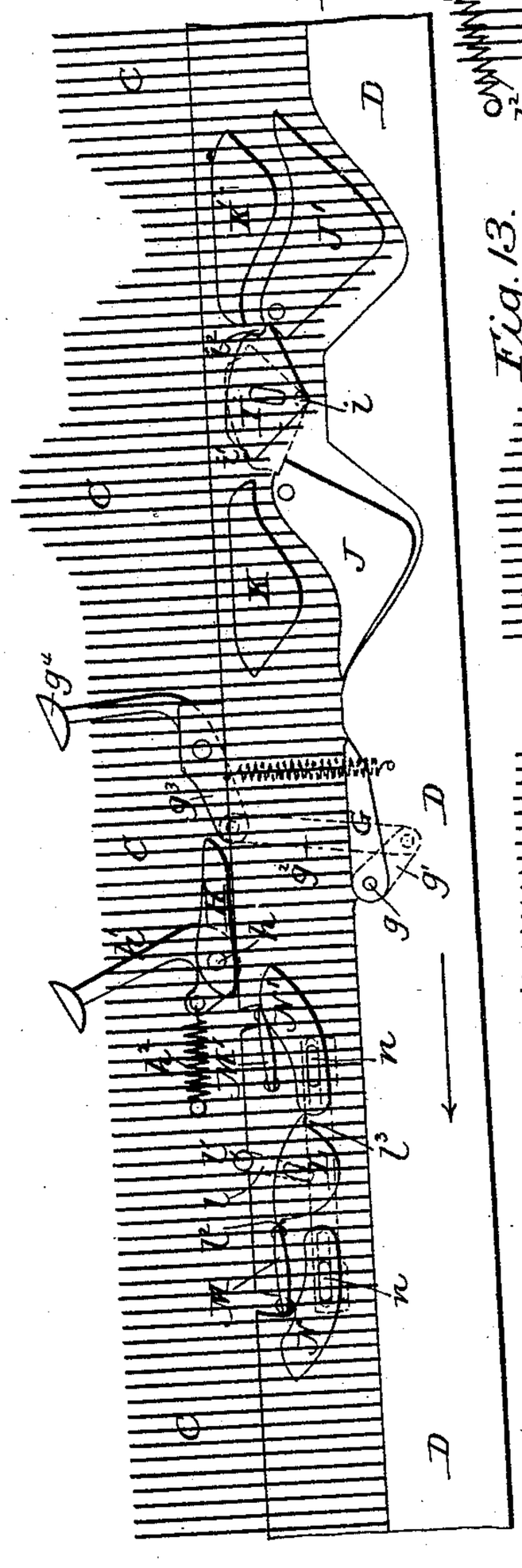

Fig. 9.

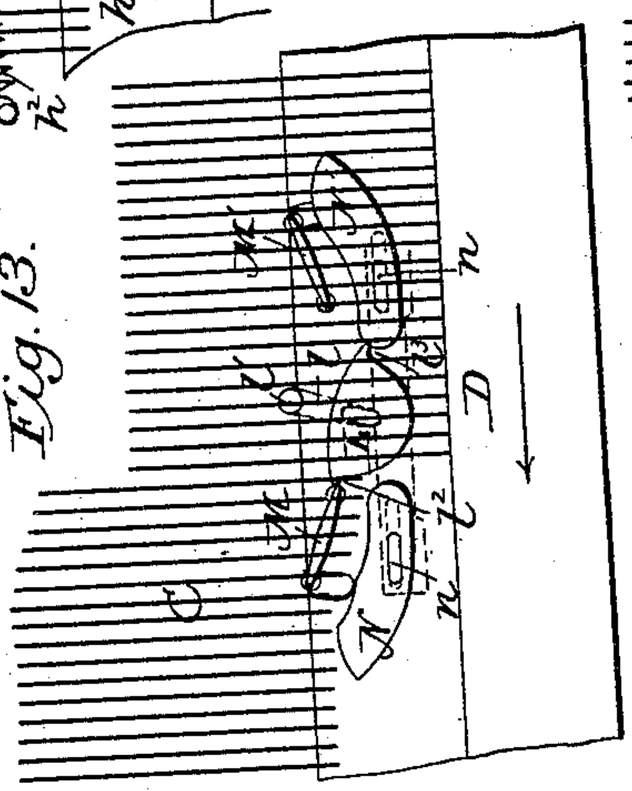

Fig. 13.

Fig. 14.

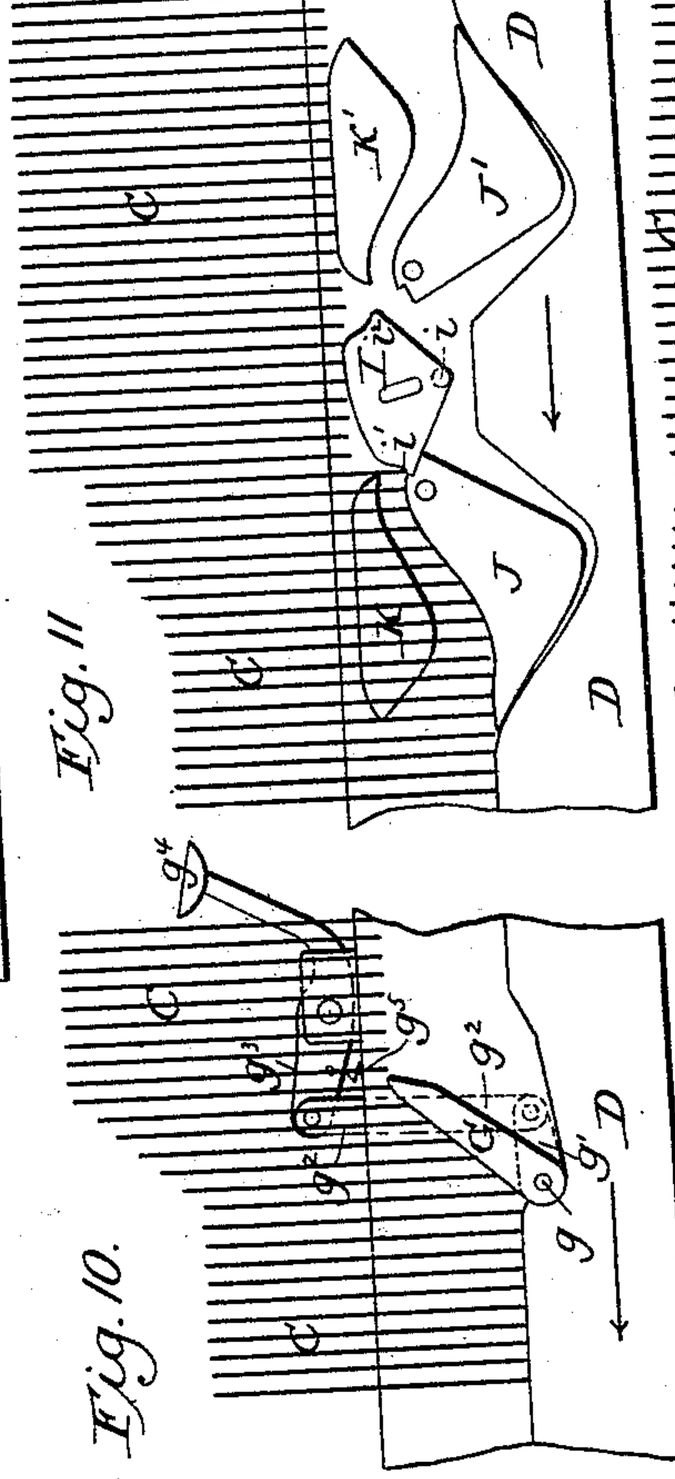

Fig. 11

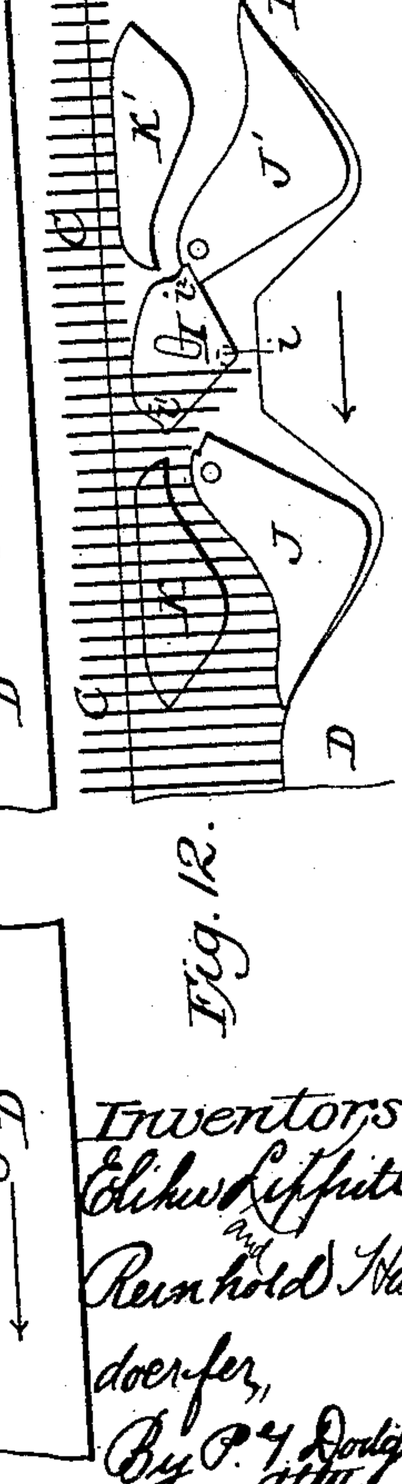

Fig. 12.

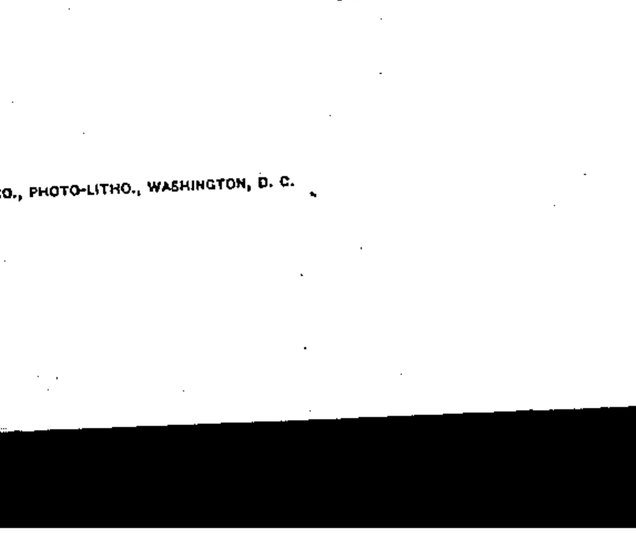

Fig. 10.

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Atty.

UNITED STATES PATENT OFFICE.

ELIHU LIPPITT AND REINHOLD HANSDOERFER, OF ZANESVILLE, OHIO, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO HENRY H. STURTEVANT, JOHN MARTIN, ANNA LIPPITT, AND ANNA MERCER, ALL OF SAME PLACE.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 429,856, dated June 10, 1890.

Application filed January 6, 1888. Serial No. 260,016. (No model.)

To all whom it may concern:

Be it known that we, ELIHU LIPPITT and REINHOLD HANSDOERFER, of Zanesville, in the county of Muskingum and State of Ohio, have invented certain Improvements in Circular-Knitting Machines, of which the following is a specification.

In knitting heels and toes in stockings in ordinary cylinder knitting-machines it is the custom to first raise the needles on one side of the cylinder out of the path of their actuating-cams, so that they will retain their stitches and for the time being remain inactive. The machine is then given an oscillating instead of a rotary motion, in order to knit additional stitches upon those needles which were left down in their operative positions. At the end of each course thus knit on the depressed needles an additional needle is lifted out of action, and this lifting of the needles one at a time at the alternate ends of the course is continued until but a few needles, usually but one-sixth of the entire number, are left in action. When this point is reached, the oscillating action being still continued, the needles are carried downward into action, one at the end of each course, until finally the number of needles in action is the same as at the beginning of the heeling operation.

It is the aim of our invention to combine with the parts of a knitting-machine, which may be in all other respects of ordinary construction, mechanical devices to effect the above-named adjustments of the needle—that is to say, to throw one-half of the needles instantly out of or into action, and to throw the remaining needles, first, one at a time out of action, and thereafter one at a time into action. To this end we provide in connection with the machine four distinct devices or sets of devices: first, a cam carried by a revolving ring around the cylinder and shaped to be held momentarily in action by hand for the purpose of throwing the needles on one side of the cylinder upward beyond their operating-cams, so that they may retain their stitches; second, a cam or finger carried by the revolving ring around the cylinder and adapted to be held momentarily in action by hand for the purpose of restoring the needles raised by the first-mentioned cam to their operative positions; third, an automatic cam which acts upon the needles and which is in turn set by the needles one at the end of each course; fourth, a cam which acts upon and is in turn adjusted by the needles for the purpose of depressing the needles which are lifted out of action one at the end of each course.

In connection with the cams for effecting the adjustment of the needles one at a time we propose to use certain automatic devices for controlling their action and throwing them into and out of play when their duties have been fully performed.

In the accompanying drawings, Figure 1 represents in perspective an ordinary cylinder-machine with our invention applied thereto. Fig. 2 is a top plan view of the same with details omitted. Fig. 3 is a transverse vertical section of the same through the parts in the path of the broken line *x x* of Fig. 2, the cylinder being turned from the position shown in Fig. 2 to one in which the parts in section stand in the same vertical plane. Fig. 4 is a section on the line *y y* of Fig. 3. Fig. 5 is a plan view of the automatic belt-shipping devices in connection with the cam-adjusting mechanism. Figs. 6, 7, and 8 show detail views of various parts. Fig. 9 is a development or plane projection of the inner surface of the rotary cam ring or cylinder, showing the form and arrangement of the several cams. Figs. 10 to 15 show the various cams in different positions. Fig. 16 is a linear projection of the curved slide for operating the flying cams and their connections.

In the drawings, A represents the fixed base or frame; B, the upright stationary needle-cylinder; C, the vertically-sliding latched needles mounted in grooves in the cylinder; D, the rotary ring or cylinder-jacket, encircling the needle-cylinder and carrying on its inner face the needle-actuating cams; E, the driving-pulley, mounted on a driving-shaft

connected with the cam-ring by bevel-gear, as usual, to give the same a continuous rotary motion, and F the hand-crank for oscillating the cam-ring during the heeling and toeing operation.

In their construction and mode of operation the foregoing parts are, except as to certain details hereinafter specified, of the ordinary character.

Our first improvement relates to the device for raising the needles on one side of the cylinder out of action at the will of the operator, and is illustrated in Figs. 1, 2, 9, and 10, in which G represents a long cam or finger seated in the inner face of the cam-ring in position to travel beneath the heels of the needles. It stands normally in a horizontal position, as shown in Fig. 9. In this position it is inactive; but it is mounted at one end on a short shaft or journal g, extended outward and provided with a crank-arm g', which is in turn connected by a link g^2 with a finger-lever g^3, pivoted to the cam-ring and terminating in a cup-like portion g^4, exposed at the top of the machine in such position that it may be conveniently depressed and held down as the ring revolves. The depression of this lever g^3 throws the cam G upward to the inclined position shown in Fig. 10, in which position it forces all the needles under which it may be carried by the rotation of ring D upward, above, and out of the reach of their operating-cams, so that they remain inactive until again depressed. Thus, it will be seen, it is only necessary for the attendant to hold down the lever g^3 during a half-revolution of the ring in order to raise the needles on one side of the machine out of action, as shown in Fig. 1. A spring g^5 is commonly used to depress the cam when the lever is released; but this spring may be omitted, as the cam will then be depressed by gravity and the resistance of the overriding needles.

The second improvement relates to the means for again depressing or restoring to their operative positions the needles raised by cam G, and is plainly shown in Figs. 1, 2, 9, and 15, in which H represents a vertically vibratile cam or finger mounted on the inside of the rotary ring near its upper edge and connected through its journal h with the finger-lever h', the end of which is cupped and exposed at the top of the machine in position to admit of its being conveniently held down by the hand while the ring is revolving to carry it past the needles to be depressed. A spring h^2, connected to the cam and the sustaining-ring, holds the cam normally in its elevated position, (shown in Fig. 9,) so that it travels above and out of contact with the heels of the needles. When, however, the finger-lever is depressed, it depresses the cam H, as shown in Fig. 15, so that it acts on the shanks of the elevated inactive needles and carries them down within reach of their actuating-cams, so that they resume operation.

Our third improvement relates to the cam for automatically lifting the active needles out of action, one at the end of each course as the cam-ring is oscillated, as is clearly shown in Figs. 9, 11, and 12. In these figures I represents our lifting-cam, which will be hereinafter designated as the "automatic" lifting-cam to distinguish it from the others. J J′ represent the pivoted gravitating cams, one or the other of which acts to elevate the needles when knitting, according to the direction in which the machine is rotated, and K K′ the stationary cams to depress the needles when knitting. These cams are the same as those in common use, except that the cams J J′, usually made in one, are cut apart to admit the automatic cam between them. The automatic cam I is mounted on the upper end of a central arm i^3, rising from and sustained by a horizontal journal i, seated in the rotary ring or jacket, coincident, or practically so, with the apex of the cam, so that the cam may be tipped to the right or left, in order to bring either end uppermost, as required. The lower edge of cam I descends from its end to the middle; but the upper edge descends from the middle to the ends, where the cam is formed with two shoulders or notches i' i^2—one at each end. The arm i^3 and journal i are connected rigidly with, and are practically a part of, the cam I. The adjacent ends of the cams J J′ are formed and located so that the end of the cam I will, as it is tipped to and fro, rest upon and form a continuation of first one and then the other, as seen in Figs. 11 and 12. A spiral spring i^4, connected at one end to the cam-sustaining arm i^3, is attached at the other end to the ring D in such position that it will pass the center as the cam moves to and fro, and thus act to hold the cam in either position in which it may be placed. The cam acts to lift the needles out of action, as follows: Assume that the ring is carrying the cam to the left in Fig. 11, and that the cam stands in its left-hand position, as shown in Fig. 11, it will pass without action beneath the heels of those needles already lifted out of action; but on reaching the first needle, which is down in operative position, its shoulder i' will ride under and against the heel of said needle, and the heel, offering a resistance to the advance of the cam, will cause the latter to tip or rock on its journal toward the right until it assumes the position seen in Fig. 12. During this movement the needle-heel riding on the shoulder of the cam is carried so far upward that it will pass above cam K′ and become inactive. As the cam thus acts to raise the one needle, its forward end, which is for the moment the left end, rises to such position that it overrides the heels of the remaining needles, which, passing thereunder, continue in operative position. The motion of the machine is continued until the cam I is carried to the left past all the needles in operative position, when the motion is reversed and the cam carried to the right. Being now in the position

shown in Fig. 12, its shoulder i^2 will encounter the first active needle and force it upward out of action, and in so doing assume, because of the resistance of the needles, the position seen in Fig. 11, so that the heels of the remaining needles pass below it. Thus it will be seen that the cam acts automatically at the two ends of the line alternately to lift the needles out of action one at a time. The essence of the invention in this regard lies in the employment of a movable lifting-cam, which is adjusted by the action of the needles thereon, and it is manifest that it may be modified in form and arrangement within the range of mechanical skill and without departing from the limits of our invention.

The fourth part of our invention (illustrated in Figs. 2, 3, 4, 13, and 14) relates to the automatic depressing-cam L for restoring the needles raised by cam I to their operative position—that is to say, to a position in which the cams J J′ K K′ will engage their heels and cause them to perform the knitting operation. The depressing-cam L is tipped from side to side by the action of the needles, and operates in a manner somewhat similar to that of the elevating-cam, except that it forces the needles downward instead of upward, one at a time. The cam is located at such height that the heels of the needles which are out of action will pass freely thereover, while the heels of the needles which are in action will pass freely thereunder, except as they are brought by the supplemental inner cams, presently to be described, within reach of the cam L. As shown particularly in Figs. 3, 9, and 13, the cam is attached rigidly to the lower end of a crank-arm l, having its fulcrum at l' in the ring or jacket D. This crank-arm is in effect a central pivot to admit of the cam rocking to and fro. The upper edge of the cam rises from the two ends toward the middle, while the lower edge is curved downward from the ends toward the middle and formed at the opposite extremities with shoulders l^2 and l^3. In order to hold the cam to the right or the left, as the case may be, until it is moved by the needles, we mount in the ring D, as shown in Fig. 4, a vertically-movable plate l^5, urged upward by a spring l^6 and acting against the lower end of the cam-sustaining crank. On opposite sides of the cam L are placed two cams or switches M M′, commonly known as "flying cams." They are pivoted at their inner ends so that they may swing vertically at their outer ends, and their office is, acting one at a time, to bring the needles which are elevated out of action downward within the reach of the cam L. On opposite sides of the cam L, below the flying cams, are mounted two cams N and N′, which are fixed against a vertical movement, but which are allowed a limited horizontal movement in order that one or the other may be brought into contact with the cam L, according to the position of the latter. The office of these cams is to ride beneath the heels of the needles and prevent them from falling out of the desired position during their adjustment. The cams N and N′ are attached to studs n, extending through horizontal slots in the ring D to a connecting-plate n' on the outside of the ring, this plate being notched to receive the lower end of the cam-sustaining crank l, so that as the cam L moves to the right and left a corresponding movement is imparted to the cams N N′, whereby they are caused to close alternately against its end in order to afford an unbroken track for the passage of the needles over the top. The flying switch-cams M M′ are urged upward to an active position by springs m, acting against studs m' on the free ends of the cams; but they are both drawn and held down (when the cam L is to remain inactive) by inclined arms m^2 on a bar m^3, arranged to slide horizontally in guides on the ring or jacket D. A spring m^4 tends to draw the bar back and release the cams, while a toggle m^5, pivoted at m^6 to the bar and at m^7 to the ring D, as in Fig. 16, serves to hold the bar to the left.

The action of the parts in depressing the needles one at a time is as follows: Assuming that the flying cams are elevated and the cam L thrown to the left in Fig. 13, and that the ring is moving with the cams to the left, as indicated in Fig. 13, the entire group of cams will pass over the heels of the operative needles and remain inert until they reach the heels of the needles which are elevated out of action. When these needles are reached, the flying cam M will override their heels and draw them down, and the heel of the first needle engaging the shoulder l^2 of the cam L will cause the latter to swing to the right to the position shown in Fig. 14, the needle being carried down by and with the cam until its heel is in the path of the actuating-cams. The cam L in thus moving to the right causes the cam N to advance against it at one end, while at the opposite and upper end it meets the heel of the flying cam M′, as seen in Fig. 14, so that those elevated needles which follow the one first depressed will ride over the cams L M′ and retain their elevated inactive positions. After the cams have passed all the inactive needles the motion of ring D is reversed and the edges carried to the right, whereupon the heel of the inactive needle at the end of the line, passing with the others beneath the flying cam M′, will encounter cam L in the position shown in Fig. 14 and carry it to the left to the original position shown in Fig. 13. By this action the first needle is carried down into the path of the actuating-cams; but the remaining needles are caused to pass over the top of cam L and remain out of action.

It is to be observed that the parts herein designated as "cams" I and L are not merely switches or latches, but that they are, in fact, cams in the usual sense of the word with inclined edges, along which the heels of the needles travel. In the operation of each of

these cams the needle which changes the position of the cam passes the same on one side, while the following needles pass on the other side.

From the foregoing description it will be seen that the needles act to reverse the position of the cam L, and that it acts automatically to bring the needles into action one at a time at the right and left of the line alternately.

The parts above described constitue a complete and operative organization capable of producing stockings with heels and toes therein, provided the attendant throws the appropriate cams into and out of action at the proper time. In order, however, to render the machine automatic and to relieve the attendant of the care and labor of watching and adjusting the cams, we employ, in connection with the mechanism already described, devices which control the automatic lifting-cam and the automatic depressing-cam in such manner that the predetermined number of needles will be lifted one at a time out of action, then depressed one at a time into action, and finally the machine stopped. This mechanism in its preferred form is shown in Figs. 1, 2, 3, and 5. In these figures, O represents a horizontally-movable arm or lever pivoted at o, and provided on its distal end with a cam-plate o', such as shown in Figs. 6 and 7. The upper edge of this cam is intended to act on a stud o^3 on the toggle to lift the same, in order to throw the wing-cams M M′ and automatic depressing-cam L into play. Its lower edge is intended to act on arms i^8 and i^9 on the shaft of the automatic lifting-cam I, as shown in Figs. 6 and 7, to rock the cam in such manner that it will not act to lift the needles while the automatic depressing-cam is in action. A spring o^2 holds the cam-arm O normally backward outward of the path of the arms i^8 i^9 and the stud o^3. A wheel P is located on the frame or bed plate and formed with a peripheral edge, one-half of which is of greater radius than the remainder to act on a stud o^4 on the lever O, in order to throw the lever over until the cam on its end is in operative position. This wheel is provided on its lower edge with peripheral teeth o^{59}, in number half as many as the needles to be raised and lowered. The wheel is turned step by step by an angular dog or pawl p, pivoted on a lever p' and actuated through a link p^2 from an angular lever p^3, which is in turn pivoted to the lever p' and actuated by a stud p^4 on the rotary ring or jacket. A spring p^5 urges the pawl into engagement, and a spring p^6 urges the lever p' to the right. The dog p^7 engages the tooth of the wheel to prevent retrograde motion. As the ring D turns in one direction to operate the needles the lever p^3 and dog p yield under the pressure of the passing stud p^4 and turn idly on their axes; but as the ring carries the stud in the opposite direction it acts on the lever p^3 and forces it, together with the lever p' and dog p, backward to the left, so that the dog turns the wheel P forward one tooth.

In commencing the heeling and toeing operation the toggle m^5 is first depressed or straightened by hand to render the automatic depressing-cam and the flying cams inactive. At this time the stud of the cam-lever O bears on the innermost portion of the edge of the wheel P and the cam remains out of action. The cam-carrying ring D being now oscillated through the proper path, the automatic cam I acts to lift the needles one at a time. At each backward motion of the ring D the wheel P is advanced one step. This continues until the proper number of needles have been elevated, at which time the outermost portion of the wheel P will ride against the stud and force the cam-lever O forward into operative position. The ring D being properly turned, the cam lifts the toggle and releases the flying cams M M′, so that they rise to the operative position shown in Figs. 13 and 14. The oscillation of the cylinder being now continued, the flying cams bring the heels of the needles downward within the path of the automatic depressing-cam L, by which they are carried downward one at a time, as before explained. During this action the arms of the automatic lifting-cam pass to and fro beneath the cam o', which tips the cam I in a suitable manner to prevent its action on the needles. This operation continues, the wheel P still advancing, until the wheel again releases the lever O. The lever in moving backward operates a bar o^{10}, which will be suitably connected with shipping devices for throwing the driving-belt out of action and stopping the machine. These shipping devices may be of any ordinary or approved form. In Fig. 5 we have represented a simple arrangement for the purpose, in which o^{11} represents the ordinary reciprocating bar for shifting the driving-belt from the fast to the loose pulley of the machine. It is acted upon by a spring o^{12}, which tends to shift the belt to the loose pulley, and it is held in position to keep the belt on the fast pulley by a pivoted dog o^{13}, connected to the bar o^{10}. The parts are set in operative position by hand. When the cam-lever O retreats, it causes the rod o^{10} to disengage the dog o^{13} from the shipping device.

In order to facilitate the removal of the needle-cylinder and its needles from the machine when the needles are lifted out of action by the cam G, we propose to pivot cam H and its operating-lever to a supporting-plate g^6, hinged at g^7 to the ring D and secured in position by a spring-latch g^8, so that on releasing the latch the plate may be tipped backward in order to throw the cam and lever backward from the cylinder, in order that the needle-shanks may pass freely upward when the cylinder is lifted from the machine in the usual manner. As the needles are carried by the cam G to an extreme height, and as the needle-slots are continued upward in the

usual manner to permit the free removal of the needles, we find it advisable to provide means for preventing them from tipping outward at the upper ends when their heels are acted upon by the depressing-cam H. We therefore attach to the plate g^6 a second and overlying plate g^9, which bears against the needle-cylinder above the cam G and against the heels of the elevated needles, in order to hold the needles to their places in the grooves. Owing to the fact that its support g^6 is hinged, the plate g^9 may be turned backward therewith away from the needle-cylinder to a position outside of the needle-heels, so that when the cylinder or either of its needles is lifted vertically from the machine, as usual, the heels of the needles may pass upward without interference on the part of the plate g^9.

It is to be observed as a peculiarity of our machine that our rocking cams I and L are arranged to operate at their opposite ends alternately upon the needles, the action of the needles on one end of the cam causing the latter to move the needle to the required position and at the same time adjusting the opposite end of the cam in position to act upon another needle when the motion of the machine is reversed. By constructing each cam with two operating ends we are enabled to simplify the machine, to lessen the extent of the movement required on the part of the cam, and to secure a more satisfactory action.

We are aware that knitting-machines have been provided with pivoted latches for throwing the needles, one at a time, into or out of action, the latches being constructed to turn end for end, and arranged in some cases in such manner that it was necessary to employ two distinct latches for throwing the needles out of action and two distinct latches for throwing them into action, and in other cases arranged in such a manner that it was necessary to employ an external lever mechanism for the purpose of securing their action.

What we claim as our invention is—

1. In a cylinder knitting-machine, and in combination with the needle-cylinder, needles, and ring provided with needle-operating cams, as usual, the vertically-vibratile cam G, located below the usual path of the needle-heels and adapted to lift the needles above the reach of their operating-cams, the arm g', attached to cam G, the lever g^3, mounted upon the cam-ring and extended above the cylinder, the connecting-link g^2, and the spring g^5, whereby the cam may be conveniently adjusted and held during the rotation of the ring to lift the needles out of action, and automatically restored to its normal position when released.

2. In a cylinder knitting-machine, and in combination with the usual needle-cylinder, needles, cam-ring, and needle-operating cams thereon, the vertically-vibratile cam G, provided with arm g', its operating-link g^2, and the lever g^3, mounted on the cam-ring, with one end jointed to the link and the other end terminated in a cup-like form above the cylinder, whereby the cam may be conveniently held down by the end of the operator's finger during its travel with the cam-ring.

3. In combination with the cylinder, its needles, and the ring provided with needle-operating cams, as usual, the adjustable cam H, mounted on said ring above the needle-heels and adapted to depress them from an inactive to an active position, the spring for lifting and sustaining said cam, and the arm or finger-piece h', connected to the cam and extending above the cylinder, as shown, whereby the operator is enabled to conveniently control the cam H during its revolution with the ring, and the cam prevented from falling improperly across the path of the needle-heels.

4. In combination with the needles, the ring provided with the needle-operating cam, the grooved needle-cylinder, the supplemental cam H, to depress the needles from an inactive to an active position, and the plate g^9, movably mounted in position above the cam-ring and cam H, substantially as described and shown, whereby said plate g^9 is adapted to prevent the needles from tipping outward as their heels are depressed by the cam H, and also adapted to move out of its operative position to permit the lifting of the needles from the machine.

5. The needle-cylinder, its needles, and the ring provided with suitable needle-operating cams, as usual, in combination with the needle-lifting cam I, provided with the shoulders at opposite ends and centrally pivoted to admit of its ends being thrown alternately above and below the path of the active needle-heels, whereby the active needles are caused to change the position of the cam, and the latter caused to lift the needles one at a time to an inoperative position when the cylinder receives a reciprocating motion.

6. The needle-cylinder, needles, and the ring provided with the usual needle-operating cams, and the cam I, pivoted to said ring and provided at its two ends with shoulders to engage the needle-heels, and the spring i^4, to hold the cam in its two positions alternately.

7. In a knitting-machine, the cylinder, its needles, and the ring provided with cams to cause the usual knitting action of the needles, in combination with the automatic rocking cam I to lift the needles out of action, provided with arms i^9, and the stationary adjustable cam o', whereby the cam I may be prevented at will from lifting the needles.

8. In combination with the cylinder, its needles, and suitable needle-operating cams, as usual, the needle-depressing cam L, provided with shoulders at its opposite ends and centrally pivoted to admit of its ends being thrown alternately above and below the path of the inoperative needle-heels, whereby the inoperative needles are caused to change the po-

sition of the cam and the latter caused to carry the needles one at a time into action when the needle-cylinder is reciprocated.

9. In a knitting-machine, and in combination with the needles, the rocking needle-depressing cams L, the vertically-adjustable cams M M′, and the horizontally-adjustable cams N N′.

10. In combination with the intermediate shouldered rocking cam L, as shown, the two pivoted cams M M′, their lifting-springs, and the reciprocating bar m^3, having inclined surfaces to depress the cams M M′, whereby the cam L may be rendered active or inactive at will.

11. In a knitting-machine, and in combination with the rotary ring D and the cams M M′, mounted thereon, the reciprocating bar m^3, for locking the cams down, and the toggle to hold said bar.

12. In combination with the rotary ring D, cams M M′, their locking-bar, and the toggle to hold said bar and the stationary adjustable cam *o* to release said parts, as described.

13. In a knitting-machine, the cylinder, its needles, and the rotary ring D, provided with cams to effect the knitting action, as usual, in combination with the automatic rocking cam to depress the needles from an inactive to an active position, the cams M M′, their locking devices, the cam-arm O, to release said locking devices, the wheel to throw said cam into operative position, and a pawl actuated by the ring D to turn the wheel step by step.

14. The cylinder, its needles, and the ring provided with needle-operating cams, as usual, in combination with the rocking cam I, shouldered at its two ends to lift the needles individually out of action, the arms or projections i^8 and i^9, connected to said cam, the adjustable cam o', to prevent the action of the cam I, the rocking cam L, shouldered at its two ends to lower the needles individually into action, the cams M M′, whereby the cam L may be rendered inactive, and locking devices, substantially as shown, for controlling the position of the cams M M′, whereby the machine may be adjusted at will to perform automatically the operation of widening or narrowing the fabric.

In testimony whereof we hereunto set our hands, this 23d day of December, 1887, in the presence of two attesting witnesses.

ELIHU LIPPITT.
REINHOLD HANSDOERFER.

Witnesses:
MARGARET DURBAN,
FRANK A. DURBAN.