(No Model.) 6 Sheets—Sheet 1.

W. DIEBEL.

CIRCULAR KNITTING MACHINE.

No. 483,954. Patented Oct. 4, 1892.

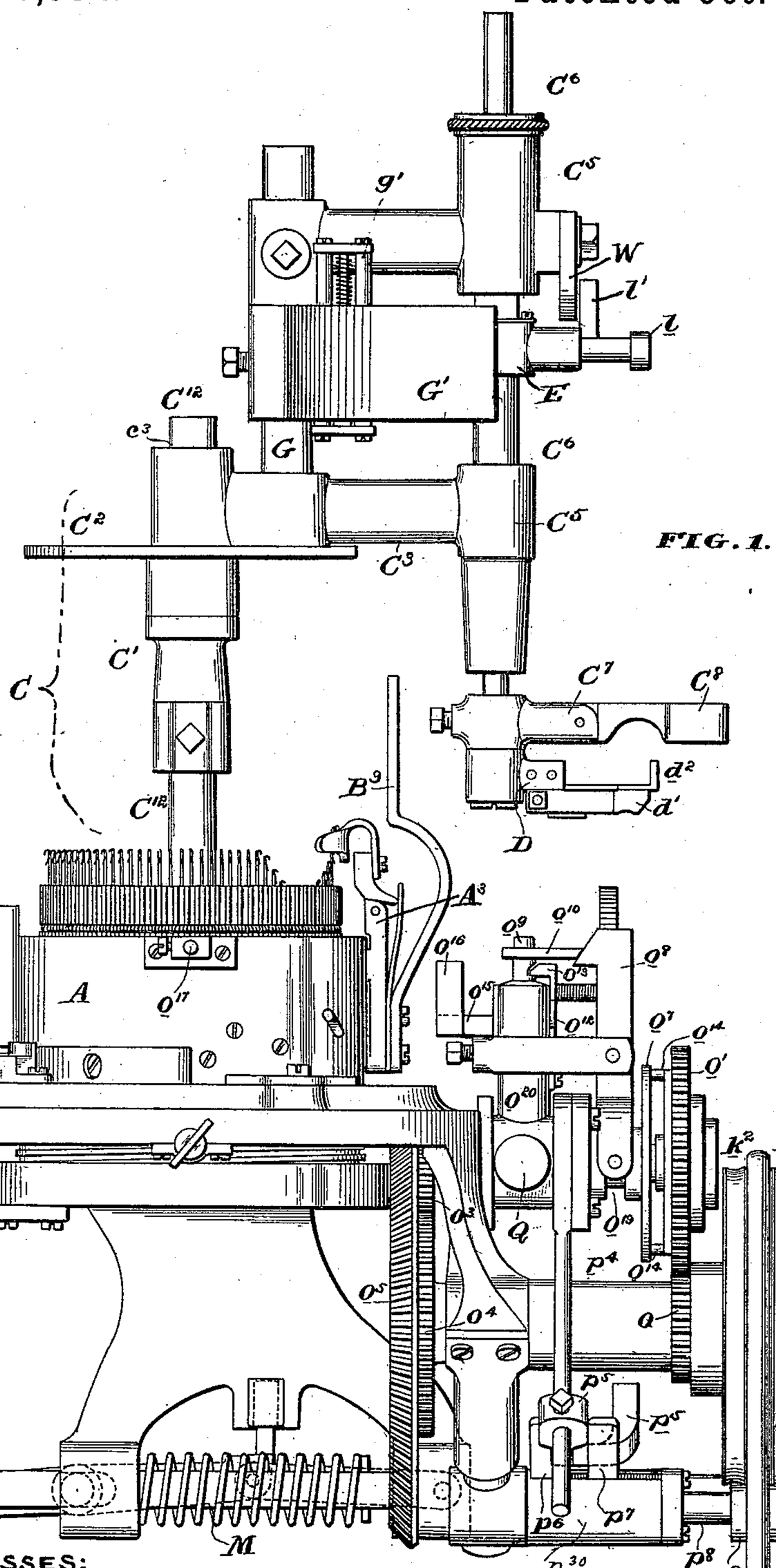

FIG. 1.

WITNESSES:
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Henry F. Dennig

INVENTOR:
William Diebel
by his atty
G. S. Harding

(No Model.) 6 Sheets—Sheet 2.

W. DIEBEL.

CIRCULAR KNITTING MACHINE.

No. 483,954. Patented Oct. 4, 1892.

FIG. 16.

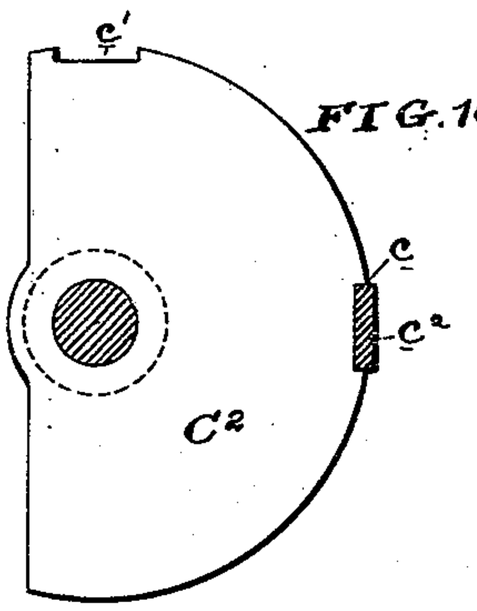

FIG. 2.

WITNESSES:
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Henry Drury

INVENTOR:
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G. H. Harding

(No Model.)

6 Sheets—Sheet 3.

W. DIEBEL.

CIRCULAR KNITTING MACHINE.

No. 483,954. Patented Oct. 4, 1892.

FIG. 3.

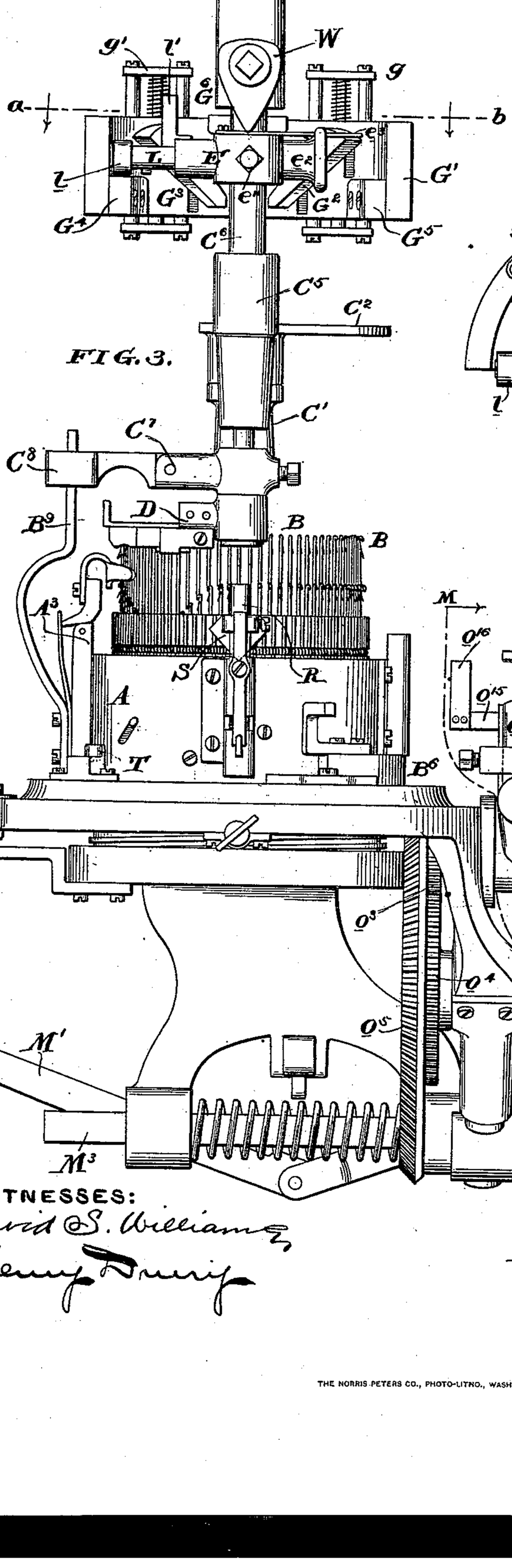
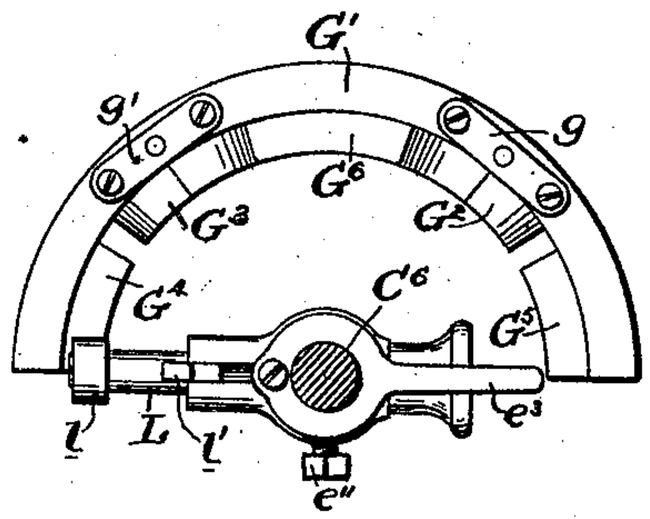


FIG. 4.



WITNESSES:
David S. Williams
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G. H. Sanders

(No Model.) 6 Sheets—Sheet 4.

W. DIEBEL.

CIRCULAR KNITTING MACHINE.

No. 483,954. Patented Oct. 4, 1892.

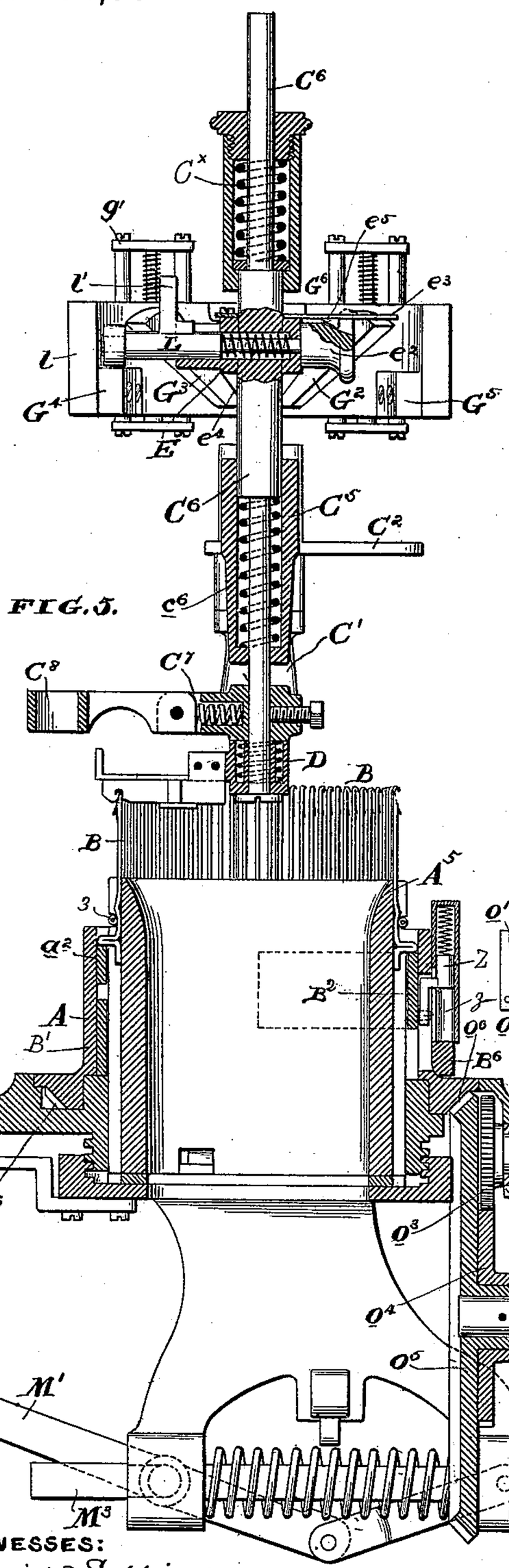

FIG. 5.

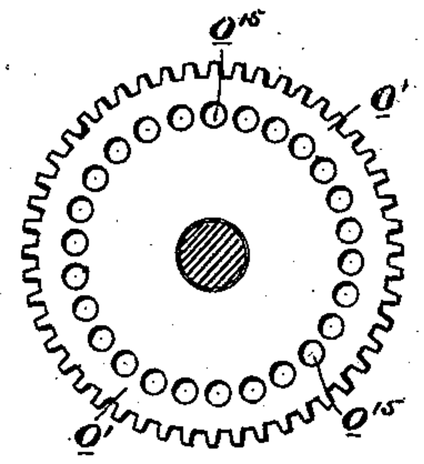

FIG. 6.

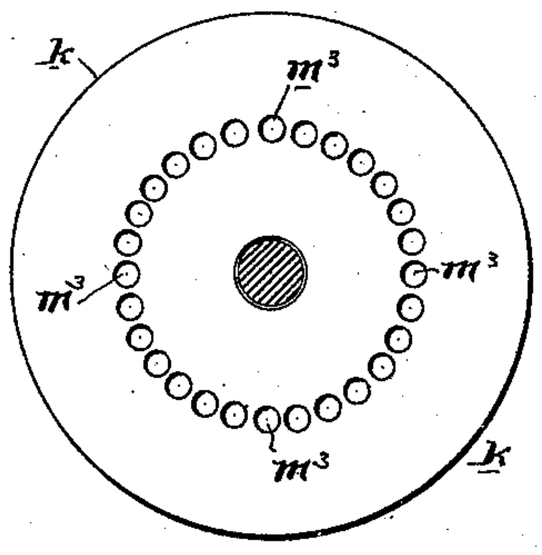

FIG. 7.

WITNESSES:
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Henry Dunning

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(No Model.)

6 Sheets—Sheet 5.

W. DIEBEL.

CIRCULAR KNITTING MACHINE.

No. 483,954. Patented Oct. 4, 1892.

FIG. 8.

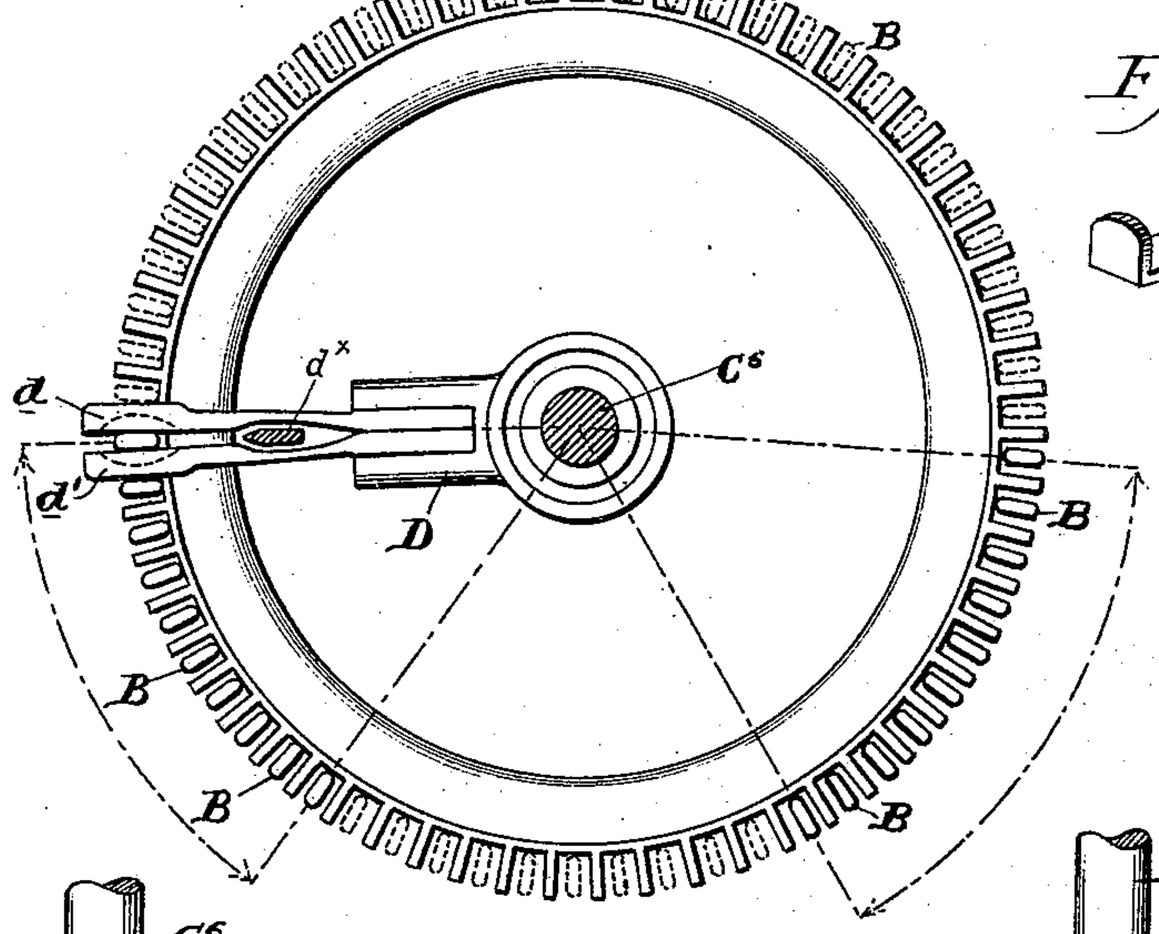


Fig. 8^a.

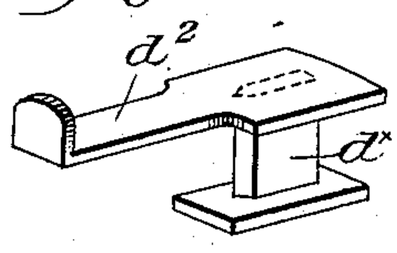


FIG. 9.

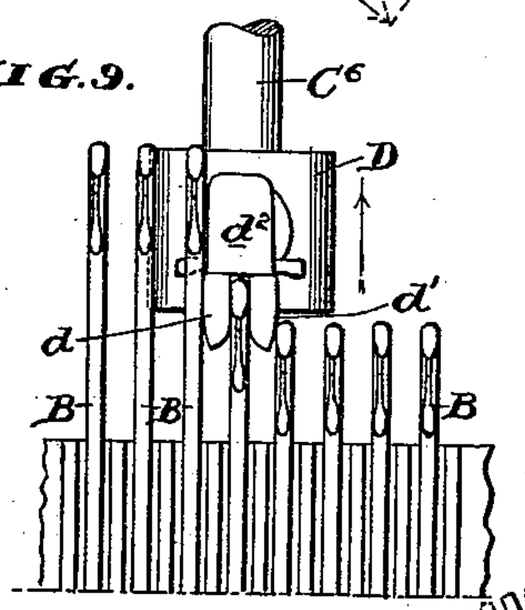


FIG. 10.

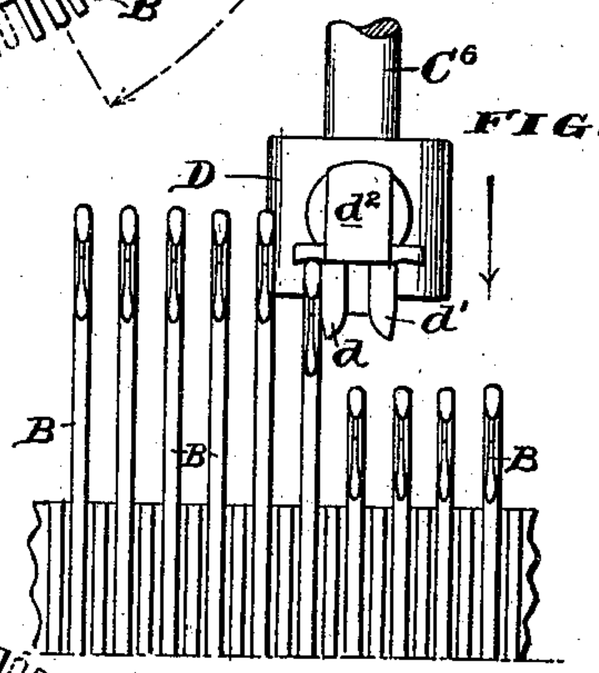
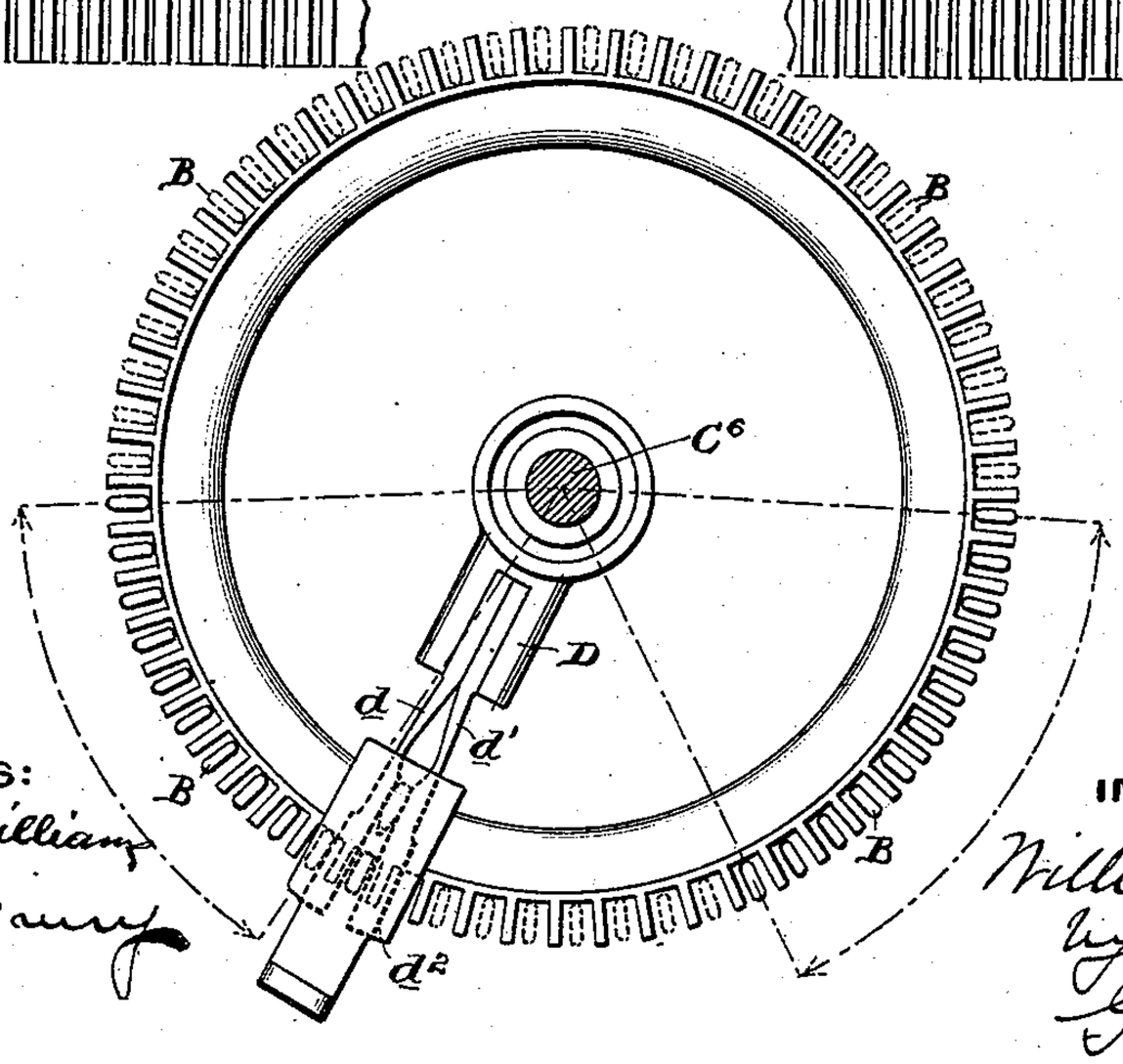


FIG. 11.



WITNESSES:

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(No Model.)

6 Sheets—Sheet 6.

W. DIEBEL.

CIRCULAR KNITTING MACHINE.

No. 483,954. Patented Oct. 4, 1892.

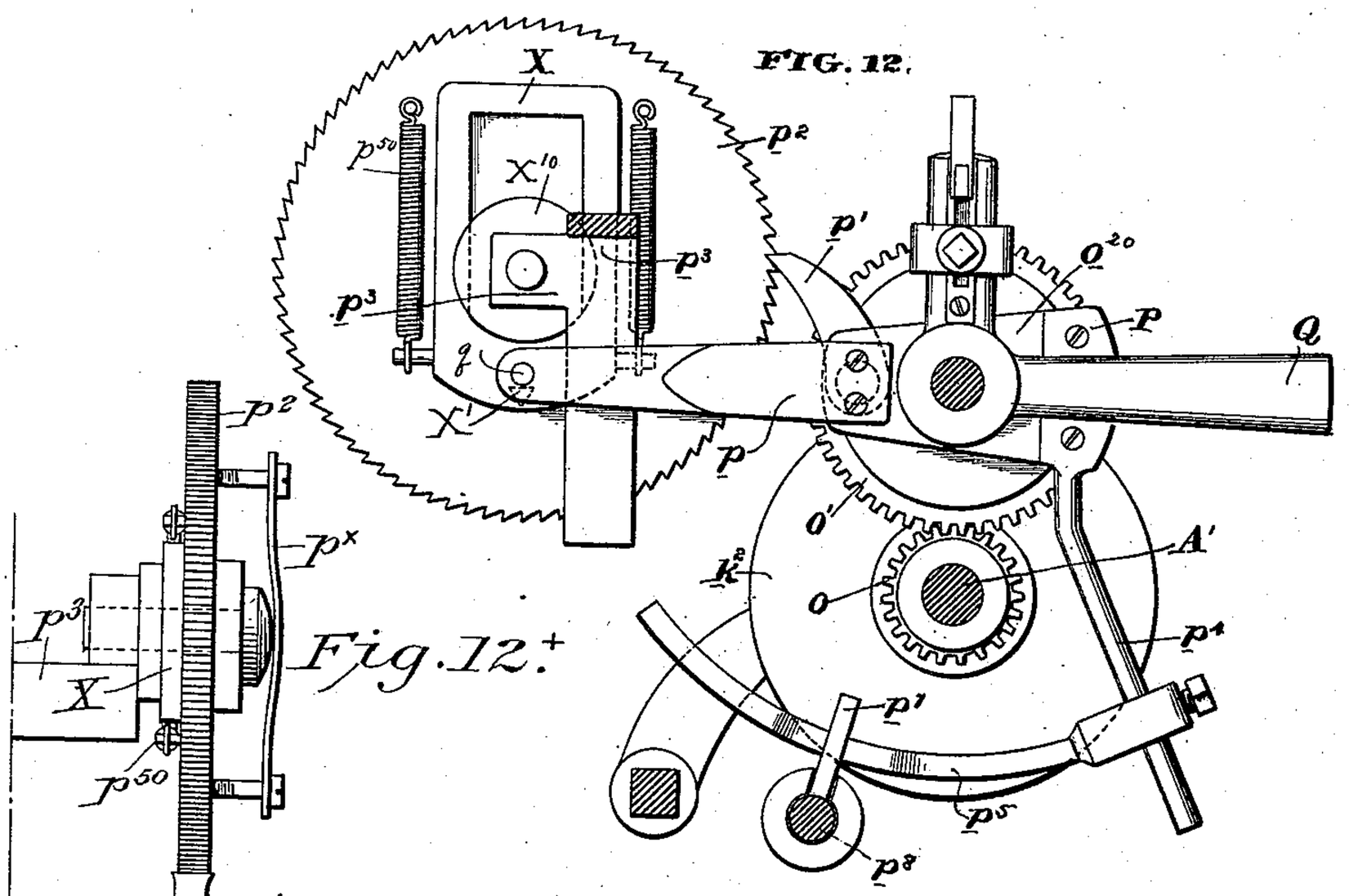


Fig. 12.

FIG. 13.

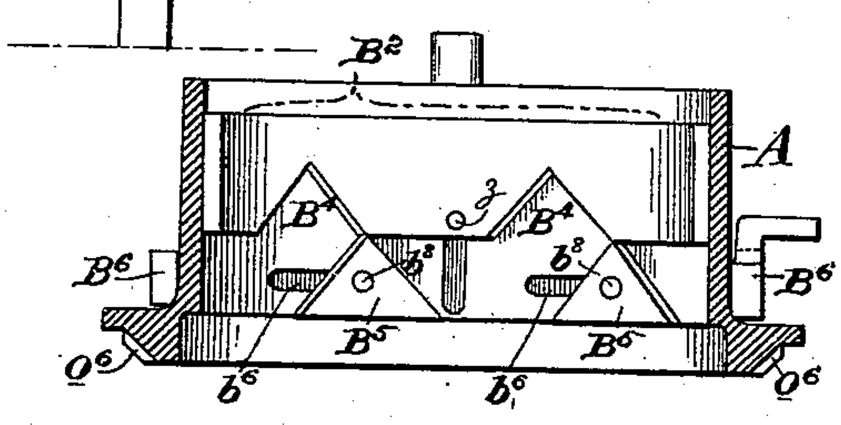


FIG. 14.

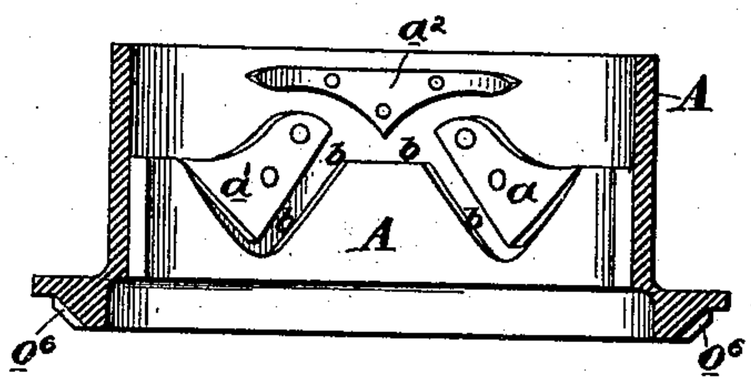
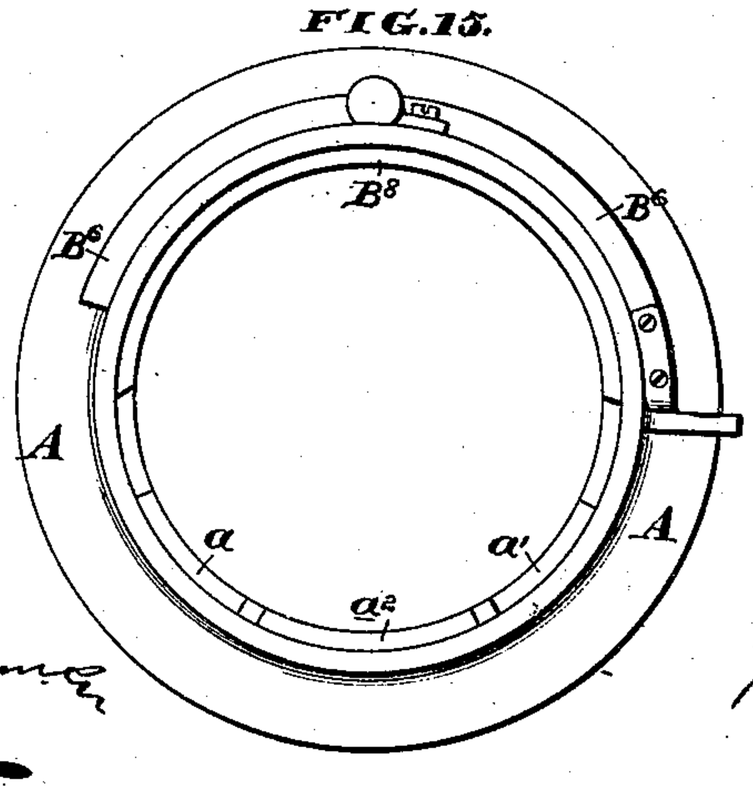


FIG. 15.



WITNESSES:
David S. Williamson
Henry Drury

INVENTOR:
William Diebel
by his atty
G. P. Harding

UNITED STATES PATENT OFFICE.

WILLIAM DIEBEL, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO FREDERICK BUCKHALTER AND VICTOR C. DRIESBACH.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 483,954, dated October 4, 1892.

Application filed August 29, 1889. Serial No. 322,352. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM DIEBEL, a citizen of the United States, and a resident of the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Circular-Knitting Machines, of which the following is a true and exact specification, due reference being had to the drawings which accompany and form part of this specification, and in which similar letters and figures denote similar parts.

My invention relates particularly to the class of knitting-machines upon which seamless goods are manufactured, or such a machine as is well known under the name of the "Branson knitter," and is particularly adapted to the purpose of enabling said machine to operate automatically at those points where only a portion of the needles are in operation—such, for instance, as where the heel or toe of the stocking is to be formed.

Heretofore in knitting-machines it was necessary when the heel was to be formed that a certain number of the needles should be elevated or thrown out of operation by hand—that is, each needle was elevated separately—and as the machine was operated at that point after each movement of the thread-carrier one of the needles was raised by hand, and after half the heel was formed it was necessary to depress the needles one by one. Again, when the toe was to be formed it was necessary to carry on the same operation by hand.

My improvement consists in arranging and combining those needles in the needle-cylinder which are necessary to be elevated and thrown out of action when the heel or toe is to be formed with suitable mechanism (to be hereinafter described) by which they may be simultaneously elevated by one movement of the hand.

My invention also consists in novel mechanism, adapted to be connected to the cam-cylinder, which will lift up one of the needles at each movement of the cam-cylinder when forming the heel or toe; and by readjusting said device it will push down a needle at each movement of the cam-cylinder or thread-carrier when the remainder of the heel and toe is to be formed.

My invention also consists in a novel arrangement of belts and pulleys and connections with the cam-cylinder, so that the cam-cylinder and thread-carrier are caused to reciprocate first in one direction and then in the other, thus alternately picking up or depressing, as the case may be, a needle at the extreme end of the travel in each direction.

My invention also consists in a novel adjustment by which the apparatus is automatically stopped when the desired number of needles have been elevated or depressed by the needle-picker. As was before stated, this invention in no way modifies the operation of the machine when it is used for full knitting—that is, when the entire number of the needles are in operation.

In the drawings, Figure 1 represents a front elevation of the machine with the needle-picking mechanism thrown out of operation. Fig. 2 is a side elevation of the same. Fig. 3 is a front elevation with needle-picking apparatus in operation. Fig. 4 is a sectional plan view on the line *a b*, Fig. 3. Fig. 5 is a front sectional view of the machine. Fig. 6 is a sectional view on the line *x x*, Fig. 3, showing face of pinion *o'* of clutch on shaft o^2. Fig. 7 is a section on the line *y y*, Fig. 3, showing face view of the wheel *k* on shaft *k'*. Fig. 8 is a diagrammatic view showing the operation of the jaws of the needle-picker when lifting the needles. Fig. 8^a is a detached perspective view of the plate d^2 and wedge-block $d^\times$. Fig. 9 is a detail showing the operation of lifting the needles. Fig. 10 is a detail showing the needle-picking device adjusted so that it will force the needle down. Fig. 11 is a diagrammatic view showing the operation of the needle-picking device when pushing the needles down. Fig. 12 is a sectional view on the line M M, Fig. 3, looking in the direction of the arrow. Fig. $12^\times$ is a detached perspective view of frame X, &c. Fig. 13 shows the needle-elevating cams. Fig. 14 shows the knitting-cams. Fig. 15 is a plan of the cam-cylinder. Fig. 16 is a sectional view on the line R R, Fig. 2.

A represents the cam-cylinder, which is provided with the knitting-cams *a a' a²*.

B B B are the needles, which rest in the needle-cylinder A^5, the butts of which are in

line with the cams a a' a^2. When the cam-cylinder A is revolved by the shaft A', driven by the pulley-wheel k, the thread-carrier A^3 is moved by the cam-cylinder upon which it is supported, and the cams a a' a^2 elevate the needles in order and then depress and again elevate them, the needles following the path b b, and thus forming the loop and stitch. This operation is the ordinary one of knitting and need not be more specifically described.

After the knitting has proceeded for a sufficient distance and it is desired to form the heel of a stocking in the ordinary operation one-half of the needles are elevated by hand, so as to be thrown out of operation, and then the machine operates as before, and at each reciprocation one fresh needle is elevated or thrown out of operation. My improved mechanism has for its object to perform this operation automatically. The needles rest upon the support B' in the cam-cylinder A. Within the cam-cylinder, extending half-way around the same, is the needle-elevating plate B^2, provided with the insets B^4, engaged by cams B^5. The object of making the elevating-plate B^2 extend half-way around the cam-cylinder is that when it is operated, as hereinafter described, one-half the needles will be elevated and thrown out of action. The spring-actuated plunger Z, secured to the lifting-plate B^2 by the pin z, holds the plate normally down. The cams B^5 are connected through the cam-cylinder A with the sliding bar B^6 by the pins b^8, said bar being upon the outside of the cam-cylinder and having a capacity to slide around said cam-cylinder for a certain distance, the distance being governed by the extent of the slots b^6 in the cam-cylinder, the pins b^8 striking the ends of the slots. When this bar is operated in one direction, the needle-elevating cam B^2 is brought into the position shown in Fig. 13, thereby elevating one-half of the needles. In operating the machine the cam-cylinder is brought to the position where the thread-carrier is directly in front of the machine, and then this bar B^6 is operated, lifting one-half of the needles.

C indicates part of the frame for the needle-picking apparatus or attachment and is supported by the upright rod C^{12}. Secured upon this rod is the bracket C', above which is the frame or plate C^2, having the notches or detents c c'. The needle-picking apparatus is supported by the bracket C^3, which is a part of the frame or plate C^2, journaled on the rod C^{12}, so that the plate and bracket C^3 can be swung away from the cam-cylinder or brought into such a position that it can be connected with the cam-cylinder, as will hereinafter be described, so that it can be operated. The plate and bracket are held in their different positions by the spring-arm c^2, connected to the bracket C', which enters either the detents c or c', dependent upon the position of the attachment. This needle-picking attachment consists of the bracket C^3, having at its outer end the lower guide C^5. An upper guide C^5 is supported at the outer end of a bracket carried by the rod G above the frame G'. Within these guides is supported a spring-seated plunger C^6, provided with the lower spring c^6 and the upper spring $c^\times$, these springs being coiled around said plunger, as shown in Fig. 5. The spring c^6 is for the purpose of returning the plunger when it is forced down by the cams G^2 G^3, as hereinafter described, and the spring $c^\times$ is for the purpose of acting as a cushion or buffer when the plunger is returned. Rigidly secured to the lower end of the plunger is the arm C^7, to which is hinged the connecting-arm C^8, so as to enable it to be engaged and disengaged with the projecting arm B^9. Beneath this connecting-arm and loosely journaled upon the plunger is the needle-picker D, which consists of two jaws d and d' and the plate d^2. This plate d^2 rests upon the upper surface of the jaws d d' and has projecting from it the wedge-shaped piece $d^\times$, which passes between the jaws d d' and has its lower end flared out, as shown in Fig. 8^a, which prevents the plate d^2 from being removed from the surface of the jaws, the projection between the jaws being for the purpose of separating the jaws, so that they become inactive, and of allowing the plate to come into action, the jaws being sufficiently flexible to allow the movement of the wedge. When the plate is in the position shown in Fig. 9, the jaws are closed, so as to form a narrow opening, while when drawn out into the position shown in Figs. 10 and 11 the jaws are open and the plate projects at the side of and beyond said jaws. At the upper end and attached to said plunger C^6 is the hollow arm E, said arm E being connected to said plunger C^6 by the set-bolt e^{11}, so that it is rigidly attached to said plunger. Within the hollow arm E is the cam-rod L, carrying at one end the roller l and projection l' and at the other end the thumb-piece e^2 and leaf-spring e^3. The cam-rod is acted upon by the spring e^4, and the rod is held in its inner position by the projection e^5 on the leaf-spring e^3, which catches the knob e^2, and upon releasing this leaf-spring the plunger and knob will move forward until the knob strikes the end of the arm E, as shown in Fig. 5. Attached to the rod G, which extends from the bracket C^3, is the cam-frame G'. Attached to this frame G' are the spring-seated guides g and g', said guides being spring-seated rods. They are spring-seated, so as to give in one movement of the plunger C^6, and connected to these guides in the interior of this cam-support are the cams G^2 and G^3. The cams G^2 and G^3 are supported in spring-seated guides, so that on the return movement of the plunger C^6 said plunger can depress and pass by said cams. Upon the interior of said frame G' are the outer buffers G^4 G^5 and the intermediate buffer G^6. When the plunger C^6 is moving in one direction, the roller strikes the under face of the cams, which depresses the plunger, while in its

movement in the other direction it strikes the upper face of the cams, forcing the cams down with or in the spring-seated guides *g g'*, allowing the plunger to pass by said cams. In the interior of the frame G' are the slots 1 and 2, through which pass the pins 3 3 and 4 4, (two for each cam,) said pins being fastened to the guide-rods 5 5 and 6 6.

A' is the main shaft of the machine. Connected with this shaft are three pulleys or wheels k k' k^2, which normally run idle upon the shaft A'. Connected with the pulley k is the belt k^3 from the source of power. Connected with the pulley k^2 is a cross-belt k^4, connected, also, with the source of power. When the machine is operating in the ordinary manner—that is, when the needle-cylinder is being revolved in one direction only—the shaft A' is thrown into gear with the driving-pulley k by means of the clutch member M, which is operated by the hand-lever M'. This clutch member is operated by the forked rod M^2, the collar of the clutch resting in the forks of the rod. Connected to the forked rod M^2 is the spring-actuated rod M^3, which is in turn connected to hand-lever M' by toggle-joint mechanism. The forked rod M^2 forces the projections m' and m^2 in the clutch member into the orifices m^3 in the pulley. The pulley then rotates the shaft through the medium of the clutch member.

When it is desired to operate the needle picker or depressor, the operation is as follows: The cam-cylinder is rotated until the thread-carrier A^3 is at the front of the machine. The needle-picking mechanism is then swung to the front of the machine and the arm C^7 is connected with the projecting arm B^9 on the cam-cylinder, and the needle-picker is brought to the front of the machine. The elevating-rod B^6 is then operated and one-half the needles elevated and thrown out of operation. The needle-picker is brought into the position shown in Figs. 8 and 9, and the cam-cylinder is caused to reciprocate in the following manner: The pulley k' has a sleeve O upon the shaft A', which has at its end the gear o, which gears into the wheel o', which runs loosely on the shaft o^2. On the other end of this shaft is the gear-wheel o^3, which gears in the wheel o^4 on the main driving-shaft. Connected to the end of the main driving-shaft is the bevel-gear o^5, which works in the gear o^6 on the cam-cylinder. On the shaft o^2 is the clutch member o^7, which is brought into engagement with the gear-wheel o' by means of the spring-actuated arm o^8, which has the end bifurcated and embracing the clutch member. This clutch member is normally held out of engagement with the wheel o' by means of the spring-actuated plunger o^9, which has the arm o^{10}, resting against the arm and holding the clutch member out of engagement. When the plunger o^9 is released by means of the operator pressing on the part o^{12}, pulling the stop o^{13} out of connection with the plunger, the plunger rises, which releases the arm o^8, and it is moved forward by the spring o^{30}, one end of which is secured to the arm o^8, the other to the bracket o^{20}, pushing the clutch o^7 forward, and the projections o^{14}, &c., of the clutch member enter the orifices o^{15} in the gear-wheel o'. The ends of the arm o^8 travel in a slot o^{19} in the projection from the clutch member, and the lever o^8 and the plunger o^9 and its mechanism are carried upon the bracket o^{20}. Projecting from the plunger o^9 is the arm o^{15}, having the projecting lug o^{16}. This projecting lug o^{16} when the clutch is in operation is in the line of travel of the projection o^{17} upon the cam-cylinder, but is out of the line when the clutch is out of action. Connected to the bracket o^{20}, upon which the clutch-actuating mechanism is mounted upon the shaft o^2, is the plate P, which plate has an arm p connected to it, and upon said arm is pivoted the pawl p', which works in the toothed wheel p^2, which is journaled upon the projection p^3 from the main frame of the machine. On the other end of the plate P is the arm p^4, having connected to it the bent rod p^5, which bent rod rests at or near its outer end between two dogs p^6 and p^7, and the rod p^5 is so bent, as shown, that in its movement it will cause the dogs to travel longitudinally, said dogs being connected to the plunger p^8, supported in the sleeve p^{30}, secured to the frame of the machine. At the outer end of the plunger p^8 is the belt-shifting arm p^9, which projects to the back of the machine and has a bifurcated end p^{10} p^{11}. Also connected to this plunger is the belt-shifting arm p^{12}, which projects to the front of the machine and has the bifurcated end p^{13} p^{14}. When the plate P is vibrated, it causes the plunger to travel forward and backward and the two arms, with their bifurcated ends, follow the plunger. These arms are in connection with the belts, so that the belts which normally run on the pulleys k' k^2 are shifted by the movement of the plate and forced alternately upon the pulley k', the arm p^{12} shifting the belt k^3, which normally runs on the pulley k, while the arm p^9 shifts the belt k^4, which normally runs on the pulley k^2. Now the operation being to form the heel of the stocking, the needle-picker slide d^2 is brought into the position shown in Figs. 8 and 9, the needle-picking mechanism being connected to the projection B^9 on the cam-cylinder. The spring-actuated arm o^8 is then operated and the clutch member o^7 thrown into connection with the gear-wheel o', which will cause the pulley k' to revolve the cam-cylinder by the intermediate mechanism before described, and the arm Q is pushed down or up, which through the medium of the arms heretofore spoken of shifts one of the belts from the idle-pulleys k k^2 onto the active pulley k'. This causes the pulley k', to revolve and it revolves with it the cam-cylinder. The cylinder is caused to revolve first in one direction and then in the other by means of the lug o^{17} on the cam-cylinder striking the projecting lug o^{16}, con-

nected with the plunger o^9, which causes the bracket o^{20} to rock and with it the rod p^5, thus actuating plunger p^8, which through the shifting-arms p^9 and p^{12} shifts the belts, according, to which side of the lug on the rocking frame is struck by the lug on the cam-cylinder, thus shifting alternately the straight and cross belt onto the active pulley, causing said pulley to rotate, and through the intermediate connecting mechanism, the cam-cylinder first in one direction and then in the other.

Referring to Figs. 8 and 9, and supposing that the lever Q be operated so that the cam-cylinder is caused to revolve initially from left to right, the plunger C^6 of the needle-picking mechanism, being connected to the cam-cylinder by means hereinbefore described, is caused to rotate with said cylinder, and the needle-picker D is stopped in its movement by striking the first needle which is left up, while the plunger C^6 continues its rotary movement until the roller l at the end of the cam-rod L passes under the cam G^2, which causes the plunger to be depressed. This depression of the plunger C^6 causes the needle-picking jaws d' d^2 to descend a distance sufficient to grasp the first needle which is down, at which time the roller l will have reached the end of the cam G^2 and the roller will slide beyond the end of the cam and the lower spring in the plunger will cause it to rise to the buffer G^6, lifting with it the needle-picker D and elevating the needle between the jaws. At this point the projection o^{17} on the cam-cylinder strikes the projection o^{16} on the plunger o^9, shifting the belts as hereinbefore described, which causes the reverse belt to rest upon the active pulley, while the other belt is shifted off of said pulley. This causes the cam-cylinder to rotate in the opposite direction, which causes the roller l to travel upon the upper surface of the cam G^2, lifting the plunger and with it the needle-picker free from the needle, the cam G^2 yielding in the movement on account of the spring-seated frame g'. When the pulley slides off the upper end of the cam it strikes the buffer G^5, which prevents the plunger dropping too far or any shock. The cylinder continues its rotation in the same direction until the roller l strikes the other cam G^2, where the operation is repeated, the plunger being caused to descend until the jaws of the needle-picker grasp the needle, when the roller passes off of the cam, at which time the projection o^{17} on the cam-cylinder strikes the lug o^{16} on the plunger o^9, reversing the belts, causing the cylinder to revolve in the other direction and the roller riding up on the top of the cam G^3 and releasing the needle from the jaws. The mechanism by which the number of needles elevated by this apparatus or device, which is generally two-thirds of the number of needles elevated by the rod B^6, is limited, as follows: The pawl p', as heretofore described, works in the toothed wheel p^2, and each time the projection on the cam-cylinder strikes the projection on the plunger, as described, the bracket o^{20}, to which the pawl is connected, is caused to vibrate, and this causes the pawl alternately to push the wheel p^2 forward one tooth and to be released from it and carried back to the next tooth, the wheel being prevented from rotating in the opposite direction when the pawl is released by reason of the spring $p^\times$, which is secured to the back of the ratchet-wheel so as to press upon the shaft of said wheel, as shown in Fig. $12^\times$. The number of teeth in the wheel p^2 depends on the number of needles in operation. X is a frame on the back of said wheel p^2.

p^{50} are springs, one end of said springs being secured to the wheel p^2, the other end of said springs to the frame X, as shown in Fig. 12, thus making the frame X a spring-seated frame. On the back of this wheel p^2 is the lug X', said frame sliding between the wheel p^2 and collar X^{10}. At the end of the arm p, which is connected to the bracket o^{20}, is the connecting-pin q. The arm p rocks when the bracket o^{20} is rocked by the projection o^{17}, striking the lug o^{16} on the plunger o^9, thus turning the wheel p^2 until the lug X' is in the path of movement of the arm p, when the pin q strikes it on its downward movement, depressing the frame X. When the cam-cylinder starts to reverse, the frame lifts the rocking frame up a distance sufficient to bring it to a central position, and the belts k^3 and k^4 are transferred to the idle-pulleys k k^2, and the machine is stopped until the lever Q is operated to move the wheel p^2 forward and the lug X' out of connection with the pin q, which shifts one of the belts upon the active pulley k'.

When the number of needles have been thrown out of action, as hereinbefore described, the remainder of the heel is formed as follows: The needle-slide d^2 is pulled out, Figs. 10 and 11, opening the jaws d and d', bringing the projecting plate d^2 on each side of the frame forward. The cam-rod L is also pulled in, which brings the roller l at the end of said rod in its movement out of the line of the cams G^2 G^3. Upon the cam-rod L is the lug l', which when said rod is brought into the position just described is brought in line with the pear-shaped cam W, which is secured to the upper guide C^5 of the machine. The lever Q is then operated to move the lug X' out of connection with the pin q, shifting one of the belts upon the active pulley, and the machine continues to operate, as before described, first to the right and then to the left, the needle-picker striking the first needle that is up, and when the lug l' strikes the cam W it is forced down, forcing the plunger C^6 down, which pushes the slide d^2 with it, forcing the needle down until the lug l' has reached the lowermost portion of the cam, when the lug o^{17} on the cam-cylinder strikes the projection on the plunger o^9, causing the machine to reverse, and the same operation is carried on with the needle on the opposite

side of the needle-cylinder. The duration of this operation is limited in the same manner as was hereinbefore described in reference to limiting the number of needles to be thrown out of action in the formation of the heel. When it is desired to return the needles which have been lifted up by the lifting-plate B^2 into their normal position, the plunger R in the guide r, secured to the cam-cylinder, is pushed down, which forces the depressor S, attached to said plunger, down within the cylinder, so that its line of travel is within the cam-cylinder, so that it runs along the projecting shanks of the needles B, forcing them down into their normal position and in the path of the cams a a' a^2. This plunger R is held down by means of the leaf-spring r', which has the projection r^2, which rests in the detent r^3 in the plunger when the plunger is down. When this plunger R reaches the point where the projection T is on the frame of the machine, said projection being in the path of the spring r', said projection T strikes the lower end of the leaf-spring r', forcing the projection p^2 out of engagement with the detent r^3, and the plunger R, by the spring r^8, against which the plunger is forced down, forces the plunger up, carrying with it the depressor S, which is prevented from rising too far by the overhanging lip t^3 on the leaf-spring, the projection T being in such position on the frame of the machine that it is opposite to the needles elevated by the plate B^2 and is in front of the needles not acted upon by said plate B^2.

In forming the toe the operation is the same as that described for the heel.

The operation of the entire machine is as follows: In making first the leg of the stocking the automatic needle-picking mechanism is thrown out of action, as shown in Figs. 1 and 2. The clutch member M is operated, which throws the shaft A′ into connection with the pulley k, causing the straight belt, which normally rests on said pulley, to rotate the shaft and through the medium of the bevel-gear o^5 the cam-cylinder, carrying with it the thread-carrier, the cams within the cylinder causing the needles to be alternately elevated and depressed, making the looped stitch by means of the butts of the needles passing through the cams, as heretofore described. This continues until sufficient of the leg has been formed. When the heel portion is reached, the needle-picking mechanism is shifted to the front of the machine, as heretofore described, the clutch-member which brought the idle pulley k into connection with the shaft A′ is released, and the needle-picking mechanism is connected to the cam-cylinder, as hereinbefore described. The cam-cylinder is then revolved until the thread-carrier is in front of the machine, when the lifting-rod B^6 is operated, which elevates through the medium of the lifting-cams B^5 B^8, as heretofore described, half of the needles, throwing them out of the action of the cams a a' a^2. These needles are held up by means of the usual spring 3, which surrounds the entire number of needles in the cylinder and rests against their butts. The cam-rod L is brought into the position which throws the roller l of said rod in the path of the cams G^2 G^3. The clutch member o^7 is then connected with the gear o', which causes the shaft o^2 to be connected with the gear-wheel o', and by shifting the lever Q one of the belts is thrown upon the pulley k', which is in connection with the gear-wheel o'. The cam-cylinder is then rotated first in one direction until the jaws of the needle-picker strike and elevate one of the needles. The lug o^{17} on the cam-cylinder then strikes the lug on the plunger o^9, shifting the reverse belt onto the active pulley k' and causing the cam-cylinder to revolve in the opposite direction, in which direction it revolves until the needle on the opposite side of the needle-cylinder has been elevated by the needle-picker. This operation continues until two-thirds of the needles have been picked up, when the machine is stopped, as before described. The cam-rod L is then pulled in so that the roller l will not be in the line of travel in such position that it will strike the cams G^2 G^3. The needle-slide is also pulled out so that the jaws d d' are open, and the projecting plate d^2 is brought in position. The machine is then started in the same manner as before described, the only difference being that in place of the needle-picking device elevating the needles they are forced down alternately on each side of the cylinder, and this continues until the proper number of needles is depressed, which is automatically determined, as before described. The picking mechanism is then moved out of connection with the thread-carrier, and the needles remaining up are depressed into the path of the cams, as before described, and the foot is formed in the same manner as the leg. The toe portion is formed in the same manner as the heel.

By my improvement I am thus enabled to automatically knit the entire stocking without it being necessary to elevate the needles by hand or govern the rotation of the needle-cylinder.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In a circular-knitting machine, in combination, the needle-cylinder, needles resting in said needle-cylinder, a cam-cylinder, a needle-elevating plate within said cam-cylinder extending over a portion of said needle-cylinder, a needle-elevating cam adapted to elevate said elevating-plate and lift a portion of the needles out of action, and means, substantially as described, to operate said elevating-cam, whereby when said cam is operated a portion of said needles are elevated out of action.

2. In a circular-knitting machine, in combination, a needle-cylinder, needles supported

within said needle-cylinder, a cam-cylinder, an elevating-plate within said cam-cylinder extending over one-half of said needle-cylinder, a needle-elevating cam to elevate said plate, a sliding bar outside of said cam-cylinder, connections between the needle-elevating cam and said sliding bar through the cam-cylinder, whereby when said bar is moved the plate elevates the needles out of action.

3. In a circular-knitting machine, in combination, the needle-cylinder, needles supported within said needle-cylinder, a cam-cylinder, a needle-elevating plate within said cam-cylinder, a needle-elevating cam adapted to elevate said elevating-plate, a sliding bar outside of said cam-cylinder, and a pin upon the needle-elevating cam, which connects said needle-elevating cam with the sliding bar, and a slot in the cam-cylinder, in which slot the pin is adapted to move.

4. In a circular-knitting machine, in combination, a needle-cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, and mechanism, substantially as described, to rotate said cam-cylinder first in one direction and then in the other.

5. In a circular-knitting machine, in combination, a needle-cylinder, needles supported within said needle-cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to said pulley k' upon the main shaft, a gear upon the end of said sleeve, intermediate mechanism, substantially as described, between said gear-wheel and the cam-cylinder, a straight belt on the pulley k, and a cross-belt on the pulley k^2, and means, substantially as described, to shift said belts on and off the pulley k', whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

6. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a clutch member upon the said shaft, means, substantially as described, to operate said clutch member, and connections between the shaft o^2 and cam-cylinder, a straight belt on the pulley k, and a cross-belt on the pulley k^2, and means, substantially as described, to shift the belts automatically off and on said pulley k', whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

7. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a clutch member upon the said shaft, means, substantially as described, to operate said clutch member, a gear-wheel O^3 on the other end of the shaft o^2, a gear-wheel O^4 on the main driving-shaft, a bevel-gear on the end of said shaft, a gear on the cam-cylinder in which said gear works, a straight belt on pulley k, and a cross-belt on pulley k^2, and means, substantially as described, to automatically shift said belts on and off the pulley k', whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

8. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 on said shaft, a straight belt on pulley k, a cross-belt on pulley k^2, a sleeve connected to the pulley k', a gear-wheel on said sleeve, intermediate mechanism, substantially as described, between the gear-wheel and cam-cylinder, including a bracket o^{20}, sleeved upon the shaft o^2, an arm p^4, connected to said bracket, belt-shifting arms p^9 and p^{12}, provided with bifurcated ends, the belts running on pulleys k and k^2 being inclosed by said ends of arms p^9 and p^{12}, and intermediate mechanism between the arms p^9 and p^{12} and the arm p^4, whereby when the bracket is vibrated the arms p^9 and p^{12} are operated and the belts shifted on or off the active pulley and the cam-cylinder caused to rotate first in one direction and then in the other.

9. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 on said shaft, a straight belt on pulley k, a cross-belt on pulley k^2, a sleeve connected to the pulley, a gear-wheel on said sleeve, intermediate mechanism, substantially as described, between the gear-wheel and cam-cylinder, including a bracket o^{20}, sleeved upon the shaft o^2, and a projection o^{17} on the cam-cylinder, and a projection o^{16}, connected to the bracket o^{20}, an arm p^4, connected to said bracket, belt-shifting arms p^9 and p^{12}, provided with bifurcated ends, the belts running on pulleys k and k^2 being inclosed by said ends of arms p^9 and p^{12}, and intermediate mechanism between the arms p^9 and p^{12} and the arm p^4, whereby the cam-cylinder in its rotation automatically shifts the belts on and off the active pulley and the cam-cylinder caused to vibrate first in one direction and then in the other.

10. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected

with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a bracket o^{20} upon said shaft o^2, a clutch member upon said shaft, gearing between the shaft o^2 and cam-cylinder, a straight belt on the pulley k, and a cross-belt on the pulley k^2, a lever o^8 for said clutch member, a spring-actuated plunger o^9, an arm o^{10} of said plunger, which normally rests against lever o^8 and holds said clutch member out of engagement, a projecting lug o^{16}, connected to the plunger o^9, and a projection o^{17} on the cam-cylinder, said projecting lug o^{16} being in the path of movement of the projection o^{17} on the cam-cylinder when the clutch member is in engagement, a stop o^{13}, normally in connection with said plunger o^9, and connections, substantially as described, between said bracket o^{20} and the said belts.

11. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a bracket o^{20}, sleeved upon said shaft o^2, an arm p^4, connected to said bracket, arms p^9 and p^{12}, provided with bifurcated ends, the belts surrounding the pulleys k k^2 being inclosed by said ends of arms p^9 and p^{12}, connections, substantially as described, between the arm p^4, and arms p^9 and p^{12}, a clutch member upon said shaft o^2, a straight belt on the pulley k, and a cross-belt on the pulley k^2, a lever o^8, a spring-actuated plunger o^9, an arm o^{10} of said plunger, which normally rests against said lever o^8 and holds said clutch member out of engagement, a projecting lug o^{16}, connected to the plunger o^9, and a projection o^{17} on the cam-cylinder, said projecting lug o^{16} being in the path of movement of the projection o^{17} on the cam-cylinder when the clutch is in engagement, a stop o^{13}, normally in engagement with said plunger o^9, a gear-wheel o^3 on the other end of said shaft o^2, a gear-wheel o^4 on the shaft A′, a bevel-gear o^5 on said shaft A′, and a gear o^6 on the cam-cylinder, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

12. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a clutch member upon said shaft, gearing between the shaft o^2 and cam-cylinder, a straight belt on the pulley k, and a cross-belt on the pulley k^2, the lever o^8 for said clutch member, a spring-actuated plunger o^9, and arm o^{10} of said plunger, which normally rests against said lever o^8 and holds said clutch member out of engagement, a projecting lug o^{16}, connected to the plunger o^9, and a projection o^{17} on the cam-cylinder, said projecting lug o^{16} being in the path of movement of projection o^{17} on the cam-cylinder when the clutch is in engagement, a stop o^{13}, normally in connection with said plunger o^9, a bracket o^{20}, sleeved upon said shaft o^2, a lever p^4, connected to said bracket, belt-shifting arms p^9 and p^{12}, provided with ends which engage the straight and cross belts, and intermediate connections between the arms p^9 and p^{12} and the lever p^4, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

13. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 on said shaft, a straight belt on pulley k, a cross-belt on pulley k^2, a sleeve connected to the pulley k', a gear-wheel on said sleeve, intermediate mechanism, substantially as described, between the gear-wheel and cam-cylinder, including a bracket o^{20}, mounted upon the shaft o^2, a plate P, attached to said bracket, an arm p^4, attached to said plate, a bent arm p^5, a plunger p^8, dogs p^6 and p^7, connected to said plunger p^8, between which said bent arm rests, belt-shifting arms p^9 and p^{12}, connected to said plunger, said arms being provided with bifurcated ends which engage the straight and cross belts, and gearing between the cam-cylinder and the shaft o^2, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

14. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k, a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a clutch member upon said shaft, gearing between the shaft o^2 and cam-cylinder, a straight belt on the pulley k, and a cross-belt on the pulley k^2, a lever o^8, connected to said clutch member, a spring-actuated plunger o^9, an arm o^{10} of said plunger, which normally rests against said lever o^8 and holds said clutch member out of engagement, a projecting lug o^{16}, connected to the plunger o^9, and a projection o^{17} on the cam-cylinder, said projecting lug o^{16} being in the path of movement of projection o^{17} on the cam-cylinder when the clutch is in engagement, a stop o^{13}, normally in connection with said plunger o^9, a bracket o^{20}, adapted to vibrate, a plate P, attached to said bracket, an arm p^4, attached

to said plate, a bent arm p^5, a plunger p^8, dogs p^6 and p^7, connected to said plunger p^8, between which said bent arm rests, and belt-shifting arms p^9 and p^{12}, connected to said plunger, said arms being provided with bifurcated ends which engage the straight and cross belts, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

15. In combination, a needle-cylinder, needles supported within said needle-cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys $k\,k'\,k^2$ upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel, which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a clutch upon said shaft, a straight belt on the pulley k, and a cross-belt on the pulley k^2, a lever o^8, a spring-actuated plunger o^9, an arm o^{10} of said plunger, which normally rests against said lever o^8 and holds said clutch member out of engagement, a projecting lug o^{16}, connected to the plunger o^9, and a projection o^{17} on the cam-cylinder, said projecting lug o^{16} being in the path of movement of projection o^{17} on cam-cylinder when the clutch is in engagement, a stop o^{13}, normally in connection with said plunger o^9, a bracket o^{20}, mounted upon said shaft o^2, a plate P, attached to said bracket, an arm p^4, attached to said plate, a bent arm p^5, a plunger p^8, dogs p^6 and p^7, connected to said plunger p^8, between which said bent arm rests, belt-shifting arms p^9 and p^{12}, connected to said plunger, said arms being provided with bifurcated ends which engage the straight and cross belts, a gear-wheel on the other end of said shaft o^2, a gear-wheel o^4 on the shaft A', a bevel-gear o^5 on said shaft A', and a gear o^6 on the cam-cylinder, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

16. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys $k\,k'\,k^2$ on said shaft, a straight belt on pulley k, a cross-belt on pulley k^2, a sleeve connected to the pulley k', a gear-wheel on said sleeve, intermediate mechanism, substantially as described, between the gear-wheel and cam-cylinder, including a bracket o^{20}, mounted on the shaft o^2, a pawl p', connected to said bracket, a toothed wheel p^2, on which said pawl rests, a spring-seated frame on the back of said wheel, a pin X' on said spring-seated frame, and an arm p, connected to said bracket, having the pin q, and devices, substantially as described, between the bracket o^{20} and the belts, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

17. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys $k\,k'\,k^2$ on said shaft, a straight belt on pulley k, a cross-belt on pulley k^2, a sleeve connected to the pulley k', a gear-wheel on said sleeve, intermediate mechanism, substantially as described, between the gear-wheel and cam-cylinder , including a bracket o^{20}, mounted on the shaft o^2, an arm p^4, connected to said bracket, belt-shifting arms p^9 and p^{12}, provided with bifurcated ends, the belts running on pulleys k and k^2 being engaged by said ends of arms p^9 and p^{12}, and intermediate mechanism between the arms p^9 and p^{12} and the arm p^4, whereby when the bracket is vibrated the arms p^9 and p^{12} are operated and the belts shifted off or on the active pulley, a pawl p', connected to said bracket, a toothed wheel p^2, on which said pawl rests, a spring-seated frame on the back of said wheel, and a pin X' on said spring-seated frame, and an arm p, connected to said bracket, having the pin q, whereby said cam-cylinder is caused to vibrate first in one direction and then in the other.

18. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys $k\,k'\,k^2$ on said shaft, a straight belt on pulley k, a cross-belt on pulley k^2, a sleeve connected to the pulley, a gear-wheel on said sleeve, intermediate mechanism, substantially as described, between the gear-wheel and cam-cylinder, including a bracket o^{20}, mounted on the shaft o^2, an arm p^4, connected to said bracket, belt-shifting arms p^9 and p^{12}, provided with bifurcated ends, the belts running on pulleys k and k^2 being engaged by said ends of arms p^9 and p^{12}, and intermediate mechanism between the arms p^9 and p^{12} and the arm p^4, a projection o^{17} on the cam-cylinder, and a projection o^{16}, connected to the bracket o^{20}, a pawl p', connected to said bracket, a toothed wheel p^2, on which said pawl rests, a spring-seated frame on the back of said wheel, a pin X' on said spring-seated frame, and an arm p, connected to said bracket, having the pin q, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

19. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys $k\,k'\,k^2$ on said shaft, a straight belt on pulley k, a cross-belt on pulley k^2, a sleeve connected to the pulley k', a gear-wheel on said sleeve, a shaft o^2, a gear-wheel normally running idle on said shaft, which gears into the wheel on the sleeve, and connections, substantially as described, between said shaft and the cam-cylinder, a bracket o^{20}, mounted on the shaft o^2, an arm p^4, connected to said bracket, belt-shifting arms p^9 and p^{12}, provided with bifurcated ends, the belts running on pulleys k and k^2 being

engaged by said ends of arms p^9 and p^{12}, and intermediate mechanism between the arms p^9 and p^{12} and the arm p^4, whereby when the bracket is vibrated the arms p^9 and p^{12} are operated and the belts shifted on or off the active pulley, the clutch member mounted on the shaft o^2, a lever o^8, connected to said clutch member, a spring-actuated plunger o^9, an arm o^{10} of said plunger, which normally rests against said lever o^8 and holds said clutch member out of engagement, a stop o^{13}, normally in connection with said plunger o^9, a projecting lug o^{16}, connected to the plunger o^9, and a projection o^{17} on the cam-cylinder, said projecting lug o^{16} being in the path of movement of the projection o^{17} on the cam-cylinder when the clutch is in operation, a pawl p', connected to said bracket, a toothed wheel p^2, on which said pawl rests, a spring-seated frame on the back of said wheel, a lug X′ on said spring-seated frame, and an arm p, connected to said bracket, having the pin q, whereby the cam-cylinder is caused to vibrate first in one direction and then in the other.

20. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a clutch member upon said shaft, gearing between the shaft o^2 and cam-cylinder, a straight belt on the pulley k, and a cross-belt on the pulley k^2, a lever o^8, connected to said clutch member, a spring-actuated plunger o^9, an arm o^{10} of said plunger, which normally rests against said lever o^8 and holds said clutch member out of engagement, a stop o^{13}, normally in connection with said plunger o^9, a projecting lug o^{16}, connected to the plunger o^9, and a projection o^{17} on the cam-cylinder, said projecting lug o^{16} being in the path of movement of the projection o^{17} on the cam-cylinder when the clutch is connected, a bracket o^{20}, mounted on said shaft o^2, a pawl p', connected to said bracket, a toothed wheel p^2, in which said pawl rests, a spring-seated frame on the back of said wheel, a pin X′ on said spring-seated frame, and an arm p, connected to said bracket, having the pin q, and devices, substantially as described, between the bracket o^{20} and the belts.

21. In combination, a needle-cylinder, needles supported within said cylinder, a cam-cylinder, needle-picking mechanism, substantially as described, adapted to be connected with said cam-cylinder, a shaft, pulleys k k' k^2 upon said shaft, a sleeve connected to the pulley k', a gear-wheel at the end of said sleeve, a shaft o^2, a gear-wheel which gears into the gear-wheel on the sleeve, normally running idle on said shaft o^2, a clutch member upon said shaft, a straight belt on the pulley k, and a cross-belt on the pulley k^2, a lever o^8 for said clutch member, a spring-actuated plunger o^9, an arm o^{10} of said plunger, which normally rests against said lever o^8 and holds said clutch member out of engagement, a stop o^{13}, normally in connection with said plunger o^9, a gear-wheel o^3 on the other end of said shaft o^2, a gear-wheel o^4 on the shaft A′, a bevel-gear o^5 on said shaft A′, and a gear o^6 on the cam-cylinder, a bracket o^{20}, mounted upon the shaft o^2, a lever p^4, connected to said bracket, belt-shifting arms p^9 and p^{12}, provided with ends which surround the straight and cross belts, intermediate connection between the arms p^9 and p^{12} and the lever p^4, a pawl p', connected to said bracket, a toothed wheel p^2, on which said pawl rests, a spring-seated frame on the back of said wheel, a pin X′ on said spring-seated frame, and an arm p, connected to said bracket, having the pin q.

22. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame.

23. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker journaled upon said plunger, said needle-picker being provided with the jaws d and d' and plate d^2, and means, substantially as described, to revolve and elevate said plunger.

24. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-actuated plunger and a needle-picker journaled upon said plunger, said needle-picker being provided with the jaws d and d' and plate d^2, said plate d^2 being adapted to slide upon and between said jaws d d'.

25. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger and a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame, said needle-picker being provided with the jaws d d' and plate d^2.

26. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame, said needle-picker being provided with the jaws d d' and plate d^2, said plate d^2 being adapted to slide upon and between said jaws d and d'.

27. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame, a cam-cylinder, and

means, substantially as described, to connect the needle-picking mechanism with the cam-cylinder.

28. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker journaled upon said plunger, said needle-picker being provided with the jaws *d* and *d'* and plate d^2, said plate d^2 being adapted to slide upon and between said jaws *d d'*, a cam-cylinder, and means, substantially as described, to connect the needle-picking mechanism with the cam-cylinder.

29. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame, said needle-picker being provided with the jaws *d d'* and plate d^2, a cam-cylinder, and means, substantially as described, to connect the needle-picking mechanism with the cam-cylinder.

30. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame, said needle-picker being provided with the jaws *d* and *d'* and plate d^2, said plate d^2 being adapted to slide upon and between said jaws *d* and *d'*, a cam-cylinder, and means, substantially as described, to connect the needle-picking mechanism with the cam-cylinder.

31. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame, a pivoted arm, arm C^8, connected to said plunger, a cam-cylinder, a projection on said cam-cylinder, which said pivoted arm surrounds.

32. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker journaled upon said plunger, said needle-picker being provided with the jaws *d* and *d'* and plate d^2, said plate d^2 being adapted to slide upon and between said jaws *d d'*, a pivoted arm, arm C^8, connected to said plunger, a cam-cylinder, and a projection on said cam-cylinder, which said pivoted arm surrounds.

33. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, and spring-seated cams in said frame, said needle-picker being provided with the jaws *d d'* and plate d^2, a pivoted arm, arm C^8, connected to said plunger, a cam-cylinder, and a projection on said cam-cylinder, which said pivoted arm surrounds.

34. In the automatic picking mechanism of a circular-knitting machine, in combination, a spring-actuated plunger, a needle-picker loosely connected to said plunger, a cam-rod connected to said plunger, a roller at the end of said cam-rod, a cam-frame, spring-seated cams in said frame, said needle-picker being provided with the jaws *d d'* and plate d^2, said plate d^2 being adapted to slide upon and between said jaws *d* and *d'*, a pivoted arm, arm C^8, connected to said plunger, a cam-cylinder, and a projection on said cam-cylinder, which said pivoted arm surrounds.

35. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-seated plunger C^6, a cam-rod L, attached to said plunger, provided at one end with a roller *l*, a cam-frame G', cams G^2 G^3, secured in spring-seated guides in said frame, a needle-picker loosely secured to said plunger, a cam-cylinder, and means, substantially as described, to connect said plunger and the cam-cylinder.

36. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-seated plunger, guides for said plunger, a cam-rod L, attached to said plunger, provided at one end with projection *l'*, a cam W, secured to the upper guide C^5, a needle-picker loosely connected to said plunger, a cam-cylinder, and means, substantially as described, to connect the plunger and cam-cylinder.

37. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-seated plunger C^6, a hollow arm in the upper end of said plunger, a cam-rod L, which rests in said hollow arm, a roller at one end of said rod, a cam-frame G, cams G^2 and G^3, secured on spring-seated guides in said frame, said roller striking said cams G^2 G^3 in its movement, a needle-picker loosely secured to said plunger, a cam-cylinder, and means, substantially as described, to connect said plunger and the cam-cylinder.

38. In the automatic picker mechanism of a circular-knitting machine, in combination, a spring-seated plunger C^6, guides C^5, in which said plunger works, a hollow arm in the upper end of said plunger, a cam-rod L, which rests in said hollow arm, a projection on said rod, a cam W, secured to the upper guide C^5, said projection on the rod in its movement striking said cam W, a needle-picker loosely secured to said plunger, a cam-cylinder, and means, substantially as described, to connect said plunger and the cam-cylinder.

39. In combination, the needle-picker mechanism, a rod C^{12}, upon which said mechanism is journaled, a plate C^2, connected to said picker mechanism journaled upon said rod C^{12}, detents in said plates C^2, and a spring-arm projecting from the main frame of the machine and adapted to rest in the detents in the plate C^2.

40. In a circular-knitting machine, in combination, a cam-cylinder, a needle-cylinder, needles held in said cylinder, a plunger R, guided in bracket r, a spring r^8, against which said plunger rests, a leaf-spring r', which normally holds said plunger down, and a depressor S, attached to said plunger, which depressor S when the plunger is forced down is within the cam cylinder and in the travel of the cylinder strikes the shanks of the needles.

41. In a circular-knitting machine, in combination, a cam-cylinder, a needle-cylinder, needles held in said cylinder, a guide r, secured to the cam-cylinder, a plunger R in said guide, a spring r^8, against which said plunger rests, a depressor S, attached to said plunger, which depressor S when the plunger is forced down is within the cam-cylinder and in the travel of said cylinder strikes the shanks of the needles, said plunger having a detent r^3, a leaf-spring r', and a projection r^2 on said spring adapted to rest in said detent in the plunger when the plunger is pressed down.

42. In a circular-knitting machine, in combination, a cam-cylinder, a needle-cylinder, needles held in said cylinder, a guide r, secured to the cam-cylinder, a plunger R in said guide, a spring r^8, against which said plunger rests, a depressor S, attached to the said plunger, which depressor S when the plunger is forced down is within the cam-cylinder and in the travel of the cylinder strikes the shanks of the needles, said plunger having a detent r^3, a leaf-spring r', a projection r^2 on said spring adapted to rest in said detent when the plunger is pressed down, and a projection T on the frame of the machine in the line of travel of the leaf-spring r', whereby if the plunger R is down when the leaf-spring strikes the projection T the projection r^2 is released from the detent in the plunger R.

In testimony of which invention I have hereunto set my hand, at Philadelphia, Pennsylvania, this 1st day of August, 1889.

WILLIAM DIEBEL.

Witnesses:

HOWARD W. HARLEY,

ABNER J. DAVIS.