

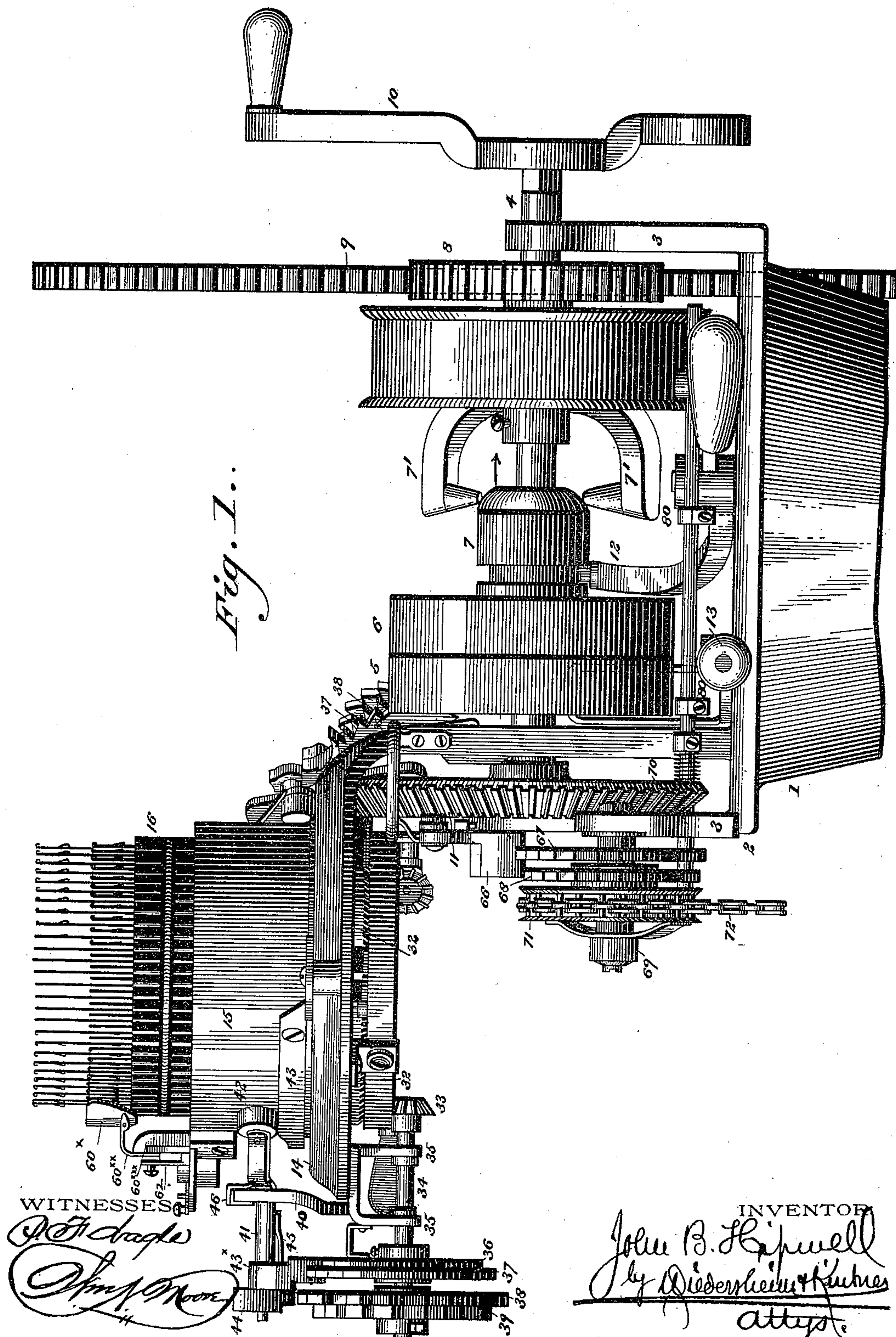
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4 Sheets—Sheet 1.

J. B. HIPWELL.
CIRCULAR KNITTING MACHINE.

No. 438,885.

Patented Oct. 21, 1890.



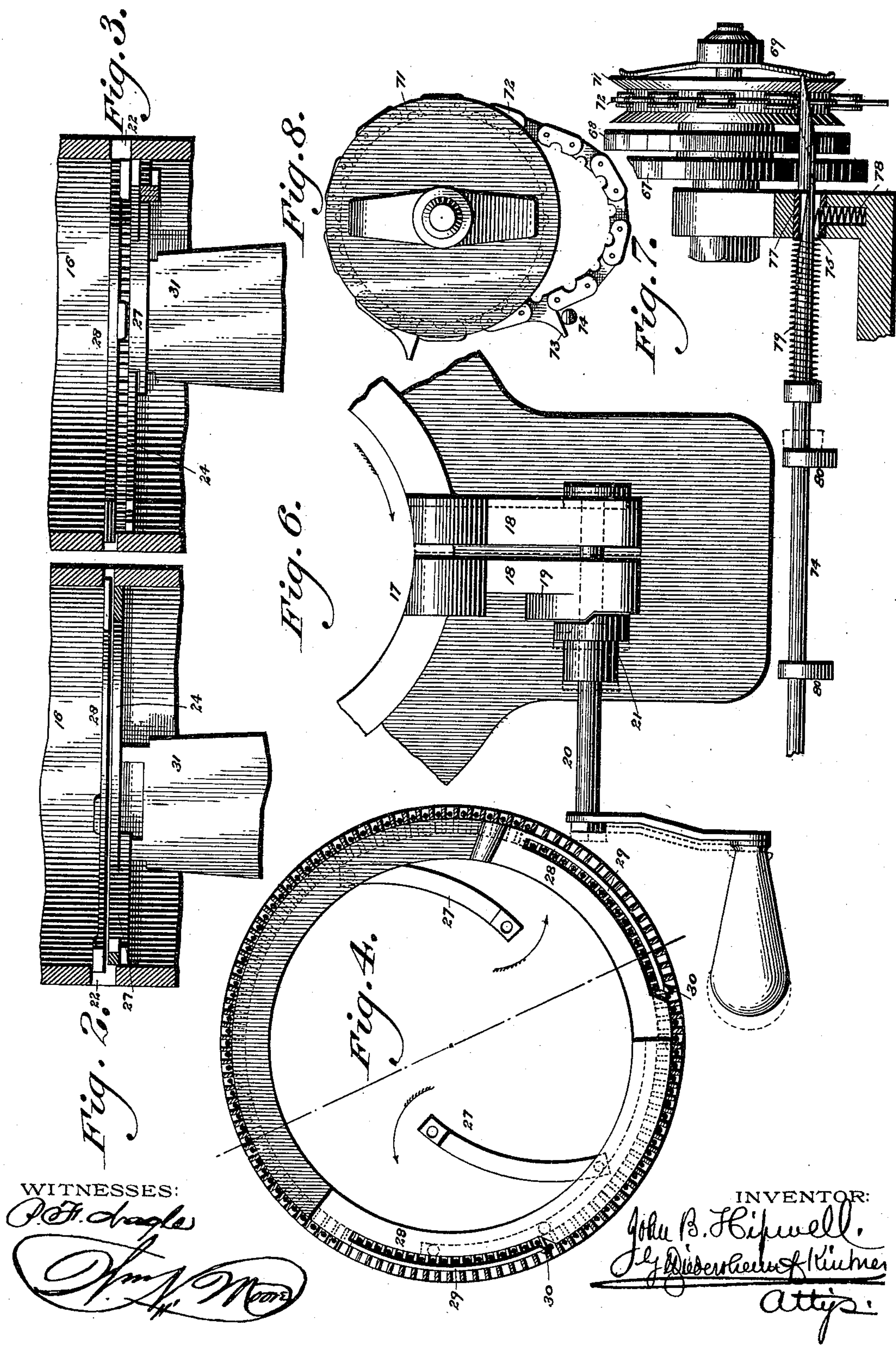
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4 Sheets—Sheet 2.

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4 Sheets—Sheet 3.

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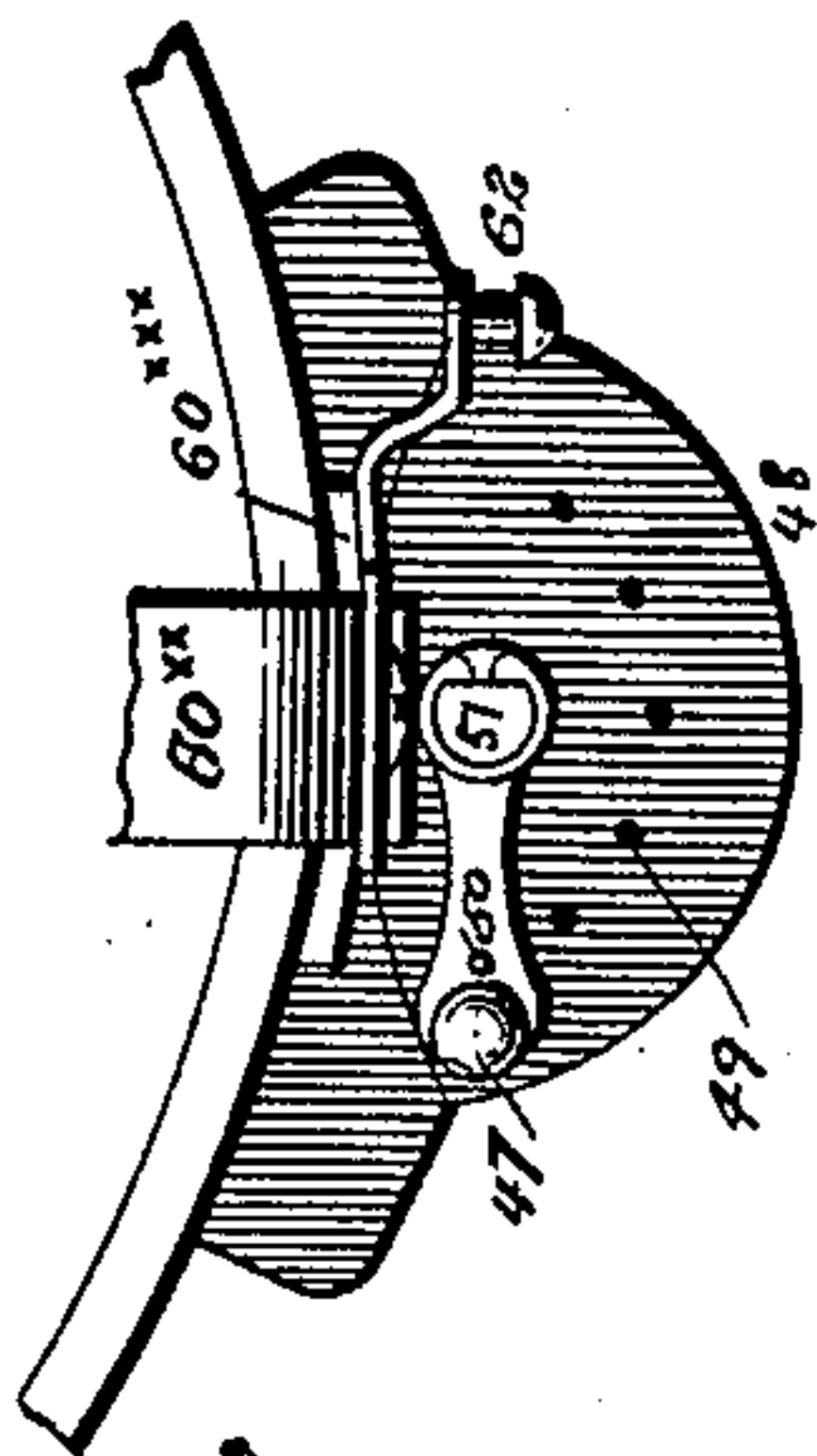


Fig. 9.

Fig. 5.

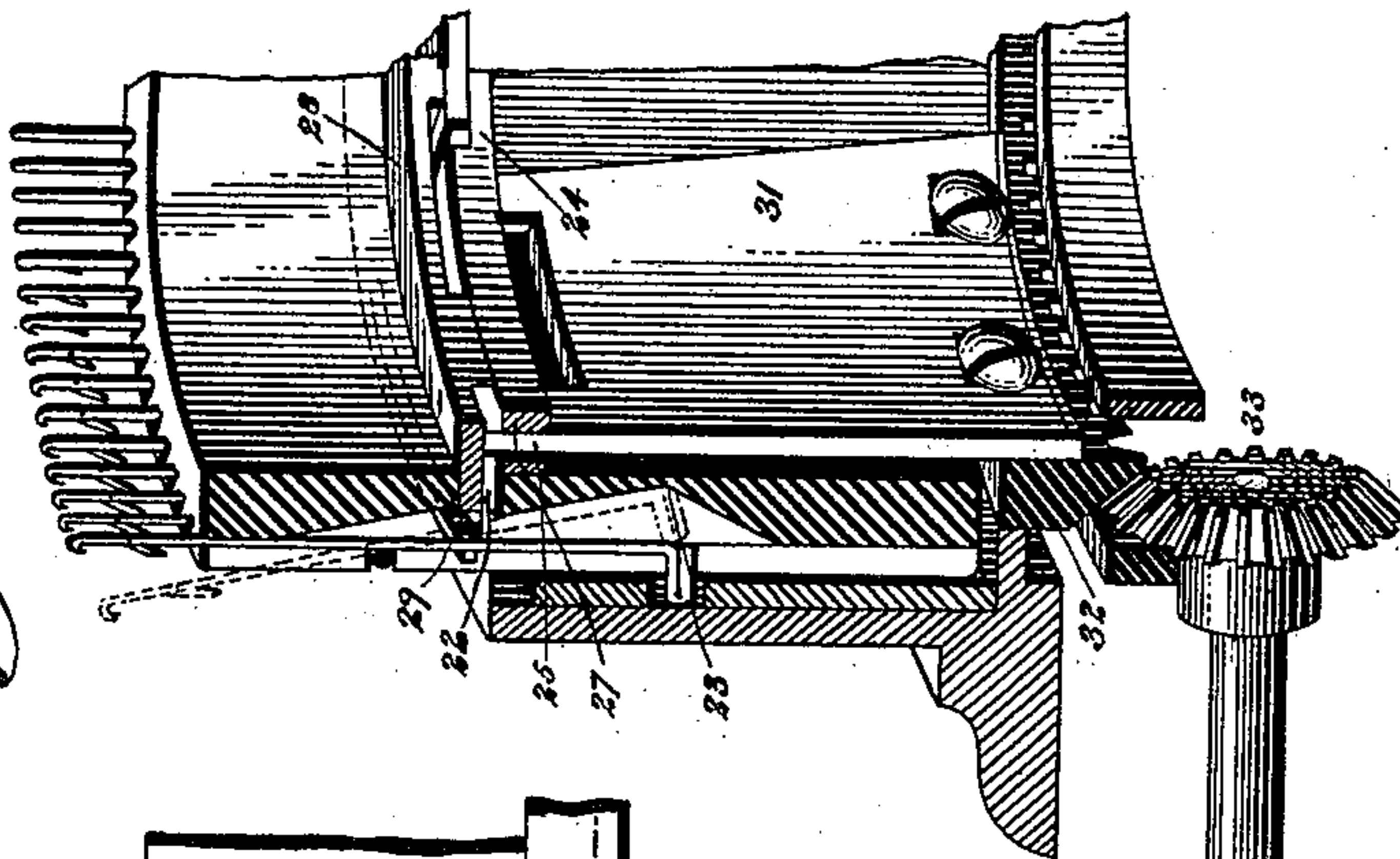


Fig. 10.

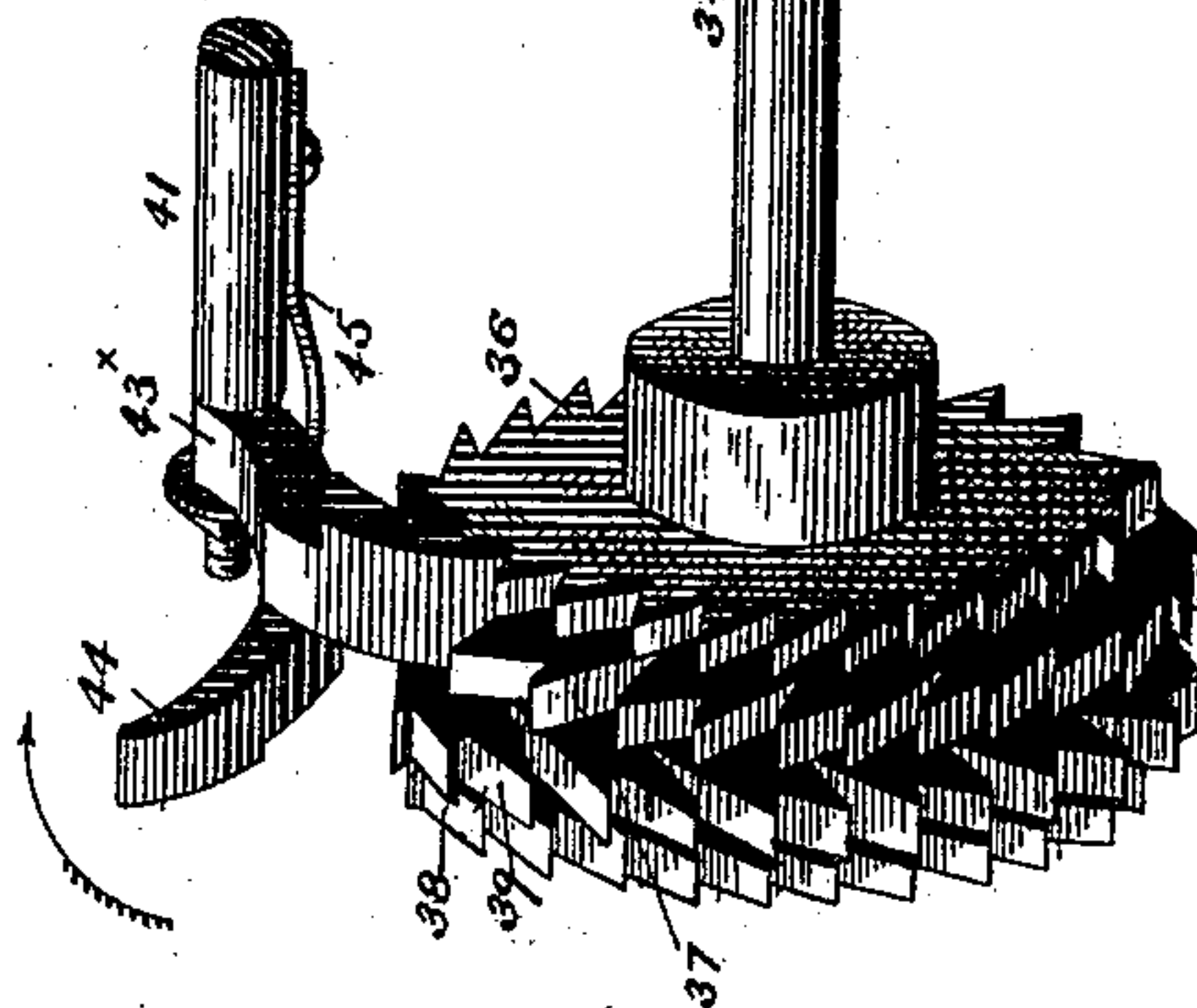
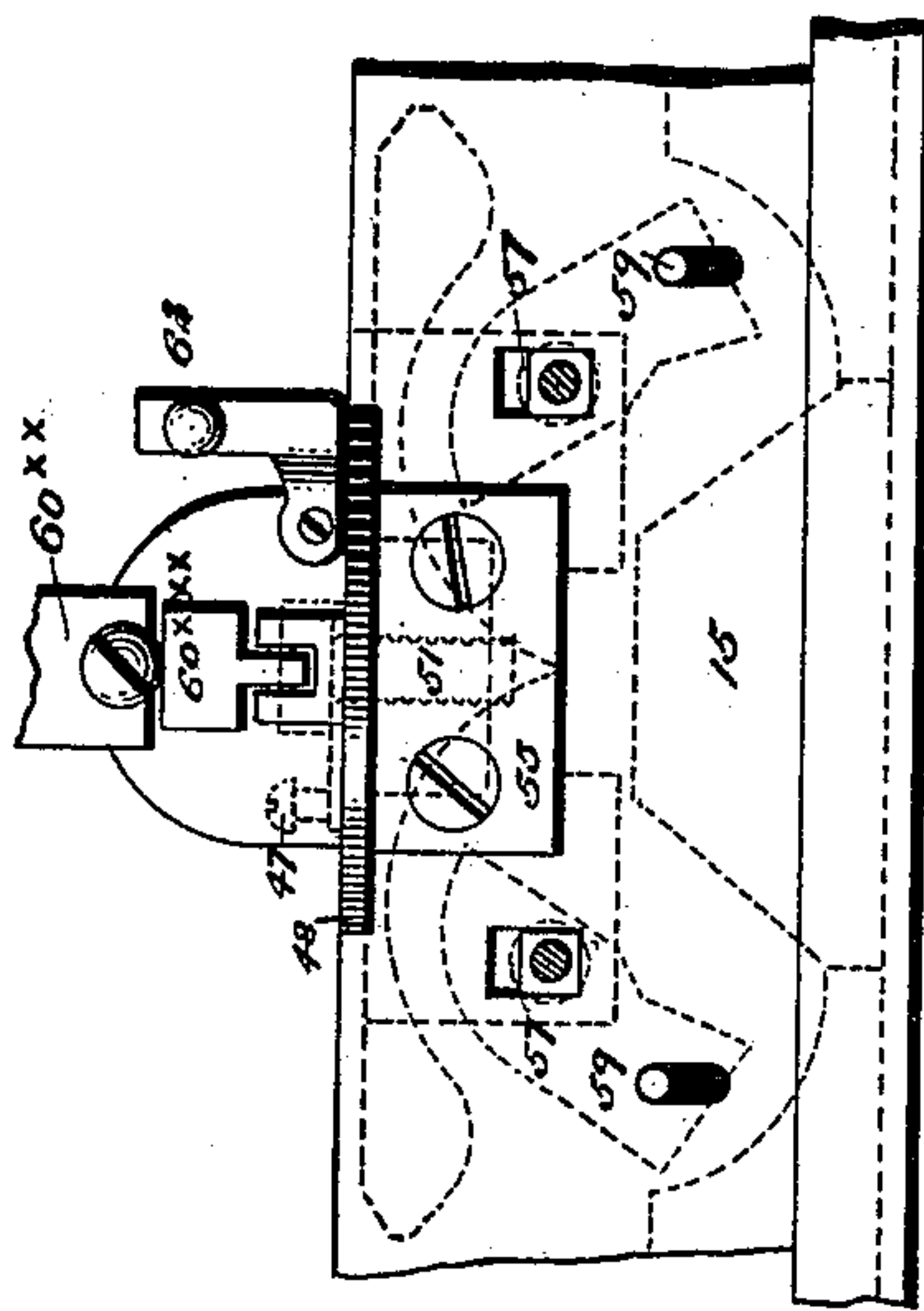


Fig. 11.

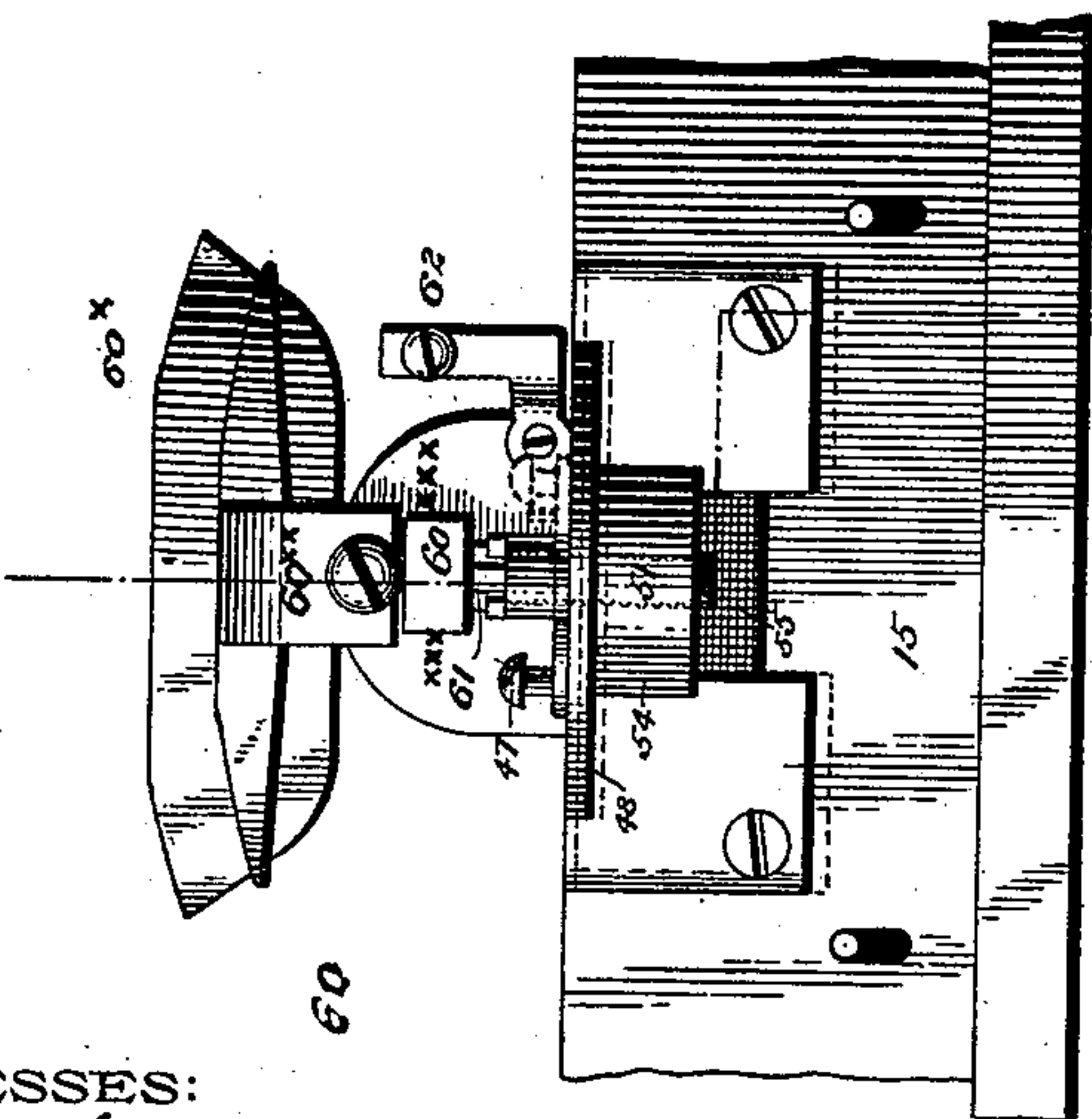
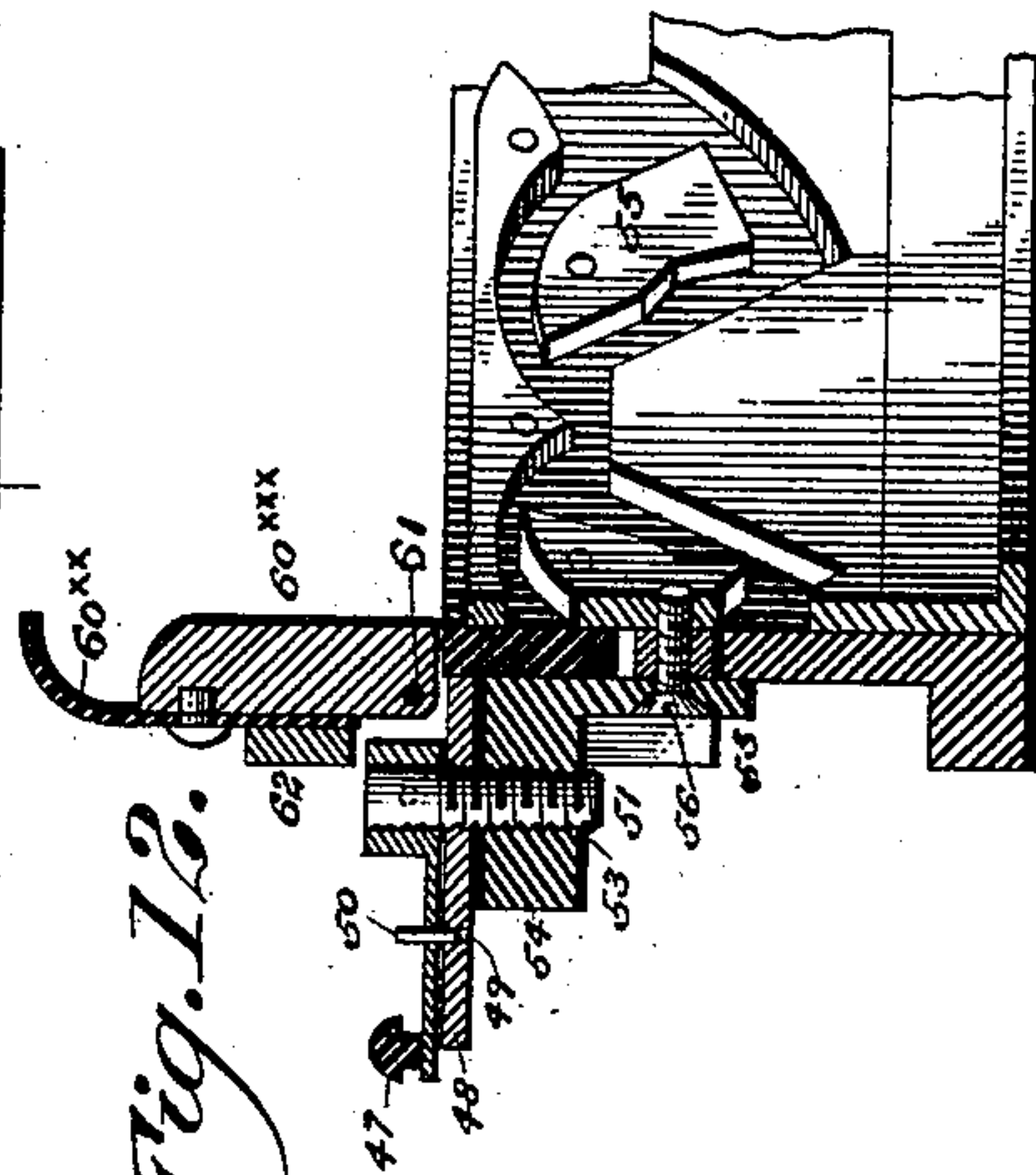


Fig. 12.



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(No Model.)

4 Sheets—Sheet 4.

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Fig. 15.

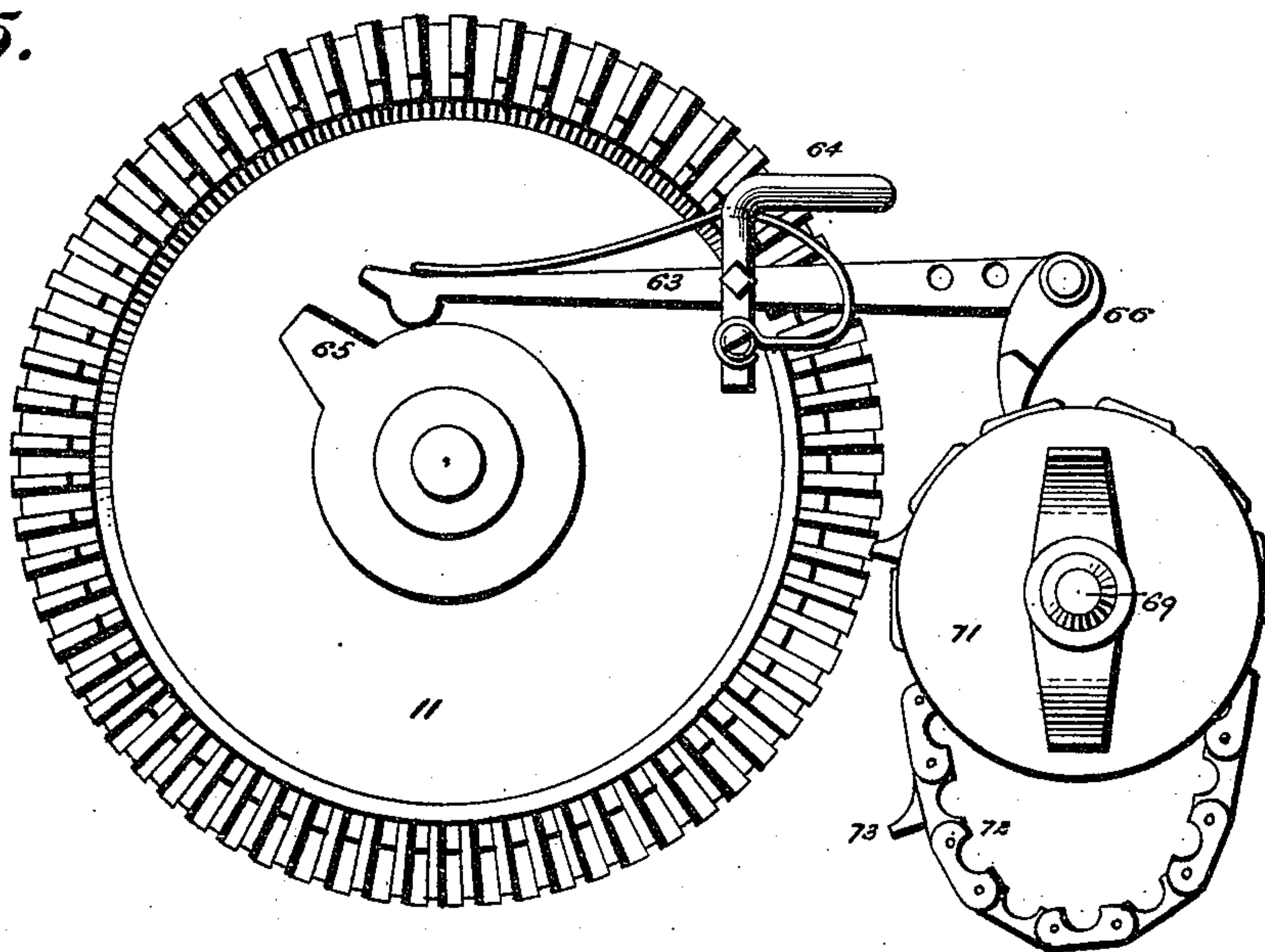


Fig. 13.

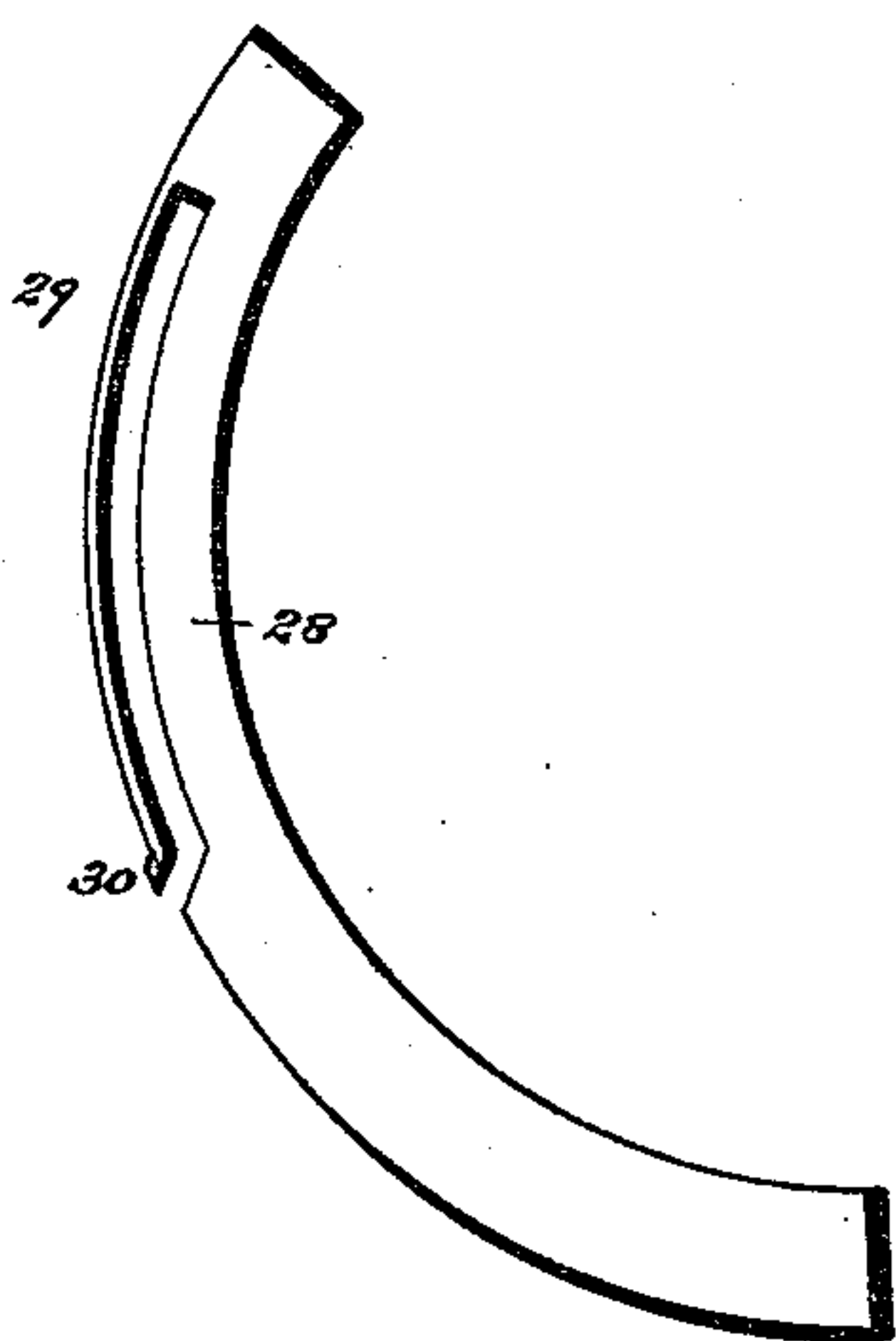
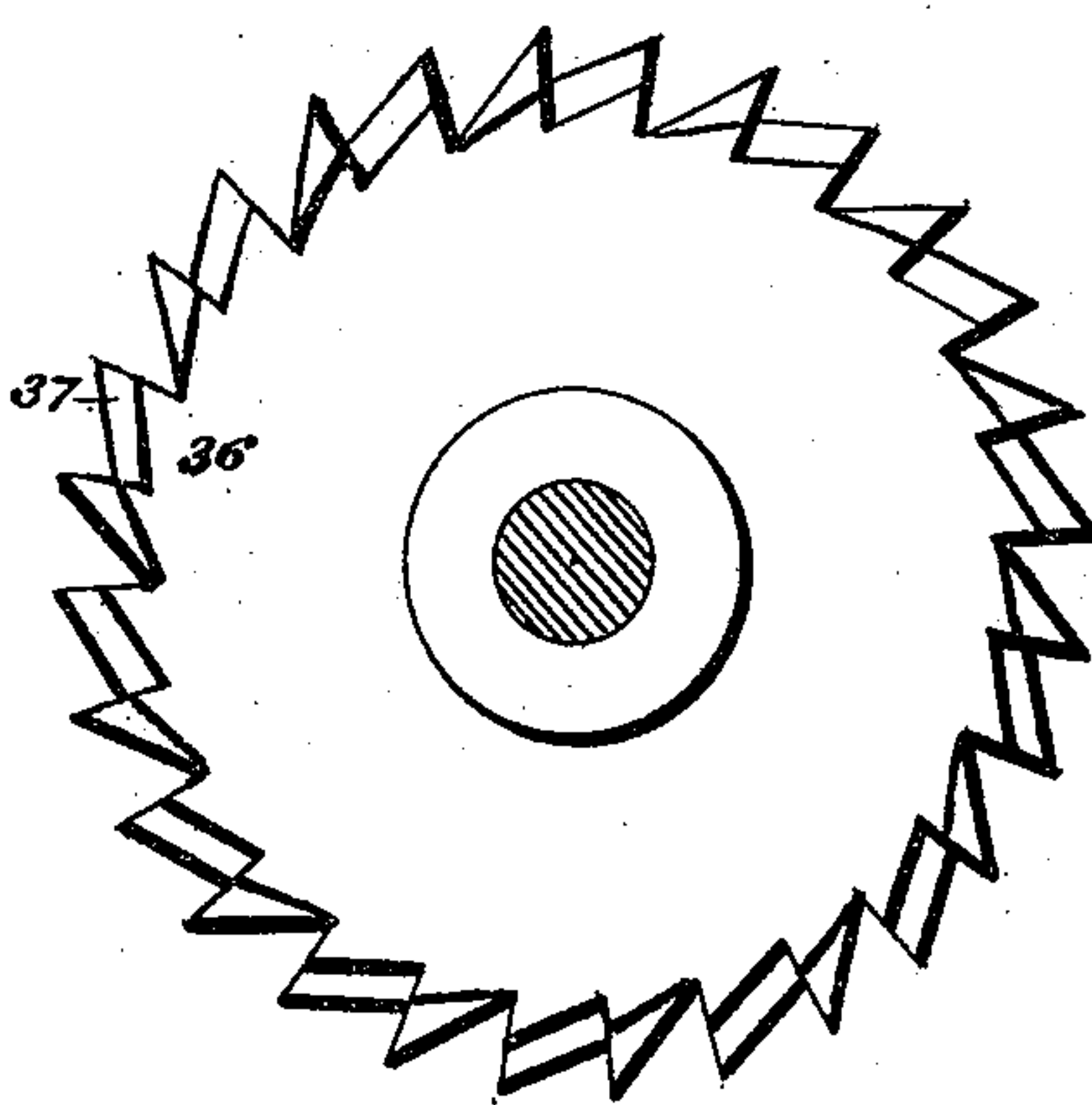


Fig. 14.



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UNITED STATES PATENT OFFICE.

JOHN B. HIPWELL, OF PHILADELPHIA, PENNSYLVANIA.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 438,885, dated October 21, 1890.

Application filed April 21, 1888. Serial No. 271,424. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. HIPWELL, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Circular-Knitting Machines, which improvement is fully set forth in the following specification and accompanying drawings.

My invention relates to improvements in knitting-machines, and especially to what are known as "circular-knitting machines."

The leading object of the invention is to provide mechanism for making a so-called "seamless stocking," or for automatically narrowing and widening the heel and toe pockets.

A further object is to provide improved mechanism for stopping the machine when the leg or foot of the stocking has been completed preparatory to making the heel or toe thereof.

A further object is to provide improved mechanism for making the knitting loose or tight or regulating the stitch.

A further object is to provide mechanism of simple, strong, and durable construction which will be thoroughly efficient in practice and inexpensive of production.

To attain the desired objects, the invention consists in mechanism for operating upon certain of the needles to form the heel and toe pockets; further, in a mechanism operated automatically for stopping the machine when the leg or foot of the stocking has been completed; further, in a mechanism for operating the stitch or shooting cams of the cam-cylinder to cause the needles to knit loose or tight or to regulate the stitch; and, finally, the invention consists in the novel details of construction, combination, arrangement, and adaptation of the various parts for service, as hereinafter described and claimed.

Figure 1 represents a side elevation of a knitting-machine embodying my invention. Figs. 2 and 3 represent detail views of part of the needle-cylinder. Fig. 4 represents a plan view of the needle-cylinder and slotted curved plates. Fig. 5 represents a perspective view, partly sectional, of the cam-cylinder, needle-cylinder, operating-shaft, and gear and ratchet wheels and pawls. Fig. 6 represents a plan view of the friction clamp or

clutch for holding the needle-cylinder in place. Fig. 7 represents an elevation of part of the stop mechanism. Fig. 8 represents an end view of the sprocket wheel and chain for operating the stop mechanism. Fig. 9 represents a plan view of the stitch-regulator. Fig. 10 represents an inner view of part of the cam-cylinder and stitch-regulator. Fig. 11 represents an outer view of a part of the cam-cylinder and stitch-regulator. Fig. 12 represents a sectional view of the cam-cylinder and stitch-regulator. Fig. 13 represents a top plan view of one of the curved slotted plates which move in the slot of the needle-cylinder for operating upon the needles. Fig. 14 represents a side elevation of one of the small ratchet-wheels and one of the large ones to illustrate the arrangement of the teeth therein. Fig. 15 represents a detail view of part of the stop mechanism.

Similar numerals of reference indicate corresponding parts in the several figures.

Referring to the drawings, the numeral 1 designates the column, standard, or support of the machine; 2, the table thereon; 3, standards or uprights rising from said table, and 4 the driving-shaft mounted in said standards. On the said driving-shaft are mounted the tight pulley 5, loose pulley 6, friction-clutch sleeve 7, and the gear-wheel 8, meshing with the rack 9. The gear-wheel 8 has arms 7' pivotally connected to the sleeve thereof, which are spread apart by sliding the clutch-sleeve 7 (in direction of arrow) between the same to thereby cause the inner ends of said arms 7' to bite against the shaft and lock the said gear-wheel in tight connection with said shaft. By reversing the movement of clutch-sleeve 7 the arms 7' are released from their contact with the shaft and the gear-wheel set free from the shaft. To the outer end of said shaft is attached a crank or handle 10, and to the inner end is secured the driving bevel-gear 11.

12 designates a lever mounted on the table for shifting the clutch to throw it into or out of operation, as desired, and 13 designates a lever also fulcrumed on the table for shifting the driving-belt from the tight to the loose pulley.

The parts stated are of the well-known construction, and to which I, broadly, lay no claim.

14 designates the bed of the knitting mechanism, which is firmly secured to the inner standard or upright of the table.

15 designates the cam-cylinder, secured in the bed-plate and adapted to be revolved therein by means of the driving bevel-gear 11 in the manner and for the purpose well known.

16 designates the needle-cylinder, which is retained firmly in place by means of the friction clutch or clamp 17. This clutch consists of the band adapted to embrace the needle-cylinder, having the arms 18, one of which is provided with a cam-face 19, and the handle 20, having a cam-wheel 21 thereon, adapted to operate conjointly with the cam-face 19 to cause the band to clasp or embrace the needle-cylinder or to relieve it, as may be desired, as clearly shown in Fig. 6 of the drawings.

The needle-cylinder 16 is provided with the annular slot or groove 22, and is also depressed or cut out at 23 to receive the butts of the needles, as will presently appear.

24 designates a band or ring secured to the needle-cylinder below the slot or groove 22 therein, and this band or ring is provided with passages 25, and has hinged arms 27 for closing said passages and opening the same.

28 designates curved plates, adapted to rest on the upper face of the band or ring 24 and move in the slot of the needle-cylinder, and these curved plates are provided with slots or passages 29, which are open at one end, and formed with a lip or guiding arm or projection 30, adapted to contact with the needles and draw them into the slots or passages and cause their butts to enter the depressed portion of the needle-cylinder.

31 designates curved vertical plates, connected at their upper ends to the slotted curved plates 28 and arranged in the passages or openings 25 of the band or ring 24, which serves as a guide for said vertical curved plates and the slotted plates and retains them in place. By reason of the curved arms on the band or ring the curved vertical plates can be removed and replaced with ease.

To the lower ends of the curved vertical plates 31 are secured racks 32, which engage with operating bevel-gears 33 on shafts 34, as clearly shown in Fig. 5 of the drawings. Two of the described mechanisms are employed to operate upon the needles—one on each side of the cylinder—for forming the heel and toe. The shafts 34 are journaled in hangers 35, depending from the bed of the machine, and to the outer ends of the shafts are secured ratchet-wheels 36 and 37, having their teeth arranged in one direction, and the ratchet-wheels 38 and 39, having their teeth arranged in the opposite direction, one set of ratchet-wheels—a pair on each shaft 34—being adapted to move the curved slotted plates 28 in one direction and the other in the opposite direction, or, in other words, one set advances the plates and the other returns them. The ratchet-wheels 36 and 38 are secured rig-

idly to the shafts, so as to rotate them in their respective directions, and the ratchet-wheels 37 and 39 are larger than the ratchet-wheels 36 and 38, and are mounted loosely on said shafts, and the teeth on the small and large ratchet-wheels are arranged as shown in Figs. 14 and 5 of the drawings, whereby the large wheel is engaged twice to once of the small wheel. The object of this arrangement of the ratchet-wheels is to prevent each shaft 34 from being moved more than once in each to-and-fro or complete reciprocating movement of the cam-cylinder. The larger wheel has its alternate teeth of different lengths, while those of the smaller wheel are uniform, and the base of the teeth of the smaller wheel and the base of each alternate tooth of the larger wheel are coincident, or at the same distance from the centers of the wheels, while the bases of the other teeth of the larger wheel are farther from the center of the wheel. By this construction the operative pawl engages at every oscillation a tooth of the larger wheel, while it takes two oscillations to move the smaller wheel one tooth, as it only engages the teeth of the smaller wheel at alternate swings.

40 designates uprights, to which are pivoted rock-shafts 41, having a bend or curve therein on the end adjacent to the cam-cylinder, and provided at their inner ends with rollers 42, adapted to travel on the outer half-cam 43 of the cam-cylinder, as clearly shown in Fig. 1 of the drawings, to produce a rise and fall of the ends of said shafts, and at their outer ends having the double pawls 43^x and 44, adapted to engage their respective ratchet-wheels. The shafts 41 are pivoted at points located in the portions transverse as to the uprights 40 between the two portions thereof, respectively, carrying the roller 42 and the pawls 43^x 44, thereby to provide for a rocking movement of said shafts.

In order to retain the double pawls out of engagement with the ratchet-wheels while the leg of the sock or stocking is being formed, I employ flat springs 45, which are secured to the rock-shafts 41 and bear against the under side of the pawls, and to cause the rollers to rest and travel smoothly on the half-cam 43 of the cam-cylinder at all times I provide the springs 46, which are secured to the uprights 40 and bear against the portion of the rock-shafts adjacent to the cam-cylinder.

The mechanism for regulating the stitch consists of the lever 47, adapted to move horizontally over the plate 48, which has openings or perforations 49 therein to receive a pin 50 on the lever to retain it in the desired place. The lever carries the screw 51, passing through the plate 48 and engaging the threaded opening 53 of the angle-plate 54. This angle-plate is also connected with the stitch or shooting cams 55 by means of screws 56, and the cam-cylinder is provided with slots 57 to receive the screws 56, and also studs 59 on the cams. (All shown in

Figs. 10, 11, and 12 of the drawings.) From this construction it is evident that the shooting or stitch cams are permitted to have a slight vertical movement to move or set the needles the desired vertical distance to regulate the stitch by merely moving the lever, which, by reason of the screw, will move the plate and cams as desired and be held in the adjusted position by means of the pin 50, as will be readily understood.

60 designates the thread-guide, which consists of the concave plate 60^x for guiding the thread, the arm 60^{xx}, connected to said concave plate, and the plate 60^{xxx}, hinged at 61, whereby the guide-plate may be brought into position and moved therefrom as desired; and in order that the thread-guide may be retained in position I employ the pivoted latch 62, adapted to engage the rear face of the plate 60^{xxx}, and thus retain the thread-guide in operative position. It will thus be seen that I provide a hinged thread-guide, and that the latch will effectually retain the said guide in operative position.

I employ the following mechanism for stopping the machine when the leg and foot of the stocking has been completed, preparatory to forming the heel and toe pockets.

63 designates a lever fulcrumed to a rod 64, secured to the inner standard of the table, and this lever is adapted to have its inner end engaged by a cam or projection 65 on the driving bevel-gear, and its outer end is provided with a pawl 66, engaging the ratchet-teeth of the ratchet-wheels 67 and 68 on a stud 69, mounted in a post or upright 70 rising from the table. The ratchet-wheel 67 is loose on said shaft and is larger than the ratchet-wheel 68, which is also mounted loose on said shaft. The pawl 66 engages the large ratchet-wheel 67 each time, but the small ratchet-wheel 68 is only engaged at proper intervals.

71 designates a sprocket-wheel, mounted on the stud 69 and secured to the ratchet-wheel 68. 72 designates a sprocket-chain passing over said wheel, having at proper places of its length arms, extensions, or lugs 73, adapted to contact with the rod 74. The ratchet-wheels and sprocket-wheels are all mounted loose on said shaft, and the ratchet-wheel 67 is held in frictional contact with the ratchet-wheel 68. From this construction it will be seen that the ratchet-wheels 68 and 67 operate substantially in the same manner as the ratchet-wheels 36 and 37—that is to say, the large ratchet-wheel 67 moves six teeth, while the smaller ratchet-wheel 68 is moved but one, and the reason for this is to cause one of the arms 73, carried by the chain 72, to contact at the proper moment (when the leg has been completed) with the rod 74 for throwing the mechanism out of operation. The chain 72 is of a determined length, and the arms thereon are arranged at the proper places on the chain and are brought in contact with the rod 74 by the rotation of the wheel 71 at the exact time

when the leg and foot of the stocking have been completed.

The peculiar arrangement of the ratchet-wheels 67 and 68 causes the chain to travel at the desired speed to bring the arms on the chain in contact with the rod 74 at the desired moment to throw the mechanism out of operation.

The rod 74 passes through an opening 75 in the post or upright 76, and has its end cut out at 77 to enable said rod to engage the upper wall of the opening, and the rod is held in engagement by means of a spring 78 in the post. A coiled spring 79 is placed around the rod to give it a spring or shooting action, the purpose of which is to cause said rod when released to strike against the belt-shifting lever and the clutch-shifting lever to throw the machine out of operation, lugs 80 being provided on said spring-actuated rod 74 for contacting with said levers to accomplish the desired end.

The mechanism employed for reciprocating the rack 9 for revolving the gear-wheel 8 in reverse directions may be of any character, such as a crank-shaft, a cam or such mechanism as employed in the patent of B. F. Shaw, granted June 8, 1880, No. 228,480.

This being the construction, the consequent operation is as follows: The needles are all down in the cylinder and the leg of the stocking is knit in the usual manner, all of the needles being operated to effect this end, and as the driving gear-wheel revolves the cam 65 thereof operates upon the lever 63, carrying the pawl 66, which engages the ratchet-wheels 67 68, and causes the sprocket-wheel 71 to turn at the proper intervals, and when the leg of the stocking has been completed a lug on the sprocket-chain engages the shooting-rod, disengaging the same from its original position, and causing it to throw the machine out of operation ready for forming the heel. When the leg of the stocking has been completed, one of the pawls on each of the rock-arms, which pawls have during the knitting of the leg been retained out of contact with the ratchet-wheels 36 37 38 39 by means of the springs 45, is permitted to engage the desired ratchet-wheels. The needles in one half of the cylinder are elevated or thrown out of operation, and the machine is ready for operation to produce the heel. Lever 12 having been moved by hand to clutch wheel 8 to the driving-shaft, as the rack moves up and down it transmits motion to the cam-cylinder, causing the same to revolve first in one direction and then in the other, the half-cam thereon operating upon the roller of one rock-shaft and then on the other, which has the effect to cause the pawl on one rock-shaft to engage its ratchet-wheels and then the pawl on the other shaft to do the same. The pawls engage the larger ratchet-wheels twice to but once on the smaller ratchet-wheels, and when the smaller ratchet-wheels are en-

gaged the shaft on which they are mounted is turned, causing the bevel gear-wheels carried by said shafts to engage the racks which carry the slotted plates, the plates being moved far enough to take in one needle at a time, first on one side of the cylinder and then on the opposite side, and draw their butts into the depressed portion of the cylinder, and thus throw said needle out of operation after it has formed its loop. The outermost needles of the series in action during the knitting of the heel are first operated upon and the knitting is narrowed gradually as the needles are successively operated upon, and when the narrowest portion of the heel or pocket has been knitted the pawls are reversed, causing the same to engage the other ratchet-wheels, causing the needles at the narrowest portion to be operated upon, and gradually widening the knitting as the needles are successively restored to operative position. Thus the needles at each side of the cylinder are drawn in after they have been operated upon from the widest to the narrowest portion of the pocket, and then thrown out again from the narrowest to the widest portion, producing the heel-pocket. After the heel-pocket is formed (which, as is evident, is substantially of V shape) the machine is again stopped, the needles are all thrown into operative position, in order that they may be utilized to form the foot, the driving-belt is thrown upon the fast pulley, and the foot is knit. When the foot is formed, the machine is stopped, and then the toe-pocket is produced in the same manner as the heel-pocket.

It will thus be seen that the heel and toe are automatically formed by the machine, as it is merely necessary after the leg or foot has been formed to throw the needles of one half of the cylinder out of operation and allow the other half to be operated upon by the mechanism which produces the heel and toe pockets. It will also be understood that the outermost needles of the series in action are operated upon and then those next adjoining, and so on from the outermost needles inward to the needles at the middle of the series, and when the knitting in this direction has been gradually narrowed to a sufficient extent the needles are successively restored to action, thus producing the narrowing and widening and forming the heel or toe pocket. This is a great advantage over that method of forming the heel and toe in which the needles are each operated upon and as soon as they have completed their work are lifted up by hand, and thus thrown out of operation, which requires considerable time and labor, and also involves a great expense; but in my machine the needles in one half the cylinder are elevated and thrown out of operation and the needles in the other half are operated upon by the curved slotted plates and are thrown out of operation as soon as they have completed their work by drawing their butts into

the depressed portion or groove in the cylinder, as is evident. I also provide a very simple and efficient stitch-regulator.

The many advantages of my machine will be readily apparent to all skilled in the art to which it appertains, and hence need no further comment herein.

I would have it understood that I reserve the right of making minor changes in the construction and arrangement of the parts of the machine without departing from the spirit or scope or sacrificing any of the advantages of the invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a knitting-machine, a needle-cylinder having an annular slot and a depressed portion, the latter adapted to receive the butts of the needles, in combination with curved plates having passages adapted to receive the needles and cause their butts to enter the depressed portion of the needle-cylinder, substantially as described.

2. In a knitting-machine, the combination of a needle-cylinder provided with an annular slot and depressed portion below said slot, plates arranged in said slot having passages to receive the needles and draw their feet or butts within the depressed portion of the needle-cylinder, and means for operating said plates, substantially in the manner and for the purpose described.

3. In a knitting-machine, the combination of a needle-cylinder provided with an annular slot and depressed portion, curved plates arranged in said slot and adapted to remove the heels of the needles into the depressed portion of the needle-cylinder, needle-passages with one end closed and the other open, said plates each having guiding arm or lip at the open ends of the passages, and mechanism for moving said plates, substantially in the manner and for the purpose described.

4. In a knitting-machine, the combination of the needle-cylinder provided with an annular slot and depressed portion, the plates arranged in said slot and having passages to receive the needles and adapted to cause the butts of the needles to enter said depressed portion of the needle-cylinder, the plates having racks secured thereto, and mechanism for operating the racks, substantially in the manner and for the purpose described.

5. In a knitting-machine, the combination of a needle-cylinder provided with an annular slot and depressed portion, plates having passages arranged in said slot and open at one end, and having a lip adapted to come in contact with the needles and draw their butts into the depressed portion of the needle-cylinder, vertical plates connected to said plates, racks connected to the vertical plates, gear-wheels meshing with said racks, and mechanism for rotating the gear-wheels to move the racks and operate the mechanism

connected therewith, substantially in the manner and for the purpose described.

6. In a knitting-machine, a needle-cylinder having an annular slot and a depressed portion to receive the butts of the needles, plates arranged in said slot and provided with passages, one end of each of said passages being closed and the other end open, a guiding lip or arm at the open end of each passage for guiding the needles into said passages, and a cam-cylinder, said parts being combined substantially in the manner and for the purpose described.

7. In a knitting-machine, the combination of a needle-cylinder having a slot and a depressed portion, curved plates having passages and arranged in said slot, each plate having a lip and adapted to draw the butts of the needles into the depressed portion of the needle-cylinder, vertical plates connected with the aforesaid plates, racks carried by said vertical plates, gear-wheels engaging said racks, shafts on which said gear-wheels are mounted, ratchet-wheels on said shafts for imparting motion thereto, oscillating pawls engaging said ratchet-wheels, rock-shafts carrying said pawls, and means, substantially as set forth, for actuating said rock-shafts, all arranged substantially as described.

8. In a knitting-machine, the combination of the needle-cylinder provided with an annular slot, the plates arranged in said slot, the vertical plates connected with said plates, and the bands having hinged arms for retaining the vertical plates in place and permitting their removal as desired, substantially as described.

9. In a knitting-machine, the combination, with the needle-cylinder, of the herein-described clamp for holding the needle-cylinder in place, consisting of the band having the arms at the ends thereof, one of said arms having a cam-face, and the shaft passing through said arms and having a cam for operating in conjunction with the cam-face of the arm to cause the band to clutch or clamp the cylinder, substantially as described.

10. In a knitting-machine, the combination of a cam-cylinder having a half-cam on its exterior and provided with means, substantially as described, connected therewith for imparting a reciprocating motion thereto, of rock-shafts operated by said cam, pawls connected with said rock-shafts, ratchet-wheels operated by said pawls, shafts rotated by said ratchet-wheels, bevel gear-wheels operated by said shafts, and the curved vertical and the slotted plates operated by said gear-wheels for operating upon the needles, substantially as described.

11. In a knitting-machine, the combination of a cylinder having a cam, rock-shafts carrying at one end rollers operated by the said cam and at the other end pawls, a shaft having ratchet-wheels with teeth in opposite direc-

tions, and bevel gear-wheels thereon, curved vertical plates with racks, slotted curved plates with lips, and a needle-cylinder with a slot and depressed portion, substantially as described.

12. In a knitting-machine, the combination of the needle-cylinder provided with an annular slot and depressed portion, the needle-operating plates arranged in said slot, the vertical plates connected with said plates, the band or ring having passages to receive the vertical plates and hinged arms to close said passages, racks secured to the vertical plates, gear-wheels engaging said racks, shafts carrying said gear-wheels, having ratchet-wheels mounted thereon with their teeth arranged in opposite directions, pawls for engaging said ratchet-teeth to cause the shafts on which they are mounted to rotate in opposite directions, and mechanism for operating said pawls, substantially in the manner and for the purpose described.

13. In a knitting-machine, the combination, with the driving gear-wheel having a cam or projection, of the lever operated by said cam or projection, the pawl carried by said lever, a ratchet-wheel operated by said pawl, the wheel rotated by said ratchet-wheel, the chain having the arms carried and moved by the rotation of the wheel, the spring-actuated rod released by contact with said arms, and a shifting-lever operated by said spring-actuated rod to throw the machine out of operation, substantially in the manner and for the purpose described.

14. In a knitting-machine, the stitch-regulator consisting of a cylinder having side cams adjusted by means of screws passing through slots in the cylinder, and having an angle-plate connected therewith, the screw engaging said angle-plate, the crank or handle connected to said latter screw for rotating the same to raise and lower the angle-plate and cams, the pin or stud on said crank, and the plate having a series of openings adapted to receive said pin for retaining the handle, and consequently the angle-plate and cams, in the desired adjusted position, substantially in the manner and for the purpose described.

15. In a knitting-machine, the combination of a needle-cylinder having an annular slot and a depression below the same to receive the butts of the needles, curved plates arranged in said slot and having needle-passages therein and provided with arms or lips for guiding the needles into said passages, plates having racks, rotary gear-wheels meshing with said racks for moving said plates, and means, substantially as described, for actuating said gear-wheels, substantially as and in the manner set forth.

JOHN B. HIPWELL.

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