

(No Model.)

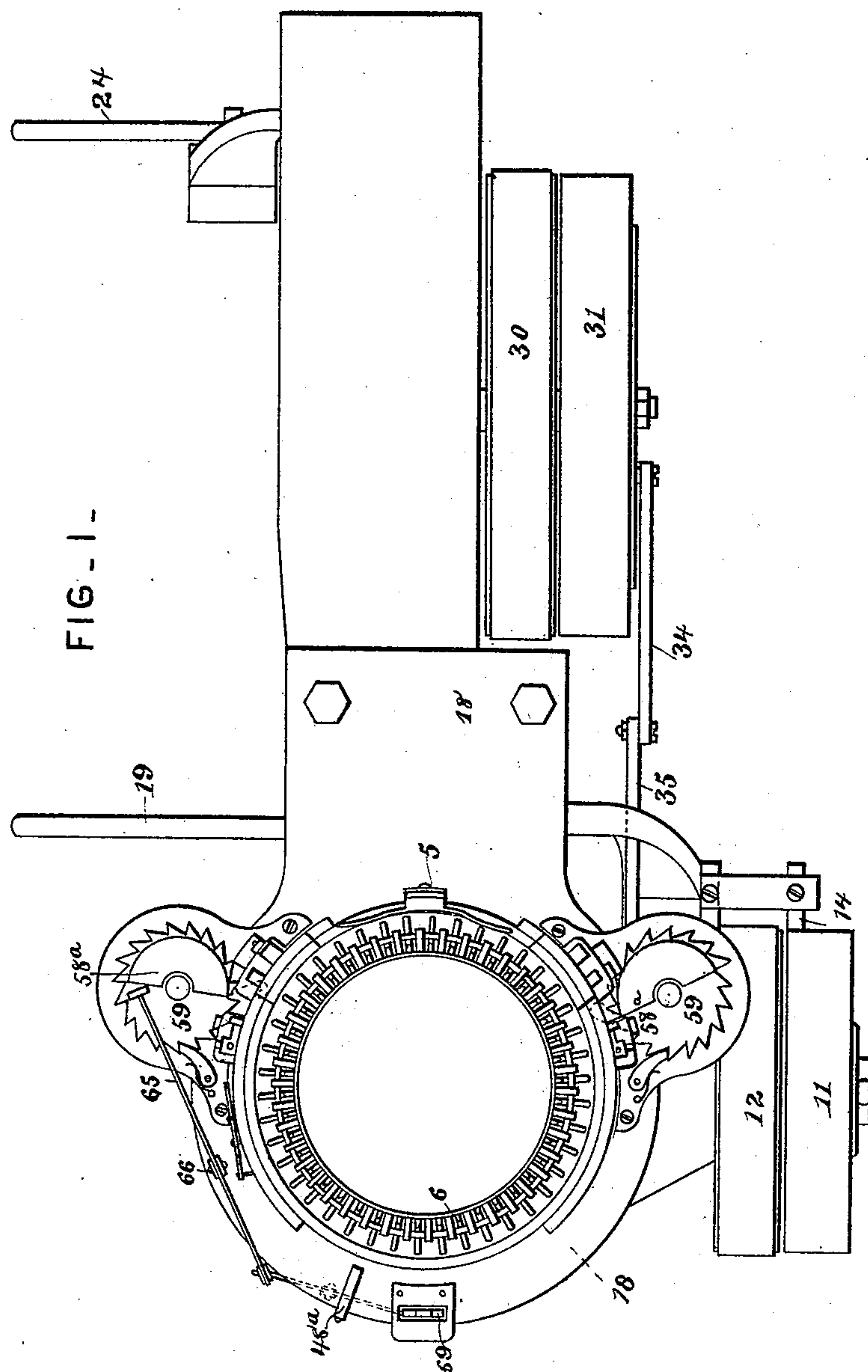
7 Sheets—Sheet 1.

E. LIPPITT.

CIRCULAR KNITTING MACHINE.

No. 396,578.

Patented Jan. 22, 1889.



Witnesses,

Edmund Steer,

Emma Arthur.

Inventor,

Elihu Lippitt

By Knight Bros

Attys

(No Model.)

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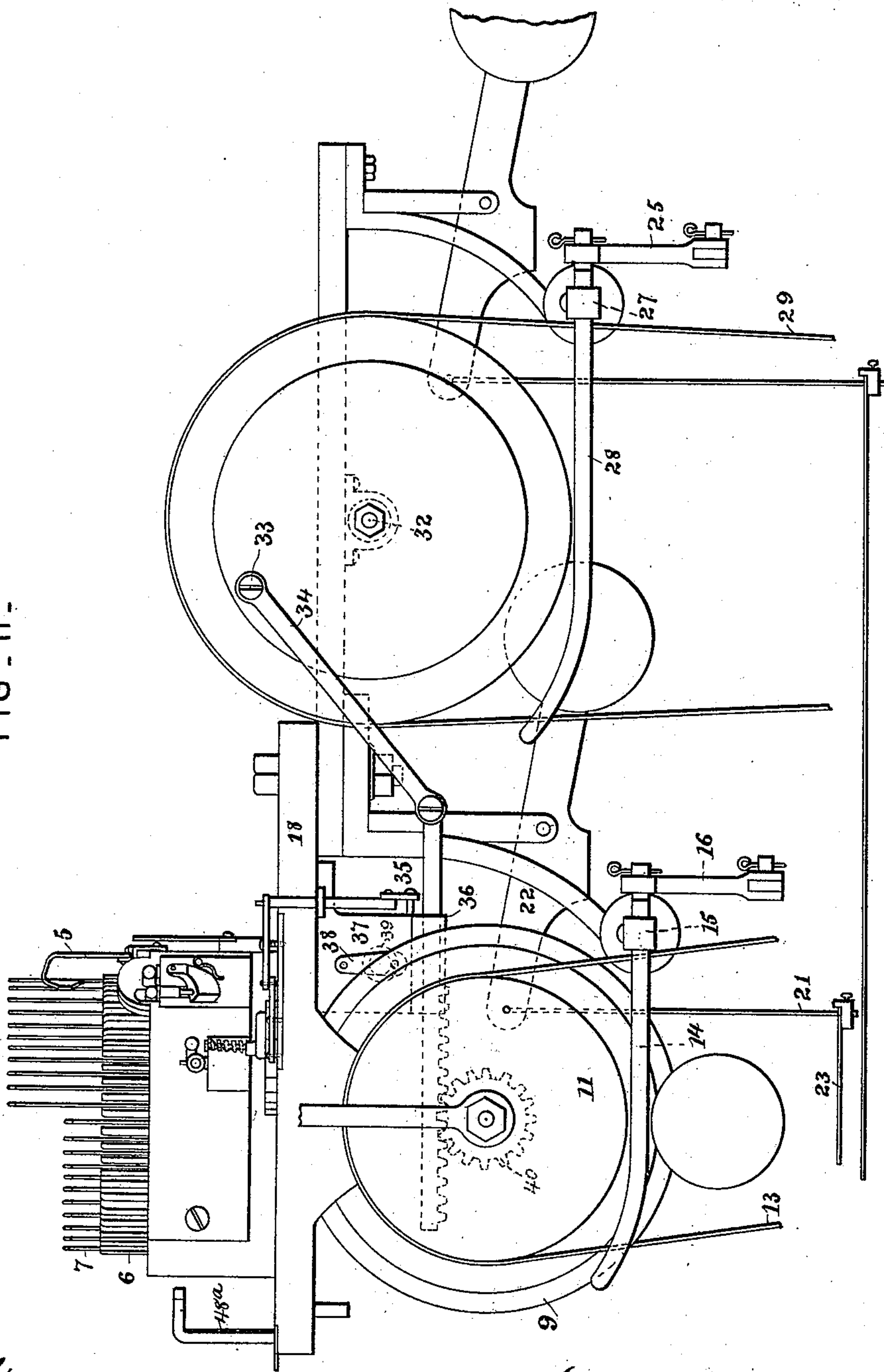
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FIG - II -



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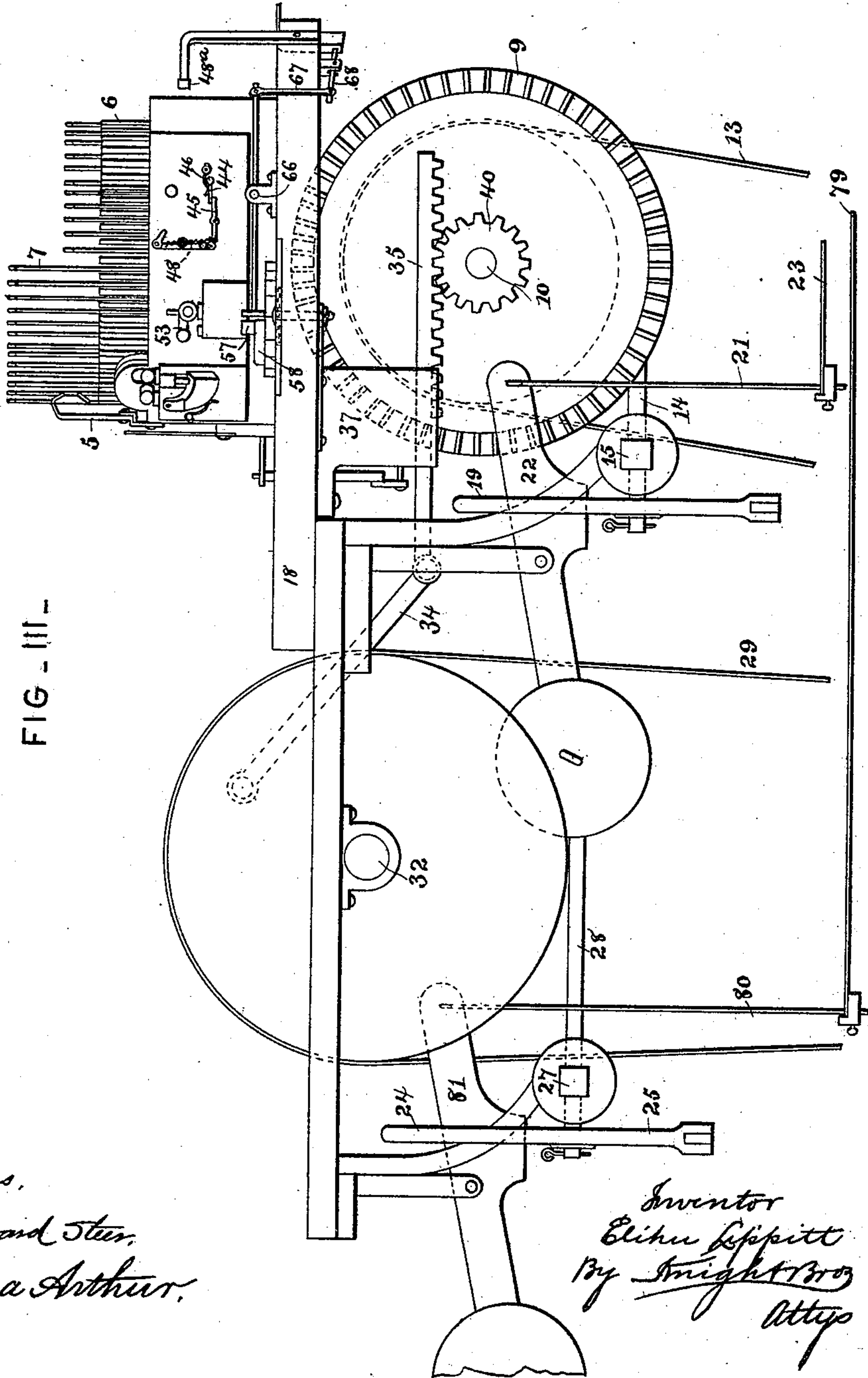
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FIG - IV -

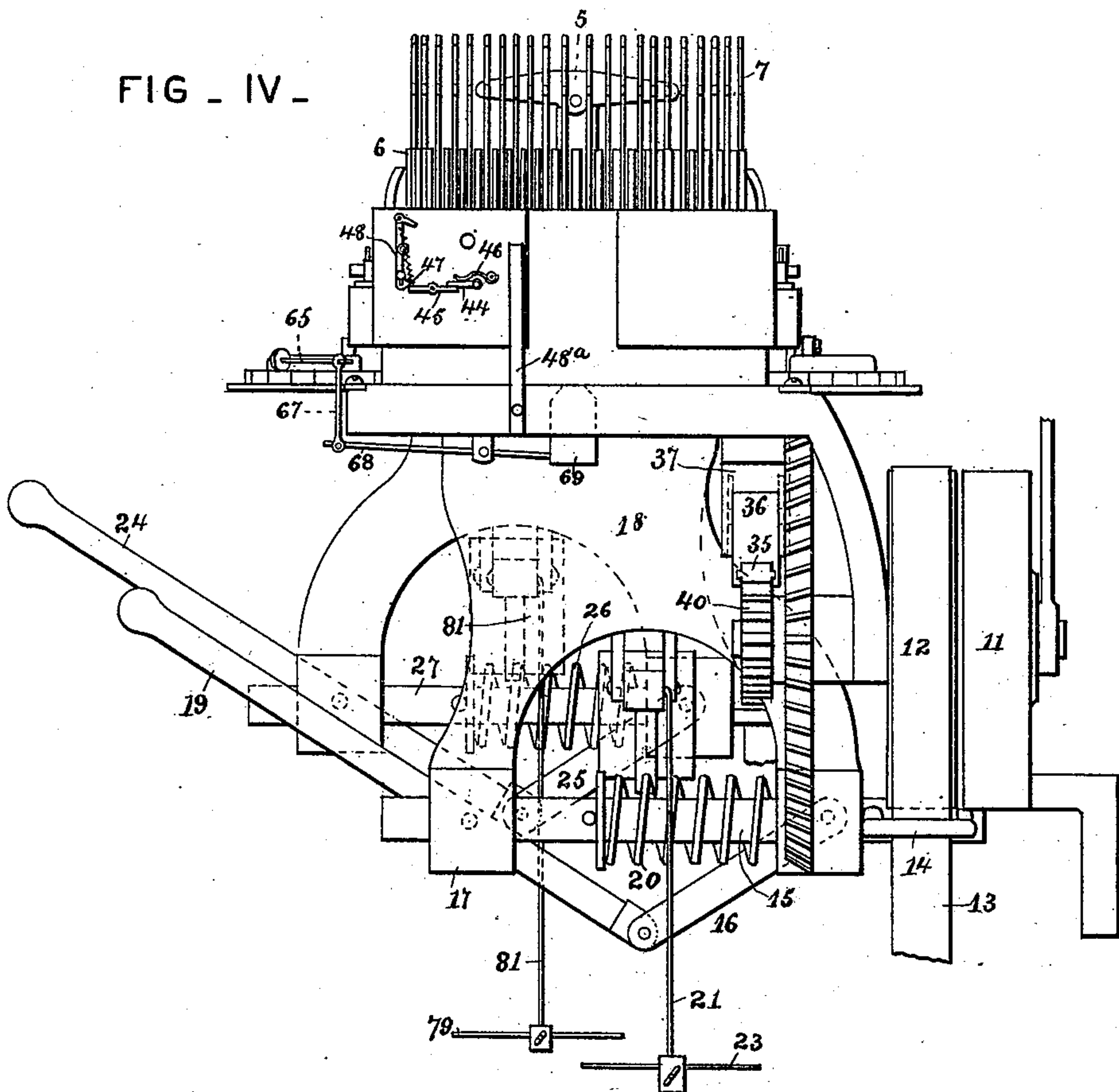
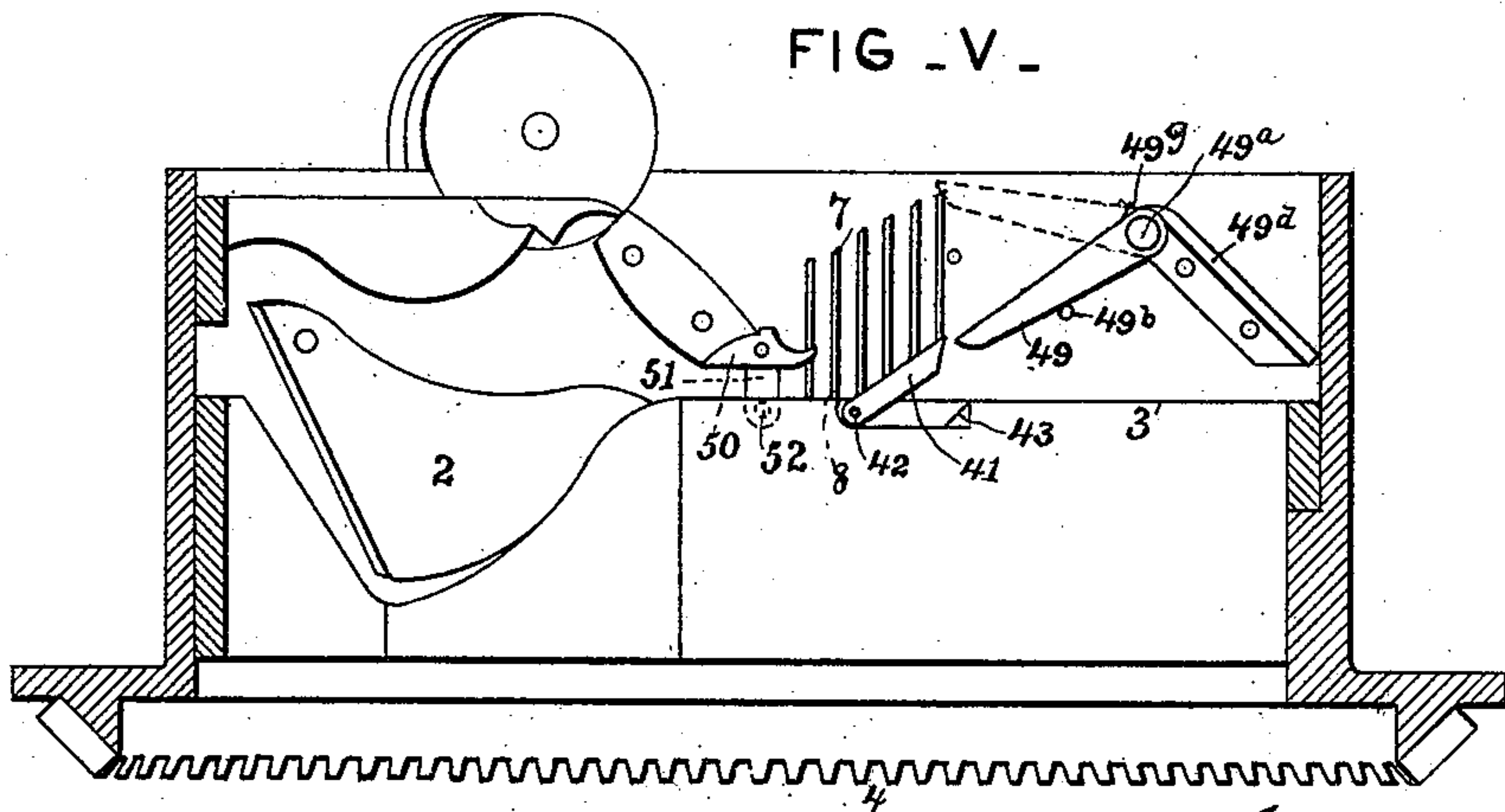


FIG - V -



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FIG. VI.

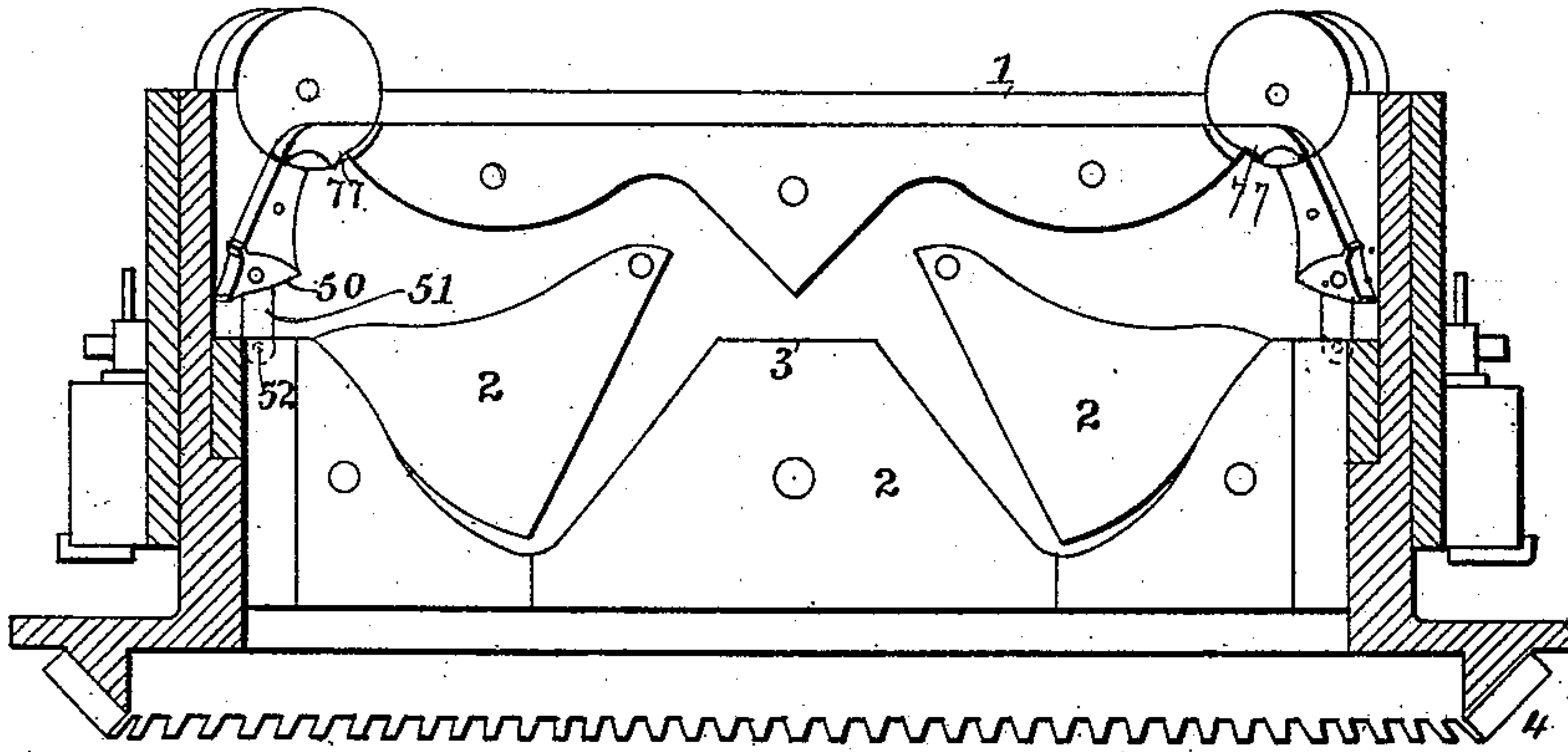


FIG. VII.

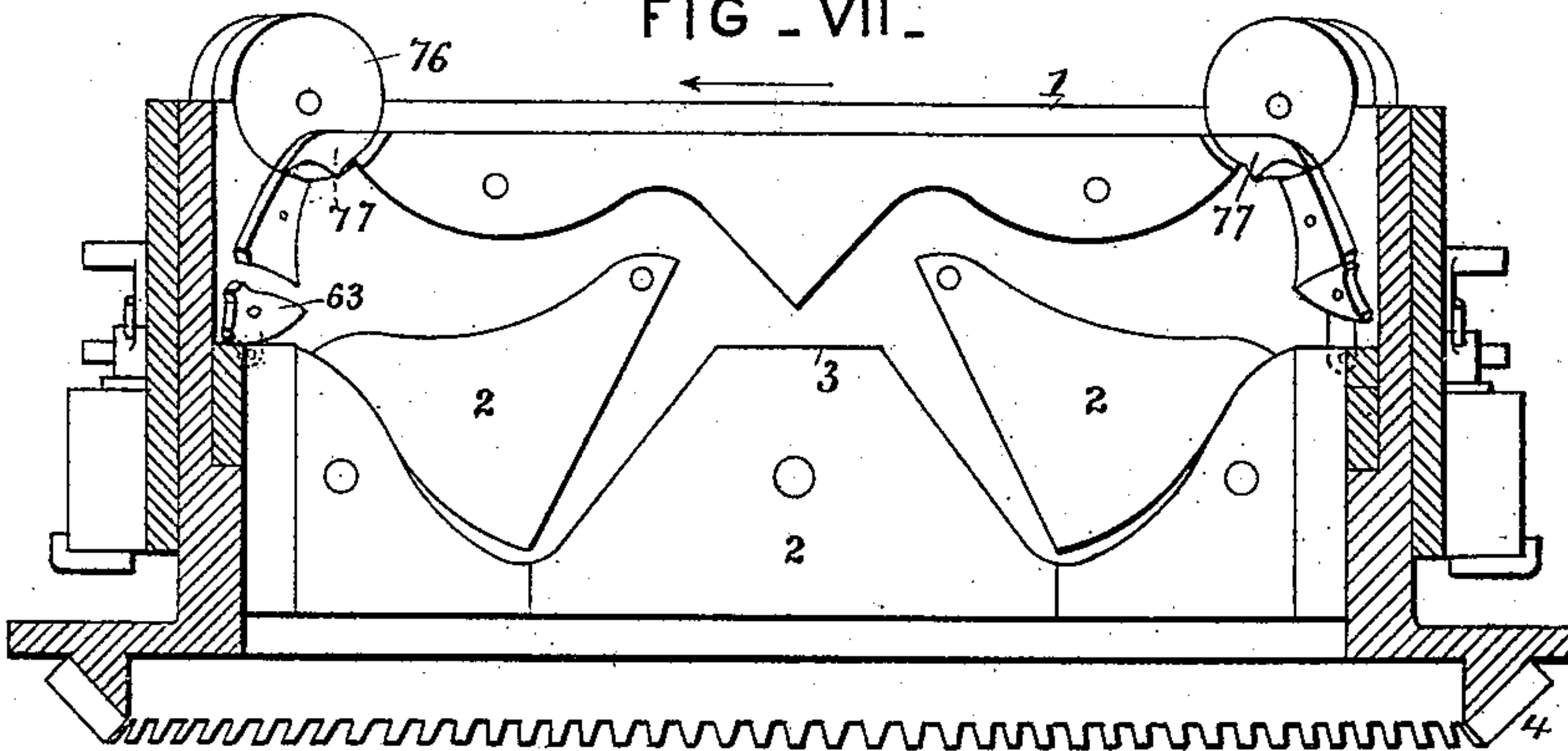
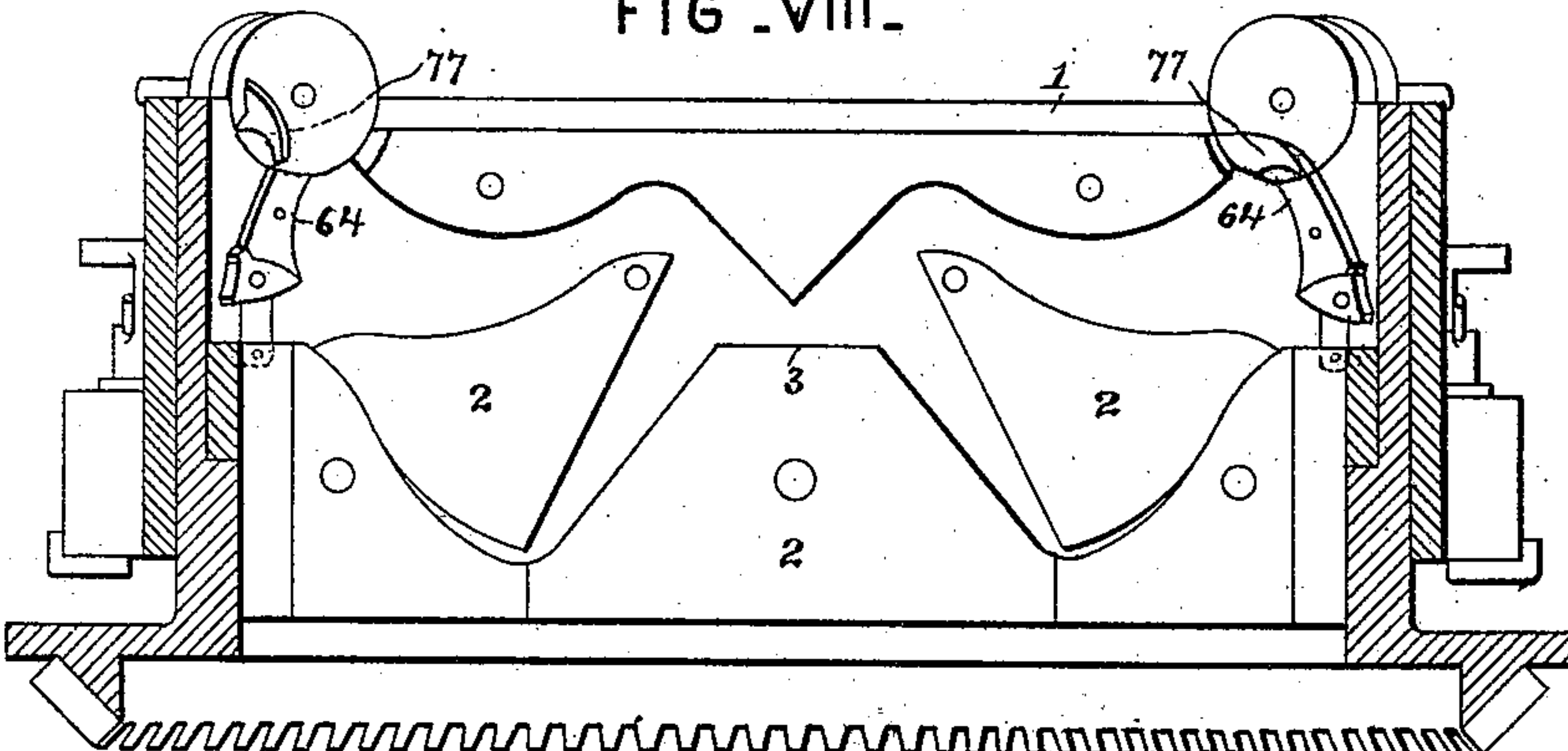


FIG. VIII.



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FIG. XIII.

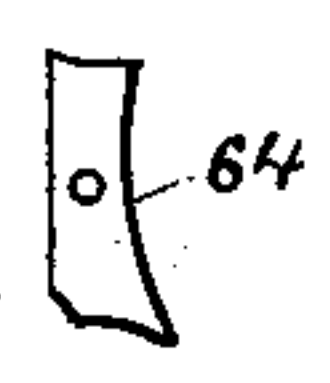


FIG. XIV.

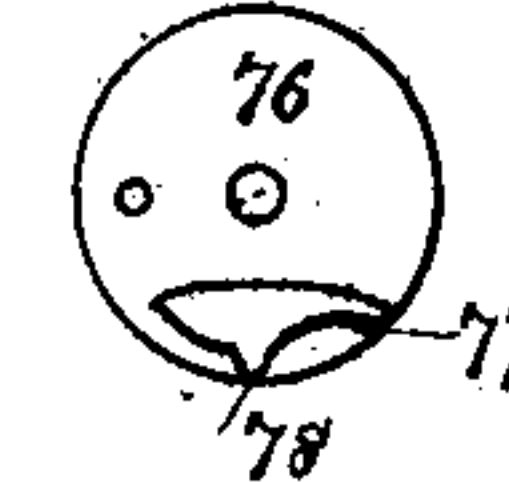
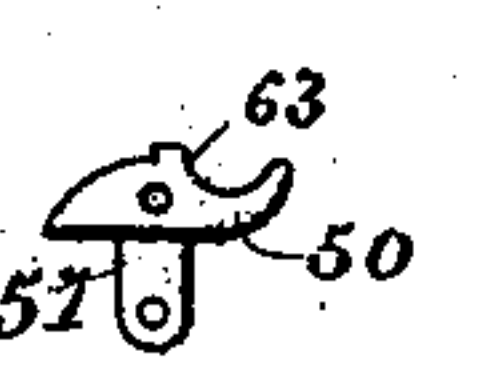


FIG. XV.



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(No Model.)

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FIG. IX.

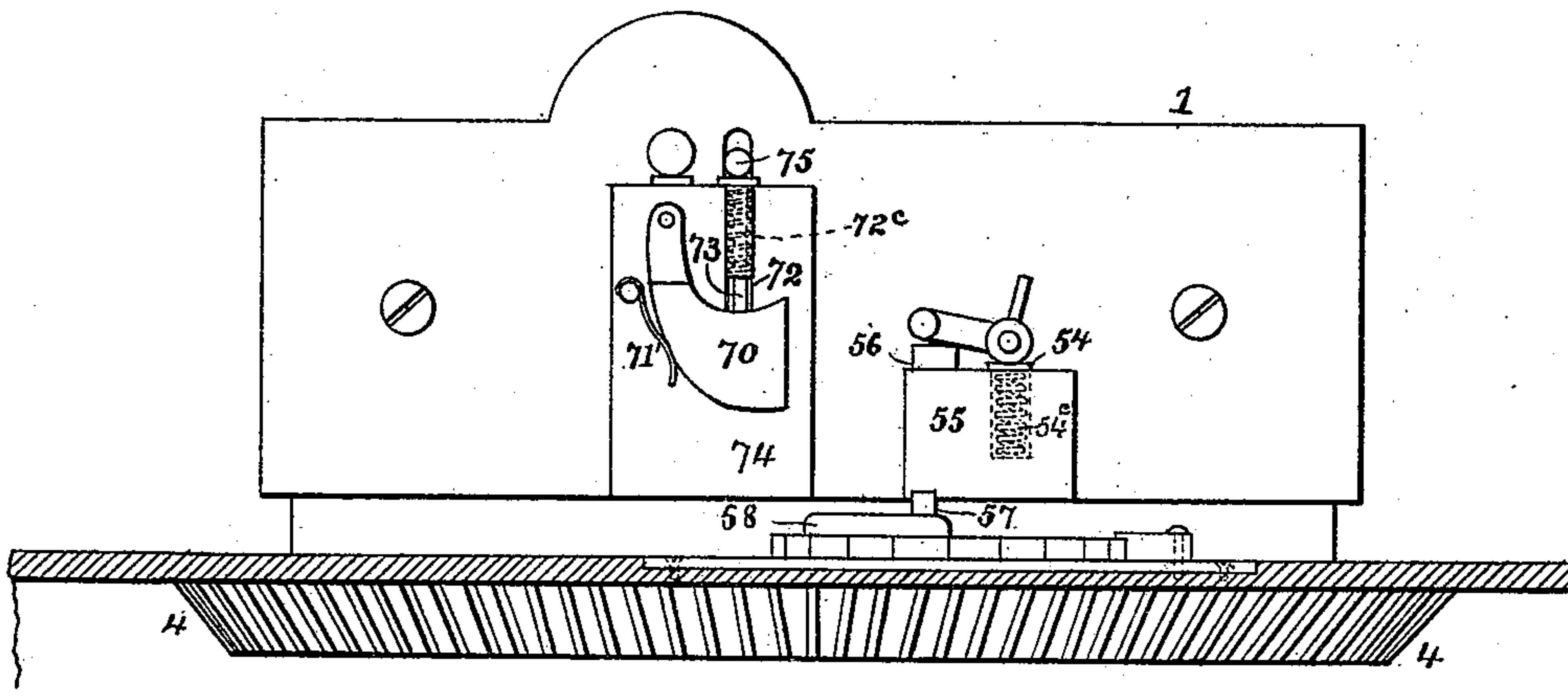


FIG. X.

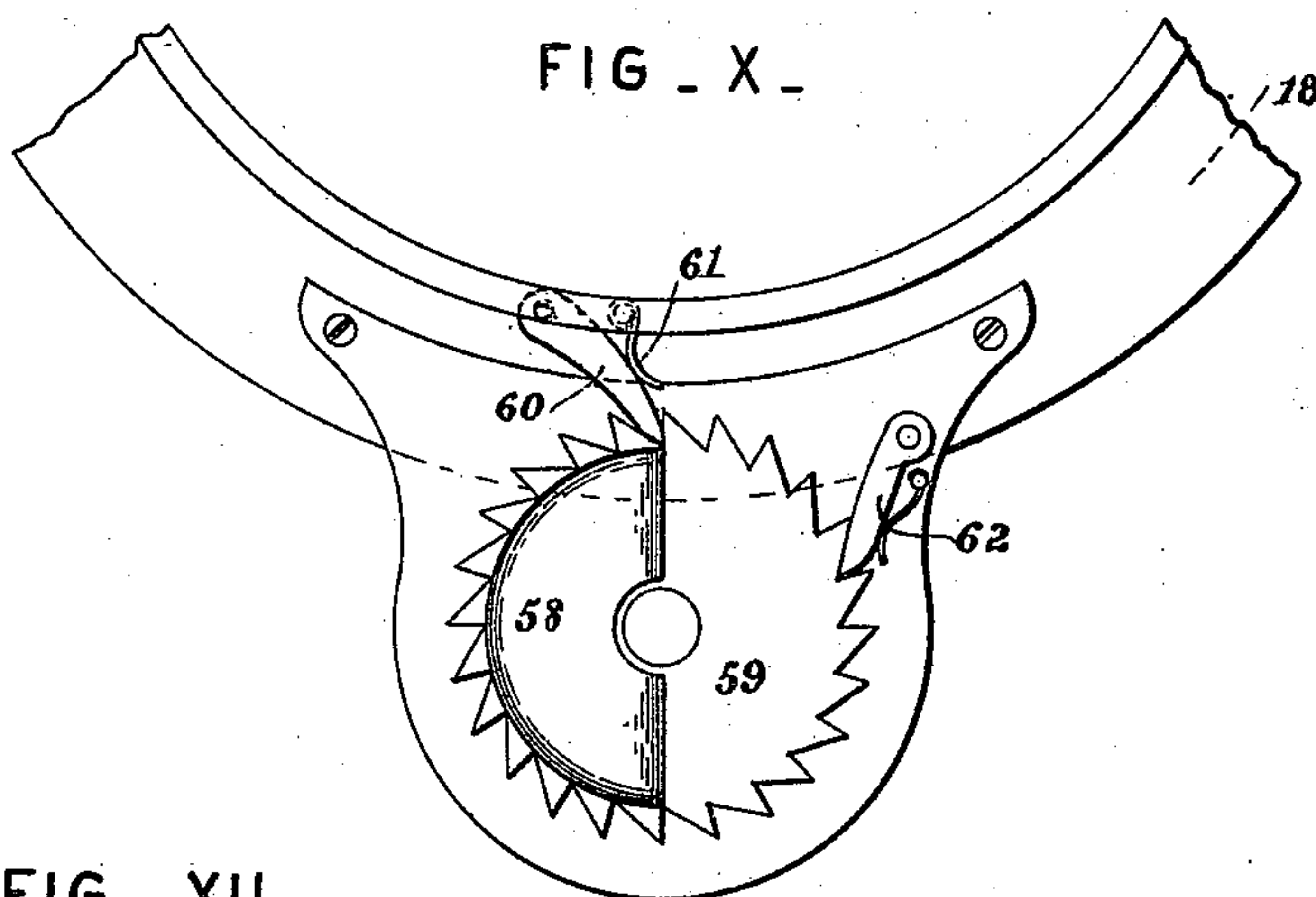


FIG. XII.

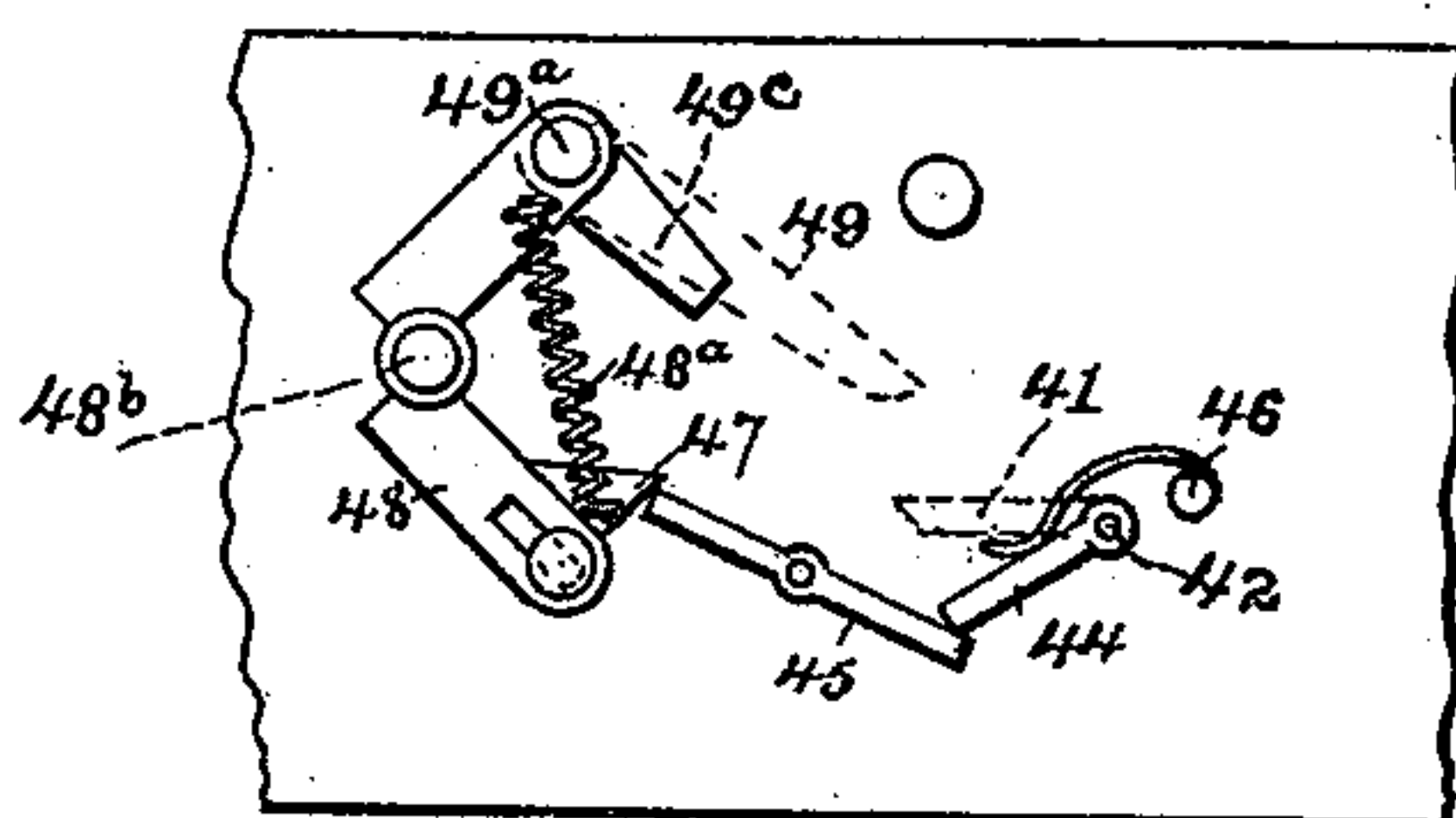
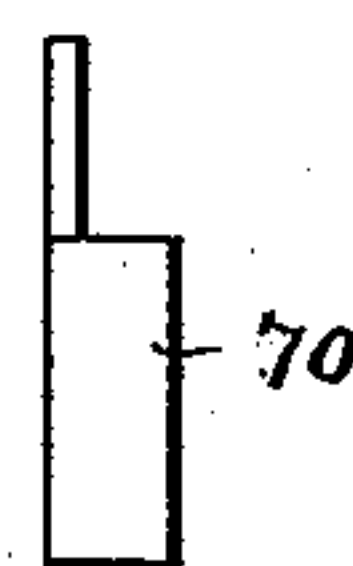


FIG. XI.



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(No Model.)

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FIG. XVI.

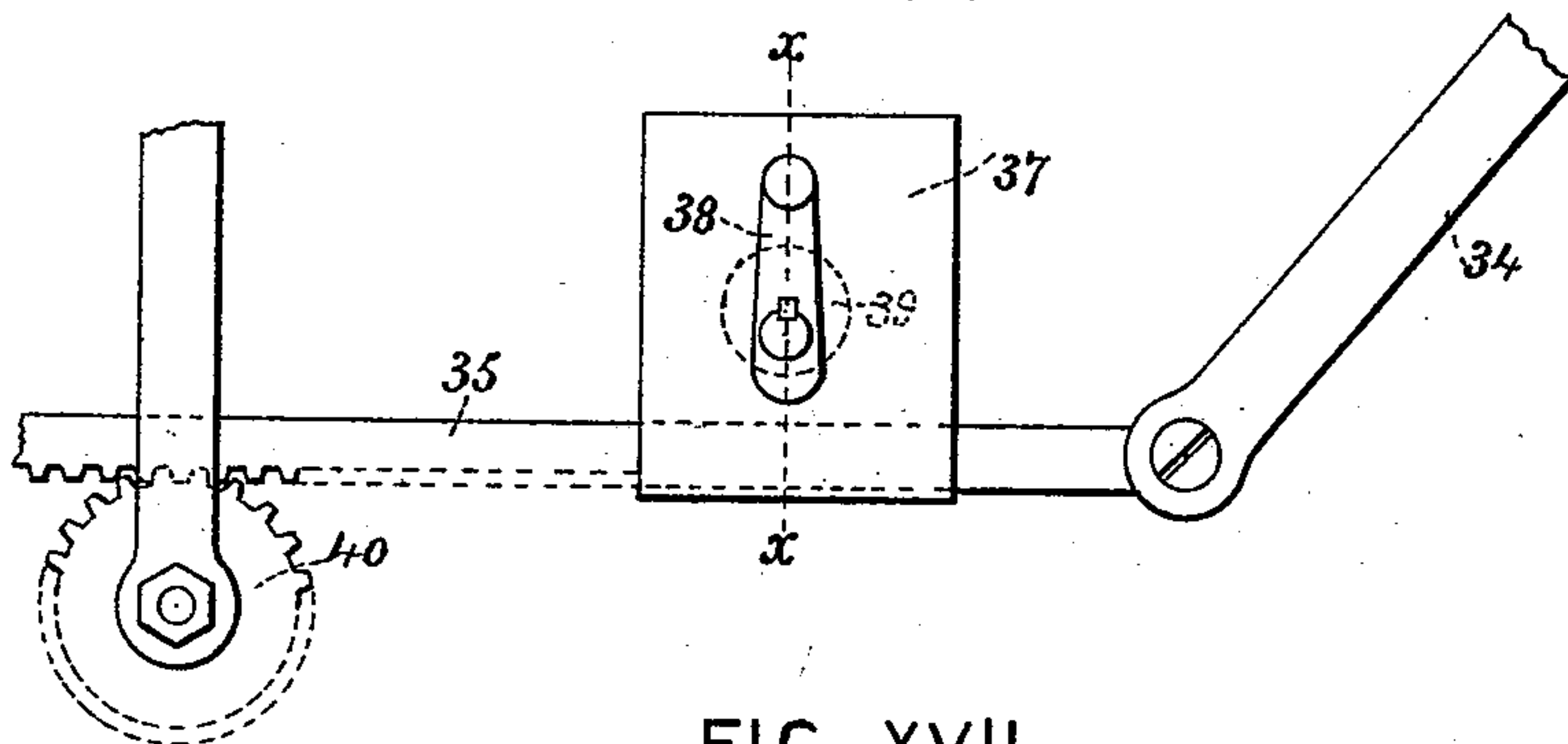
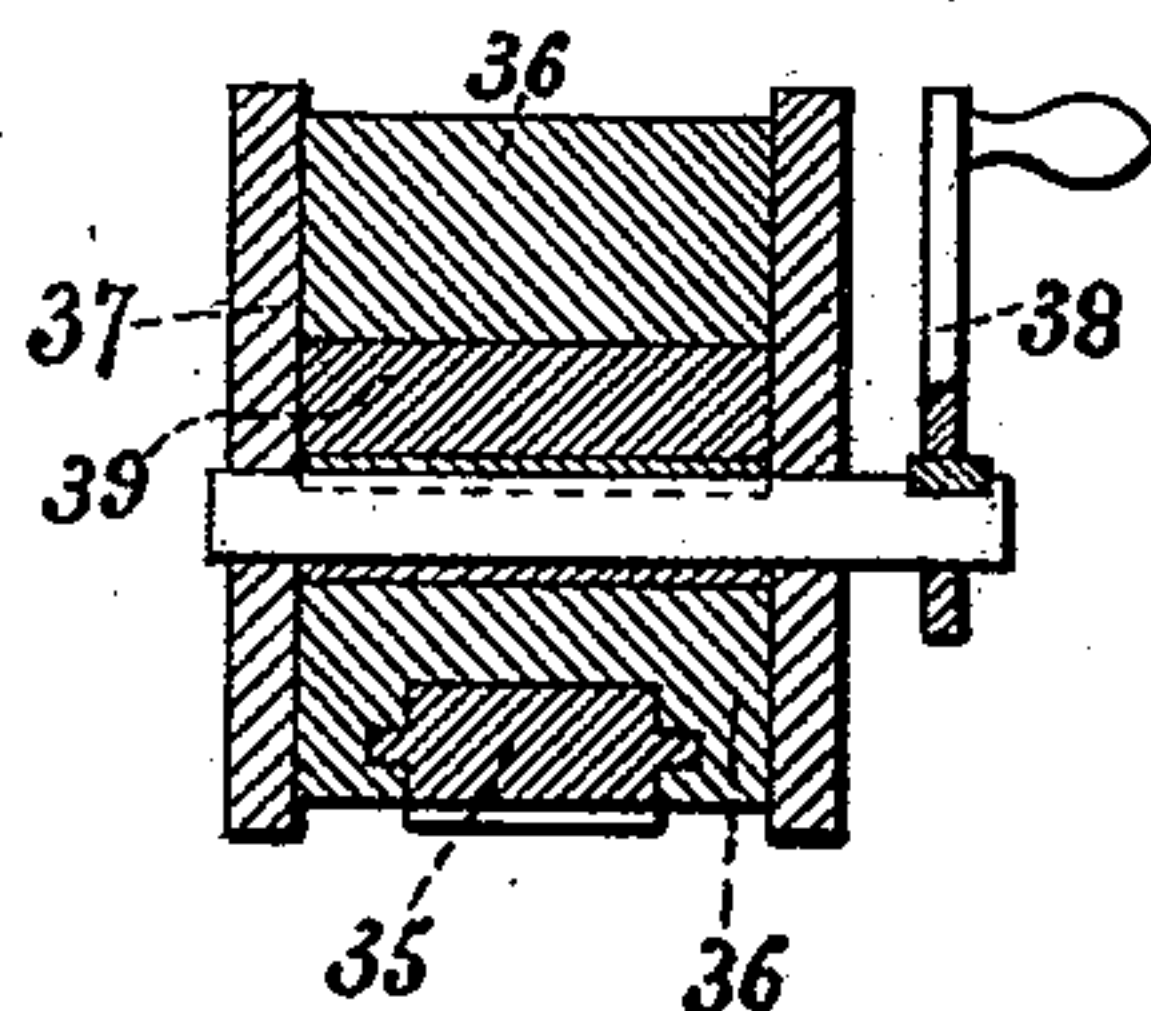


FIG. XVII.



Attest:

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Inventor:

Elihu Lippitt
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attys.

UNITED STATES PATENT OFFICE.

ELIHU LIPPITT, OF ZANESVILLE, ASSIGNOR TO ANNA L. LIPPITT, OF MUSKINGUM COUNTY, OHIO, AND H. H. STURTEVANT AND JOHN MARTIN.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 396,578, dated January 22, 1889.

Application filed September 5, 1887. Serial No. 248,871. (No model.)

To all whom it may concern:

Be it known that I, ELIHU LIPPITT, a citizen of the United States, residing at Zanesville, in the county of Muskingum and State of Ohio, have invented certain new and useful Improvements in Circular-Knitting Machines, of which the following is a specification.

My invention has for its object the production of a circular-knitting machine which shall be entirely automatic so far as the needle movement is concerned, and which shall involve as little change and complication of the ordinary circular-knitting machine as possible.

To this end my improvements consist in certain details of construction, which will first be fully described with reference to the accompanying drawings, and then pointed out in the claims.

In said drawings, Figure I is a plan view of a circular-knitting machine embodying my improvements. Fig. II is a side elevation of the same. Fig. III is a similar view from the opposite side. Fig. IV is a front elevation. Fig. V is a vertical section of the cam-cylinder, showing the mechanism for throwing up out of action one-half or any desired number of the needles at one reciprocation of the cam-cylinder. Fig. VI is a similar view in a vertical plane at a right angle to that followed in Fig. V, the cams being shown in position for continuous rotary movement of the cam-cylinder. Fig. VII is a similar view, the cams being shown in position for throwing up out of action one needle at each end of the row of stitching-needles at each reciprocating stroke of the cam-cylinder. Fig. VIII is a similar view with cams shown in position for throwing down into action one needle at each end of the row of stitching-needles at each reciprocating stroke of the cam-cylinder. Fig. IX is a side elevation of the cam-cylinder, showing the cam-operating mechanism. Fig. X is a plan view of the ratchet-cam and the adjacent parts. Fig. XI is an edge view of the operating-lever of the throwing-down cams. Fig. XII is a detail elevation of the mechanism for throwing up and down one-half the needles. Figs. XIII, XIV, and XV are elevations of details hereinafter described. Fig. XVI is a side elevation, on a larger scale, of

the mechanism for throwing the rack-bar into and out of engagement with its pinion. Fig. XVII is a vertical sectional view of the same on line X X of Fig. XVI.

The following parts of the knitting-machine may be of the ordinary form shown, or of any approved construction. The cam-cylinder 1, having stitch-cams 2, shoulder 3, circular beveled driving-rack 4, and yarn-guide 5, needle-cylinder 6, having needles 7, each with a foot, 8, bevel-gear 9, keyed on shaft 10 and meshing with circular rack 4, driving-pulley 11 and loose pulley 12 on said shaft, driving-belt 13, traveling on said pulleys and shifted by arm 14 on sliding rod 15, toggle 16, having one member pivoted to the rod 15 and the other to a bracket, 17, of the main frame 18, and operated in one direction by handle 19 and in the other by retractile spring 20, and rod 21, hung from weighted lever 22 and carrying pan 23 to receive the weighted lower extremity of the article being knitted and trip the toggle for the purpose of shipping the belt.

A knitting-machine constructed, as shown, with the important elements as referred to above is capable of knitting a continuous circular fabric, and may be and commonly is so manipulated by the operator as to make varieties of goods, particularly hose and half-hose, in which at certain stages of the operation (as while forming the toe and heel) a pouch must be made by altering the motion of the cam-cylinder from a continuous circular to a reciprocating motion and by hand throwing out of and then into action the necessary number of needles. When performed by hand, this portion of the operation is not only necessarily slow, but to a considerable extent inaccurate, and my purpose is therefore to render the changing of the motion of the machine and the throwing out and in of the needles automatic. Supposing, now, that the cylindrical upper portion of a stocking or sock has been formed (either with or without ribs for a portion of its length) and the pouch for the heel is to be formed. Simultaneously two actions take place; one-half of the needles are to be thrown up out of action, and the motion of the cam-cylinder is to be reciprocating instead of circular. The weight pendent from the knitted web at the proper

moment strikes the pan 23, and by tilting weighted lever 22 trips the toggle 16 and allows the retractile spring 20 to draw the rod 15 and shift the belt 13 from fast pulley 11 to loose pulley 12. The machine then stops to allow the heel-yarn to be substituted for that used for making the upper portion of the hose. When this is done, the operator, by depressing handle 24, straightens a second toggle, 25, against the force of the retractile spring 26, and so moves the sliding rod 27, and thereby the arm 28, and shifts the belt 29 from pulley 30 to pulley 31. Both these pulleys are loose on a shaft or stud, 32, fixed to the main frame 18. The belt 29 may be driven from the same shaft as belt 13, such shaft not being here shown. The pulley 31 has a wrist, 33, for connecting-rod 34 of a rack-bar, 35. The rack-bar 35 is hung in a block, 36, adapted to slide vertically on a bracket, 37, and operated by handle 38 and cam 39. By means of this mechanism the operator lowers the rack-bar into engagement with a pinion, 40, keyed on shaft 10, when, as just described, the pulley 31 is set in motion by belt 29. By the reciprocation of rack-bar 35 a rotary reciprocating motion is thus given the cam-cylinder. Before proceeding to knit the heel-pouch, however, it is necessary to throw one-half of the needles up, so that their feet will no longer come in contact with the stitch-cams. To this end a cam, 41, is arranged on a pin or shaft, 42, so journaled in the cam-cylinder that when not in operative position said cam may occupy a seat, 43, and not interrupt the continuity of the shoulder 3. On the shaft 42 outside of the cam-cylinder is a lever, 44, held up by a latch, 45, against the action of a spring, 46. A dog, 47, carried by a toggle-lever, 48, is adapted for engagement with an end of latch 45, and in order to throw the cam 41 into the position shown in Fig. V and hold it there the said toggle-lever is set to the position shown in Figs. III and IV before the first reciprocation of the cam-cylinder. Cam 49, mounted loosely on shaft or pin 49^a, rests normally against pin 49^b in the position shown in Fig. V. With parts positioned as in Fig. V, as the cam-cylinder moves to the left in the said figure the cam 41 will strike the heels of the needles, lift them, and transfer them to the cam 49, whereby they are lifted entirely out of action. By having the cam 41 below the track along which the feet of the needles travel, instead of above, it may be made to strike in between any two needles desired. It could not so readily be made to strike between the two proper needles if it were pivoted above the feet of the needles, the space between the needles being so small. When half of the needles have been thus raised out of action, a projection, 48^a, on the main frame strikes a stud, 48^b, on the toggle-joint 48, throwing the latter to the position shown in full lines in Fig. XII, releasing latch 45 and permitting spring 46 to depress the cam 41 into its seat, the feet of the remaining

needles passing over said cam and continuing in their path immediately over the shoulder 3. A spiral spring, 48^a, connects the two parts of toggle-lever 48 for accelerating its movement. When, on the other hand, the same needles are to be thrown down, the cam 49 is raised by hand-lever 49^c to the position shown in dotted lines in Fig. V, and then in the movement of the cam-cylinder to the left in Fig. V the heels or feet of the needles will pass under said cam and under cam 49^d, and be thereby again brought into position for action. When in this upper position, a projection, 49^e, on cam 49 prevents its passage beyond the proper angle by engaging with cam 49^d. After raising into inoperative position one-half the needles for narrowing the pouch in forming the heel it is necessary to throw the remaining needles one by one out of action. For this purpose I employ cams 50 50, carried by arms 51 51, which are journaled at 52 52 in the cam-cylinder on each side of the stitch-cams.

53 53 are arms fixed to the journals of arms 51 51 outside of the cam-cylinder. Pins 54 54 are mounted in plates 55 55, fixed to the outside of the cam-cylinder, and are forced up by springs 54^e, (shown in dotted lines in Fig. IX,) so as to bear on the hubs of arms 53 53 and form brakes to hold the cams 50 50 in any position to which they are shifted.

56 56 are vertically-moving rods mounted in plates 55 55, and having feet 57 57 projecting outwardly in the path of cams 58 58. Springs shown in dotted lines in Fig. II press these rods down. The cams 58 58 are semi-circular and are carried by horizontal ratchet-wheels 59 59, pivoted on the main frame 18. The edges of the cams 58 58 are beveled off, so that the feet 57 57 will ride up on them without difficulty.

60 60 are pawls carried by the cam-cylinder, and so held by springs 61 61 as to engage each pawl with its corresponding ratchet-wheel 59 59 at each reciprocation of the cam-cylinder, and thus move said ratchet-wheel forward one tooth. In returning, the pawls slide freely over the teeth of the ratchet-wheels, and check-pawls 62 62 hold the latter from turning.

The arrangement of the parts is such that the ratchet-cams 58 58 are by the devices hereinafter fully described brought with the advance faces (marked *a a* in Fig. I) immediately in the path of the feet 57 57 at the first reciprocation of the cam-cylinder. When moving in one direction, therefore, one of said feet will strike the appropriate cam 58, lying in its path, while on the return movement the other foot 57 will strike the other cam 58. The feet are therefore lifted alternately, and they will raise the rods 56 56, so as to bring the cams 50 50 down from the position shown in Fig. VI to that shown in Fig. VII on the left-hand side in time to receive the first needle at each end of the series of needles in action.

In Fig. VII the cam 50 at the left is shown down in full lines to receive the first needle when the cam-cylinder is moving in the direction of the arrow, while at the right the cam 50 is shown up, it being forced down in time to receive the first needle at the other end of the series on the return movement of the cam-cylinder. The first needle striking either of the cams 50 bears on a shoulder 63 thereon and carries the cam with it, the cam-carrying arm turning about its journal or pivot 52. The arm 53 and rod 56 do not oppose this motion, for immediately on the foot 57 passing beyond the cam 58 the rod 56 is depressed by its spring, so as to allow arm 53 to descend. The needle which has thus been picked up by the cam 50 is transferred to the inclined guide 64 and by it raised entirely out of action. The cam now occupies the position shown in Figs. V and VI until again brought into action at the next reciprocation of the cam-cylinder. Thus one by one the needles are raised out of action until the cams 58 58 have been turned by pawls 60 60 and ratchet-wheels 59 59 beyond the path of the feet 57 57. The cams and ratchet-wheels may be varied so as to have this occur after any desired number of needles have been raised. The heel is now half-formed, and one by one the needles just thrown out are to be thrown down into action to widen the pouch. At this point one end of rocking lever 65, which has been resting on one of the ratchet-wheels 59, is struck by the advance face of cam 58 on said wheel and raised. Lever 65 is pivoted at 66 to a standard on the main frame and connected by rod or link 67 to a lever, 68, hung to a bracket under the main frame and supporting a cam, 69. This cam projects through a slot in the main frame, and when the lever 65 is acted on by cam 58, as described, the cam 69 is raised and protrudes above the base or frame in the path of arms 70. These arms are pressed up by springs 71 71, which yield to allow the arms to swing back out of the way when they strike cam 69 on the return movement of the cam-cylinder, but which return the said arms to the position shown in Figs. II, III, and IX in time to receive impact of the cam 69 on their curved lower faces. When thus struck by this cam, the arms 70 70 are alternately raised and carry with them rods 72 72, whose feet 73 73 rest on said arms, being pressed down by springs 72^c. (Shown in dotted lines in Fig. IX.) These members are supported in plates 74 74, fixed to the outside of the cam-cylinder. At their upper ends the rods 72 72 bear against studs 75 75, passing through slots in the cam-cylinder and carried by disks 76 76, on the inner faces of which are cams 77 77. (See Figs. VI, VII, and VIII.) While the needles are being thrown up by the mechanism previously described, the cams 77 77 remain in the position shown in Fig. VI, making no break in the continuity of the upper track for the feet of the needles.

As soon, however, as all needles which are to be thrown out of action have been thrown up and are to be one by one thrown down the cams 77 77 are by the operation of the mechanism just described alternately raised into the position shown in full lines at the left of Fig. VIII. When in this position, the first needle of the series out of action, striking one or the other of the cams 77 77 at each reciprocation of the cam-cylinder, is deflected by said cam, and, striking the shoulder 78 thereon, carries said cam with it into the position shown in Figs. V, VI, and VII. The remainder of the needles will therefore pass on, while the one needle at the end of the series, striking the cam-groove of the cylinder, will come again into action. One by one the needles are thus thrown down until half of them are in operation and the heel has been formed. The end of lever 65 now falls off the cam 58, said cam having been returned by the continuous reciprocation of the cam-cylinder to the position shown in Fig. I, ready to again operate the throwing-up cam 50. The cam 69 is depressed, so as to no longer operate the arms 70 70. By disengaging spring 61 from pawl 60, or by any other well-known means forcing the pawl out of mesh with the ratchet, the pawl will be rendered inoperative during ordinary knitting.

The weight employed to draw down the heel while being formed strikes a pan, 79, carried by a rod, 80, and, tilting the weighted lever 81, bends the toggle 25 and allows the spring 26 to shift the arm 28 and shift the belt 29 from the pulley 31 to the loose pulley 30. The reciprocating action of the cam-cylinder therefore ceases, and the operator may raise the rack-bar 35 from engagement with its pinion by means of handle 38. The thread may now be again changed, the remaining half of the needles thrown down by cam 49, and the handle 19 depressed to start again the continuous action of the cam-cylinder and form the foot. When the toe is reached, the operation is the same as at the heel.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In a circular-knitting machine, the combination, with the needles, a needle-holder, and a cam-cylinder, of a cam, as 41, pivoted to said cylinder below the path of the needles for throwing the needles up out of action, a lever connected with the pivotal shaft of said cam on the outside of the cylinder, a lever, as 45, and a spring and toggle-levers for actuating said lever, whereby the cam is operated, substantially as described.

2. The combination, with the main frame, needles, needle-holder, and cam-cylinder, of throwing-up cams, arms pivoted to said cylinder on which said cams are pivoted, arms secured to the journals of said first-mentioned arms on the outside of said cylinder, vertically-moving rods arranged on said cylinder

beneath said arms, and cams on the main frame for moving said rods, substantially as described.

3. The combination of the needles, the needle-holder, the cam-cylinder, throwing-up cams having pivotal connections with carrying-arms pivoted to the cylinder on each side of the stitch-cams, arms connected with said carrying-arms, cams on the main frame, vertically-moving rods mounted on the cam-cylinder operated by said cams on the main frame for moving the said arms, and thus operating the throwing-up cams, and ratchet-wheels and pawls for rotating the cams on the main frame by the movement of the cam-cylinder, substantially as set forth.

4. The combination of the needles, needle-holder, cam-cylinder, throwing-up cams, and arms on which said cams are pivoted, levers secured to said arms outside the said cylinder, cams on the main frame, rods between said last-named cams and said levers, a lever pivoted on the main frame and operated by said cams on the main frame, a lever and cam operated by said last-named lever, swinging arms, as 70, on said cylinder operated by the last-mentioned cam, throwing-down cams located near the upper inner portion of the said cylinder, studs secured to the same, vertical rods resting on said arms 70 for moving said studs, whereby the throwing-down cams are operated, springs on said rods, and the ratchets and pawls, substantially as described.

5. The combination of the needles, the needle-holder, the cam-cylinder, the stitch-cams, a throwing-down cam on each side of the stitch-cams, a cam supported on the main frame, swinging arms secured on the cylinder, spring-actuated rods supported on said arms and placed in contact with studs formed on said throwing-down cams, said cam on the main frame coming in contact with said arms, whereby said cam operates the throwing-down cams, and a lever and cam secured on the main frame for operating said cam supported on the main frame, substantially as set forth.

6. The combination, in a circular-knitting machine, of throwing-down cams having studs projecting out therefrom, springs and rods

for forcing said studs upward, arms, as 70, supporting said rods and springs, a cam located on the main frame for operating said arms 70, and levers and a cam located on the main frame for operating said other cam, whereby the same is raised and lowered, substantially as described.

7. The combination, in a circular-knitting machine, of the throwing-down cams, disks whereon the same are mounted, studs on said disks, spring-pressed rods bearing under said studs, spring-supported arms for operating said rods, and a cam on the main frame for operating said rods, substantially as described.

8. In a circular-knitting machine, the combination, with the main frame, of a cam-cylinder, 1, ratchet-cams mounted on the main frame, pawls carried by the cam-cylinder for operating said ratchet-cams, throwing-up and throwing-down cams secured to the cam-cylinder, a lever having a cam, 69, secured thereto, swinging arms secured to the cylinder and with which said cam comes in contact, spring-actuated rods supported on said arms and acting against studs connected with said throwing-down cams, vertically-moving rods carried by said cylinder, having contact with arms connected with the throwing-up cams and operated by said ratchet-cams, the lever 65, and the rod 67, substantially as described.

9. The combination, in a circular-knitting machine, of the cam-cylinder, circular driving-rack 4 thereon, bevel-gear 9, shaft 10, pinion 40, rack-bar 35, pulley 31, connected to said rack-bar, loose pulley 30, belt 29, belt-shifting mechanism and pan 79, and rod 80, for operating said belt-shifting mechanism, substantially as described.

10. The combination of a cam-cylinder, 1, driving-rack 4 thereon, gear 9, shaft 10, pinion 40, rack-bar 35, mechanism for reciprocating said rack-bar, bracket 37, sliding block 36, supporting said rack-bar and supported by said bracket, and handle 38, with cam 39, for throwing said rack-bar into and out of engagement, substantially as set forth.

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Witnesses:

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