

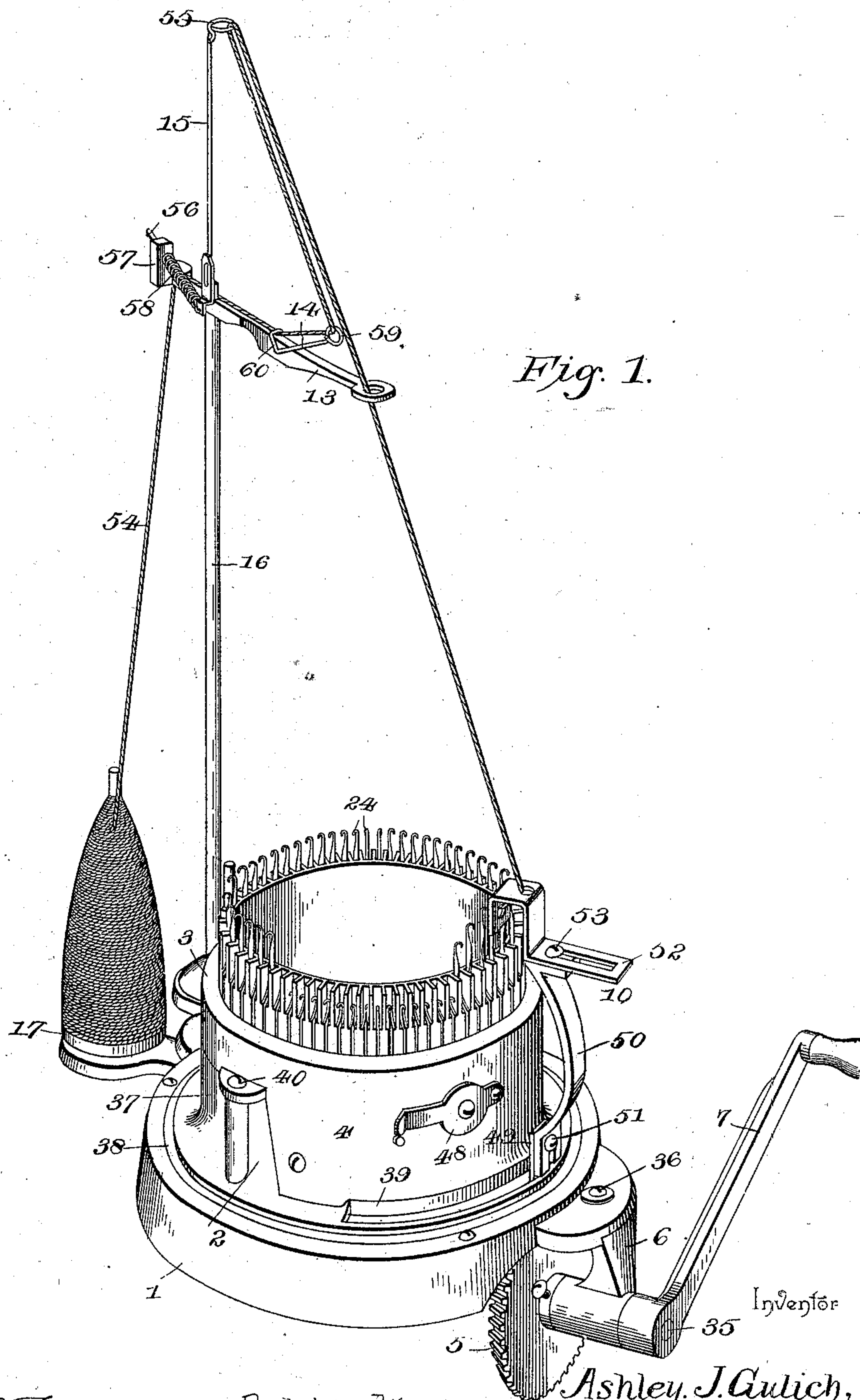
(No Model.)

4 Sheets—Sheet 1.

A. J. GULICH.  
CIRCULAR KNITTING MACHINE.

No. 560,712.

Patented May 26, 1896.



Witnesses  
Chas. Ford.  
V. B. Hillyard.

By his Attorneys.

Inventor  
Ashley J. Gulich,  
C. A. Snow & Co.

(No Model.)

4 Sheets—Sheet 2.

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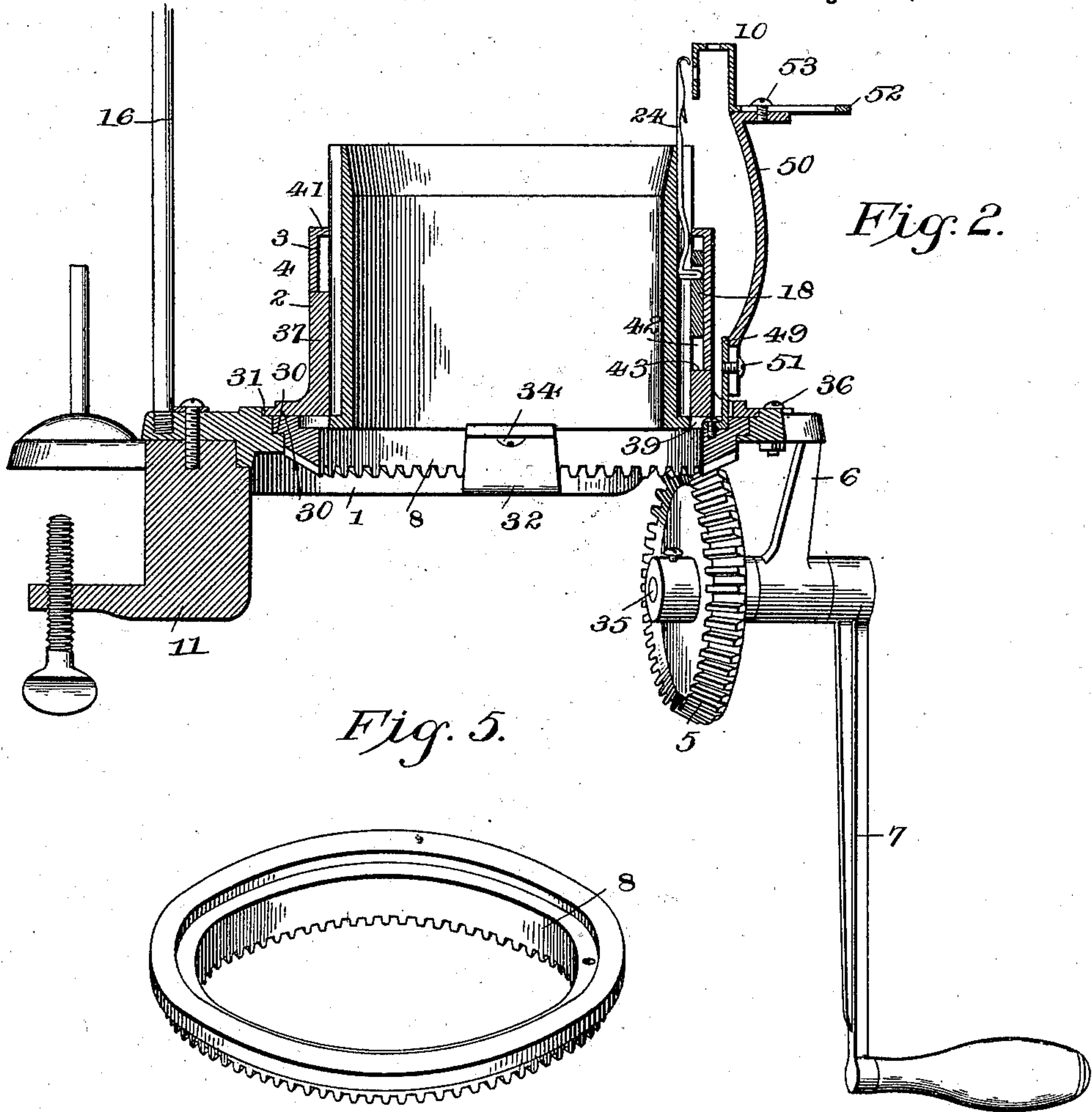


Fig. 6.

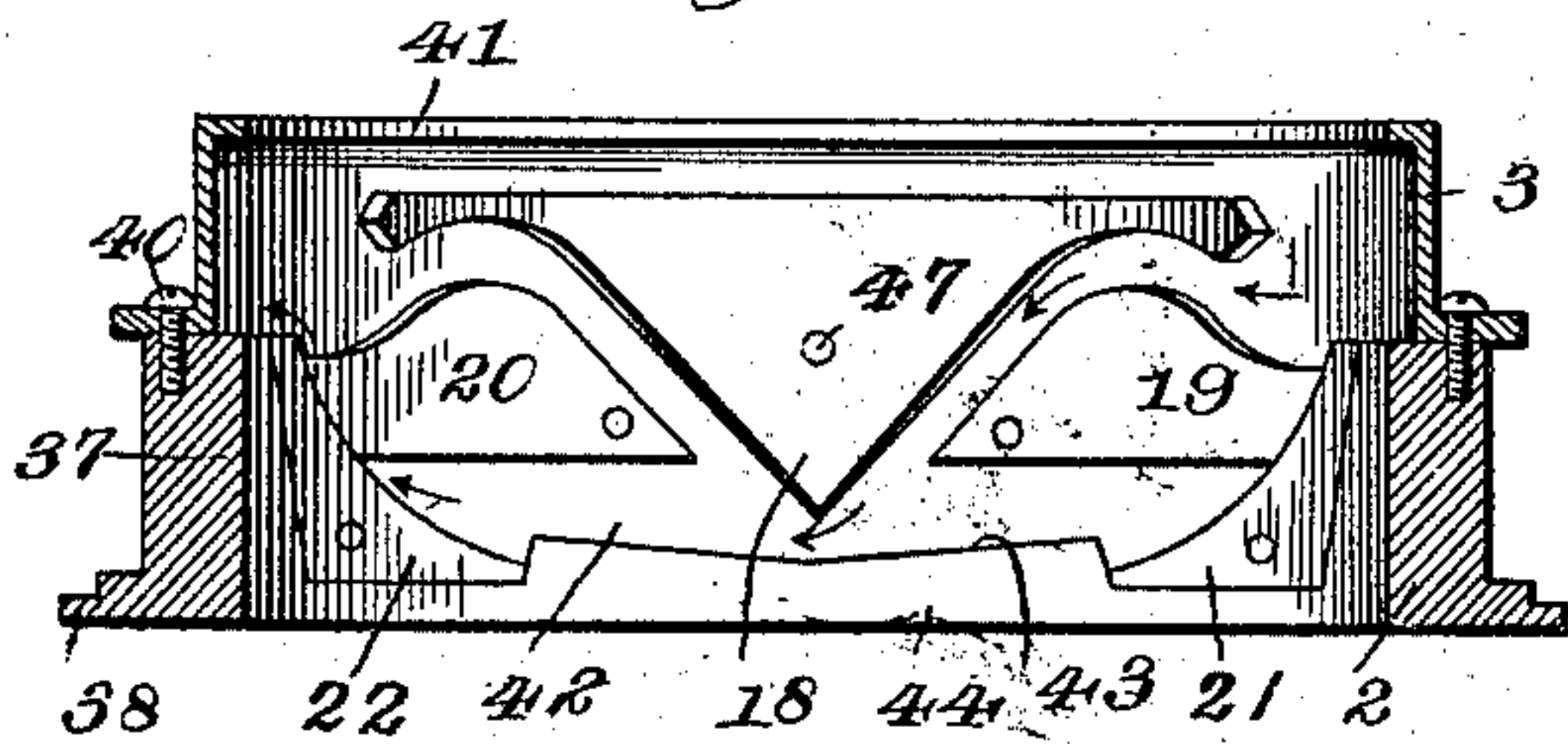
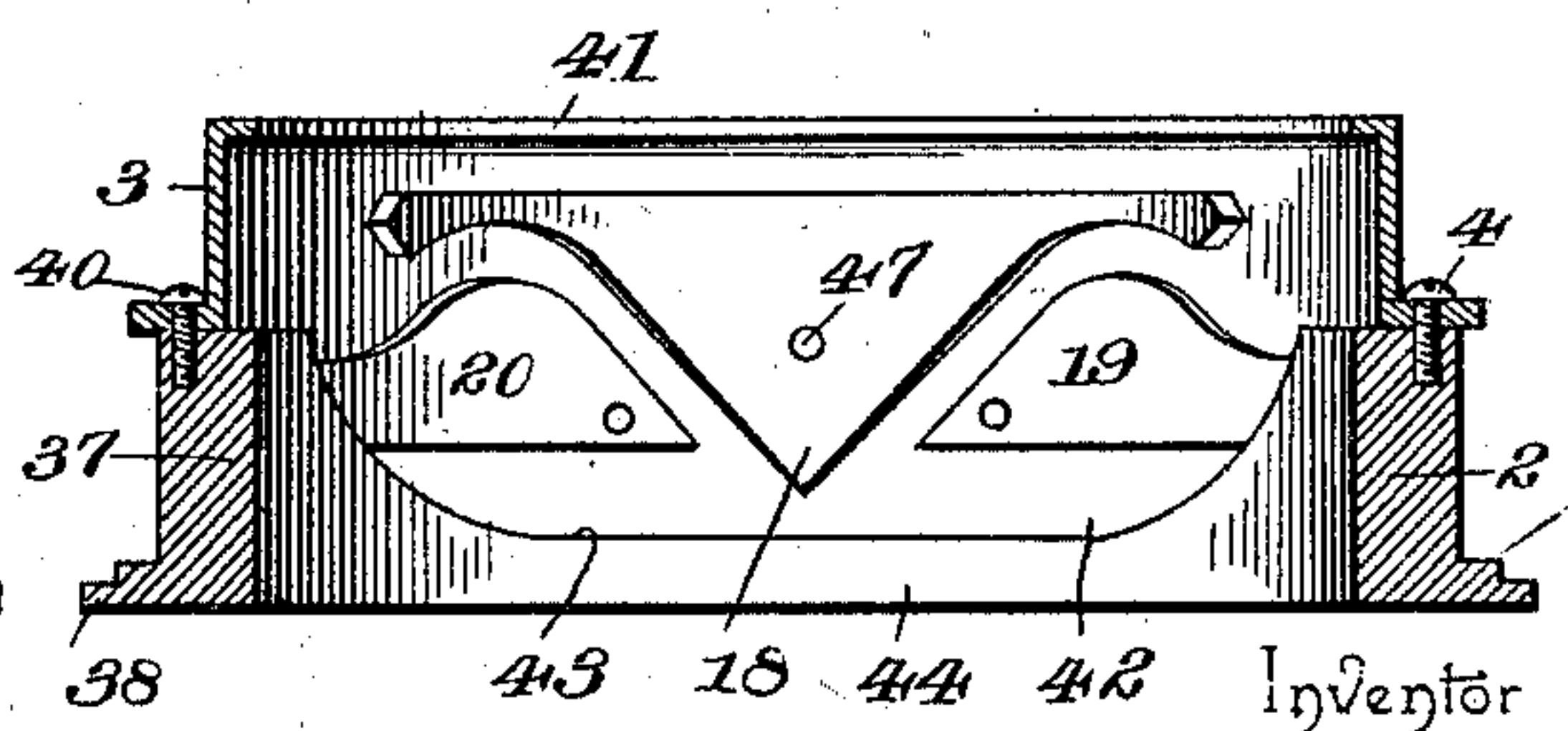


Fig. 7.



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Fig. 3

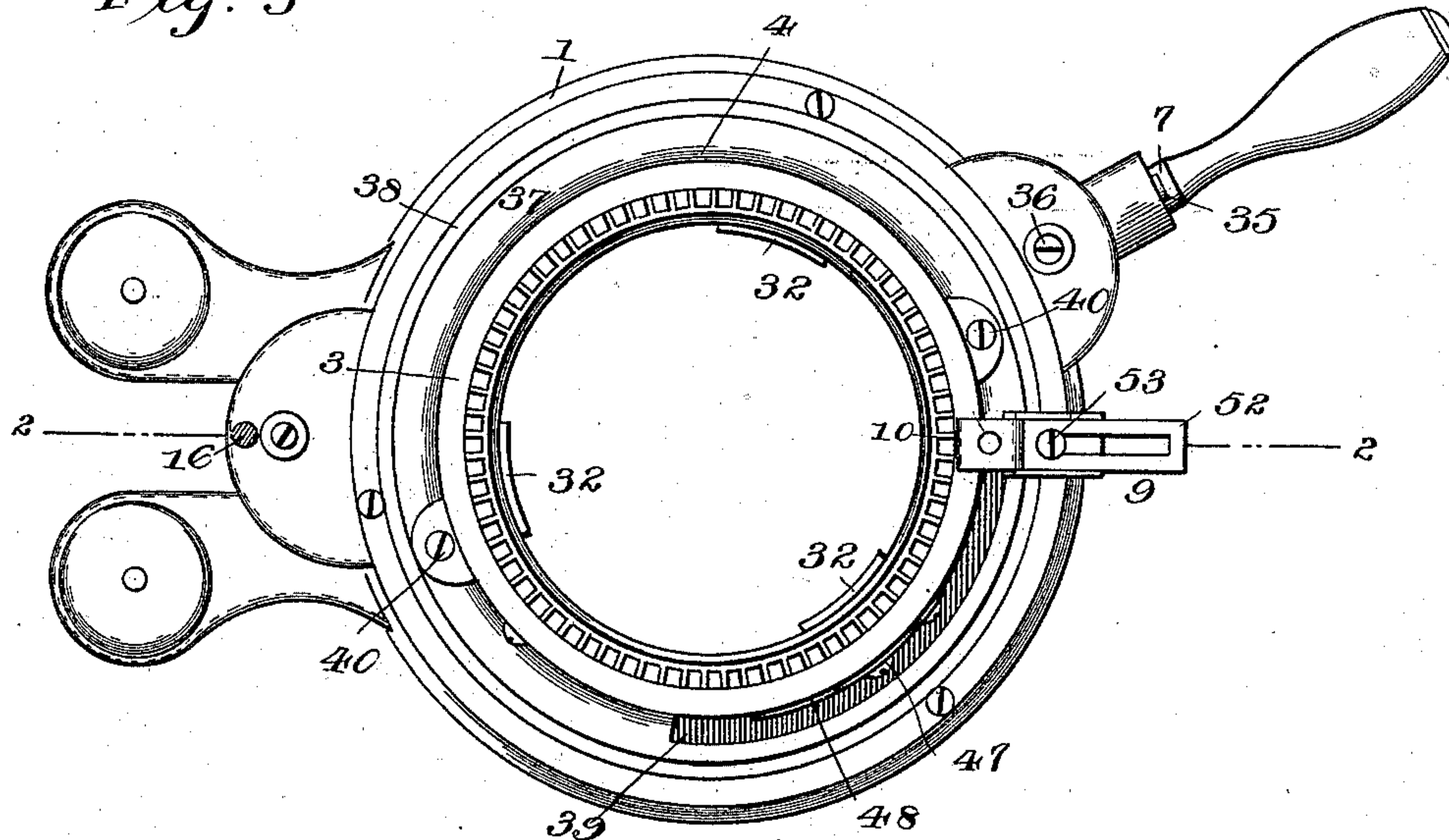


Fig. 8.

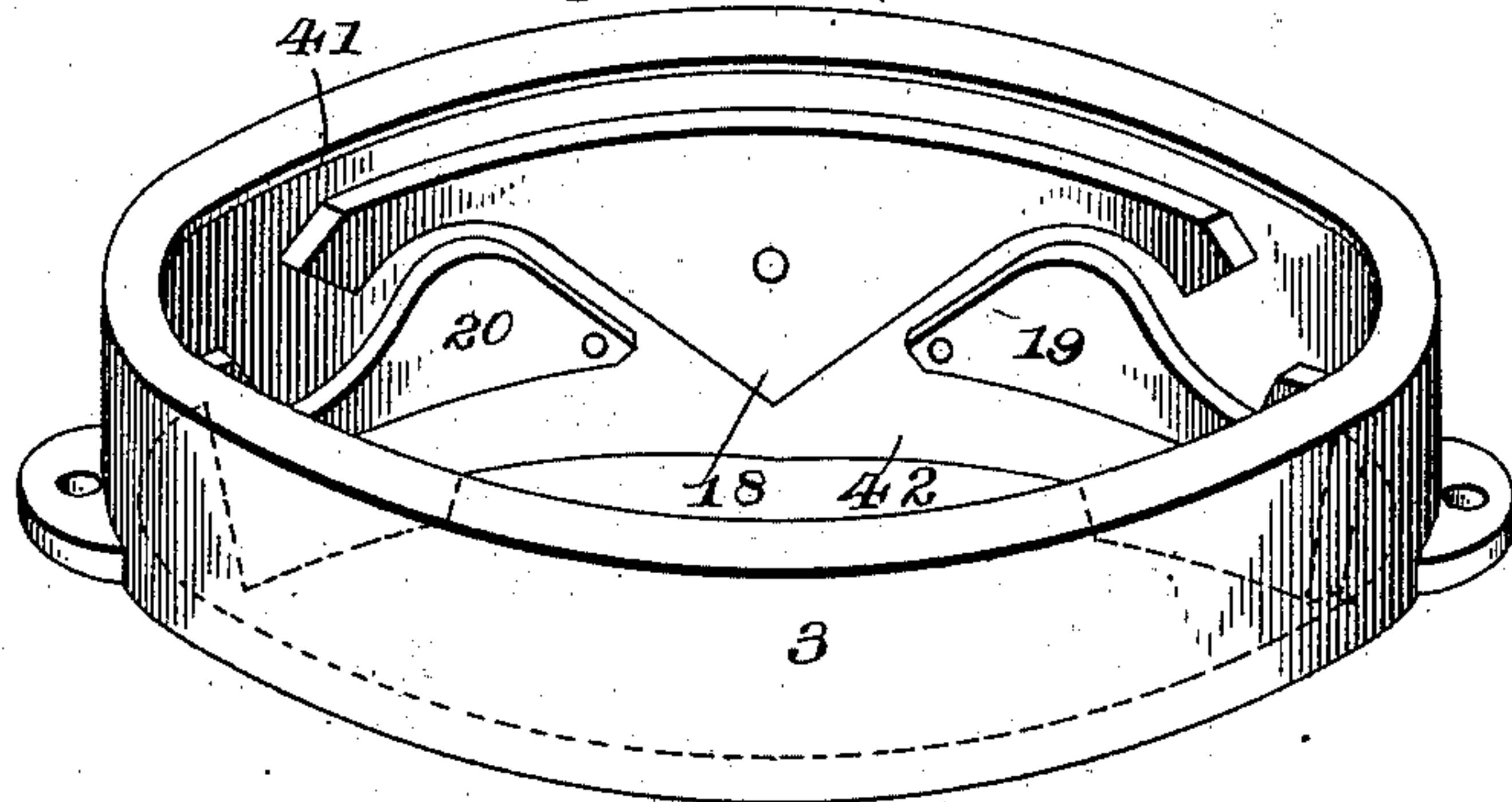
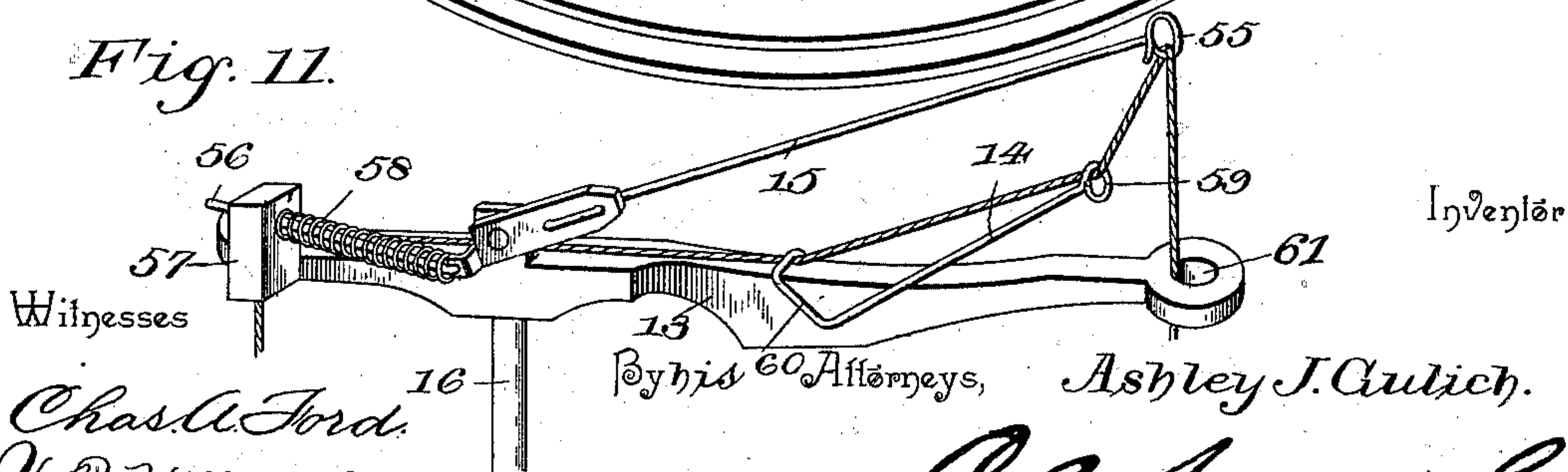


Fig. 11.



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Fig. 4.

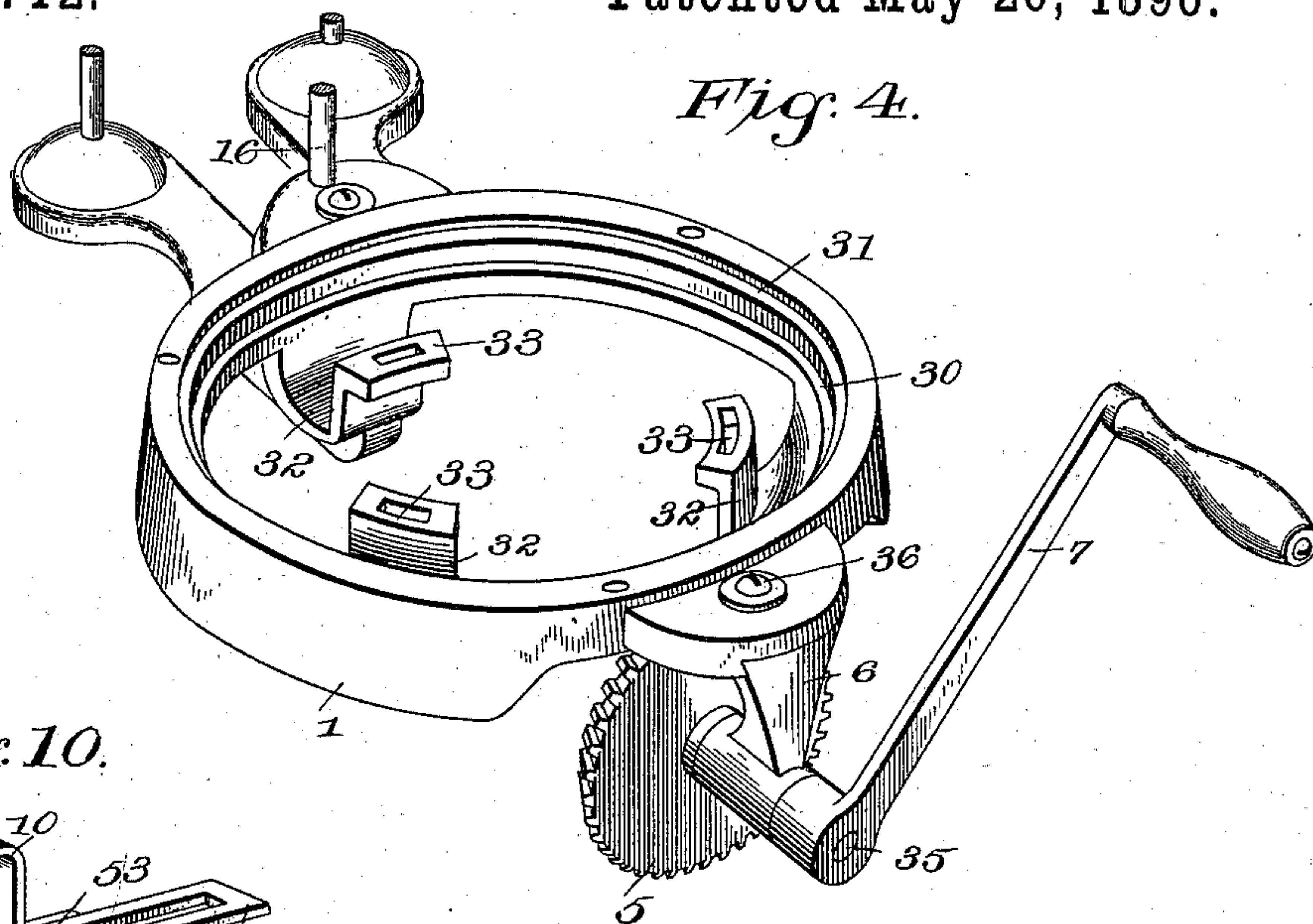


Fig. 10.

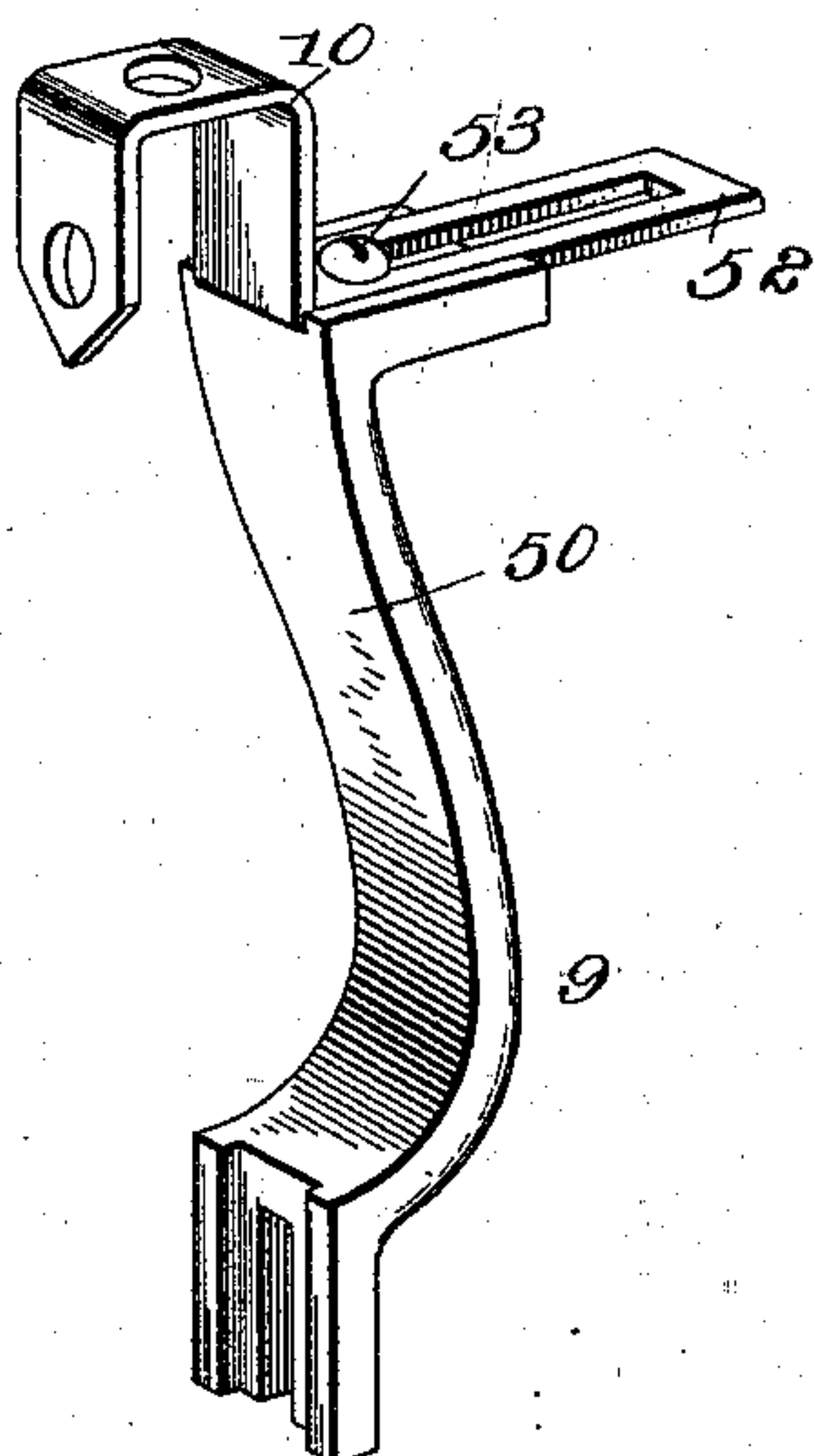


Fig. 9.

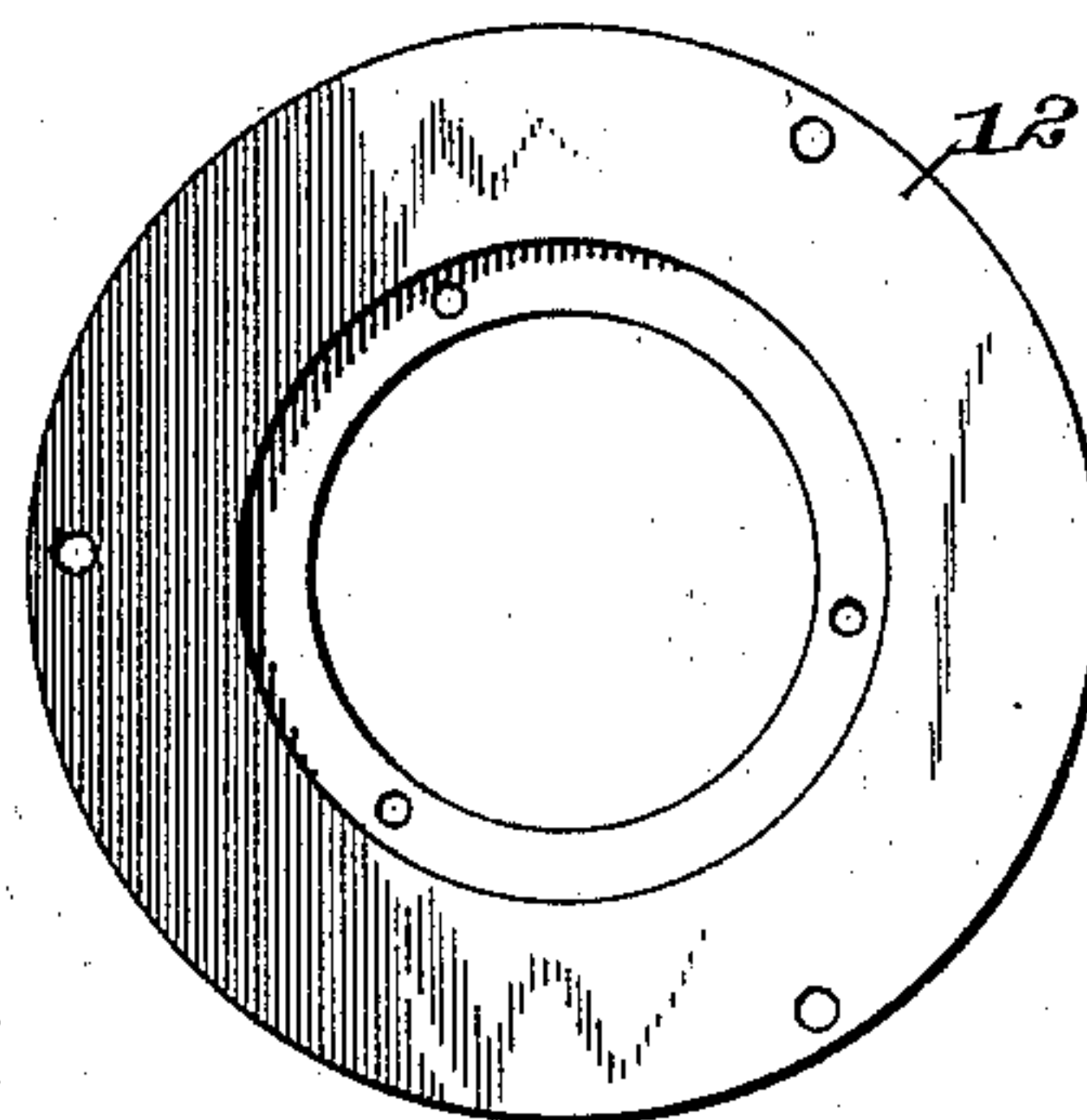


Fig. 12.

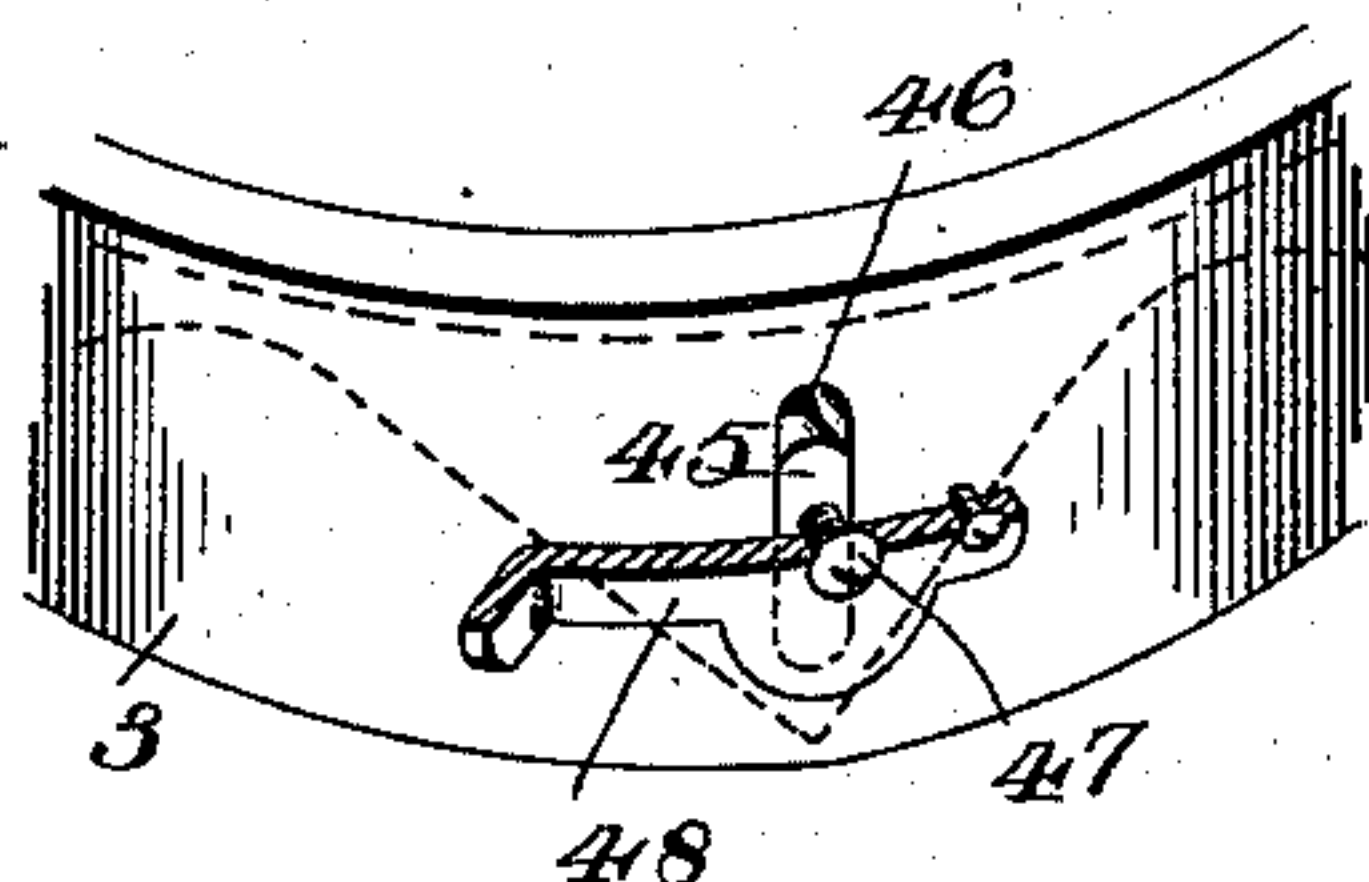
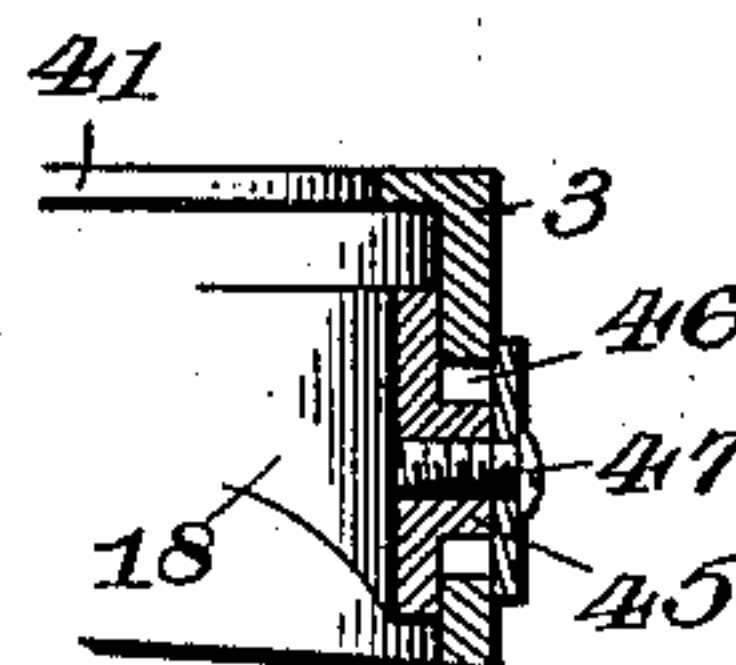


Fig. 13.



Witnesses

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By his Attorneys.

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# UNITED STATES PATENT OFFICE.

ASHLEY J. GULICH, OF CLEARFIELD, PENNSYLVANIA.

## CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 560,712, dated May 26, 1896.

Application filed February 28, 1895. Serial No. 540,090. (No model.)

*To all whom it may concern:*

Be it known that I, ASHLEY J. GULICH, a citizen of the United States, residing at Clearfield, in the county of Clearfield and State of Pennsylvania, have invented a new and useful Circular-Knitting Machine, of which the following is a specification.

The present invention aims to improve that class of circular-knitting machines in which the needles are reciprocated in their guide-ways in the cylinder by means of a rotating ring provided with actuating-cams and in which the cylinder and cam-ring are interchangeable with others to adapt the main frame and rim-rotating mechanism for cylinders and cam-rings of different sizes, whereby the same machine can be used for knitting seamless fabrics of varying sizes within the capacity and limits of the machine.

An essential feature of the invention is the provision of means for automatically taking up the yarn during the process of knitting the heel of hosiery when the cam-ring is rotated in reverse directions to form the required rows of stitching necessary to turn the heel and during the time that the cam portion of the cam-ring is passing out of the path of the needles used for forming the said heel.

A further purpose of the invention is to simplify the construction of the cam-ring and the formation of the track, whereby the needles are reciprocated during the process of knitting, said cam-ring being formed of an upper and a lower part, the top edge of the latter forming the track and lower wall for the needles to travel upon.

A still further purpose of the invention is to provide a simple construction for the interchangeability of the cam-ring and cylinder and the corresponding adjustability of the yarn-carrier, so that when changing the machine from forming fabric of one size to another all the parts will coöperate in the same manner as if specially constructed and devised for knitting a fabric of a given and required size.

For a full and clear understanding of the invention reference is to be had to the accompanying drawings and the subjoined description.

Figure 1 is a perspective view of a circular-knitting machine constructed in accordance

with and embodying the vital features of the invention. Fig. 2 is a section on the line 2 2 of Fig. 3. Fig. 3 is a plan view of the machine. Fig. 4 is a detail view of the base, the operating parts being detached. Fig. 5 is a detail view of the toothed ring. Fig. 6 is a sectional detail view of the rotatable cam-ring. Fig. 7 is a sectional detail view of a modified form of rotatable cam-ring. Fig. 8 is a detail view of the cam-ring shown in Fig. 6, with the parts separated and arranged in a relative position. Fig. 9 is a view of an interchangeable ring for a cylinder of smaller size than that contemplated by the other figures of the drawings. Fig. 10 is an enlarged detail view of the yarn-carrier. Fig. 11 is a view showing the application of the yarn-lock when the take-up is compensating and preventing slack in the yarn during the time that the yarn-carrier is returning after the cam of the rotatable cam-ring has passed fully beyond the series of needles used for forming the heel and prior to the return of the said cam by a reverse movement of the rim to form another row of stitches in the formation of the heel. Fig. 12 is a detail view showing the mechanism for adjusting the V-cam, whereby the tension of the stitch is regulated. Fig. 13 is a detail view in section of the parts shown in Fig. 12, so as to illustrate more clearly the means for securing the V-cam in the located position.

The numeral 1 represents the frame or base of the machine and is circular in outline and provided at one side with a clamp 11, by means of which the machine can be readily secured to a table, shelf, or similar support. This base is rabbeted in its inner peripheral edge to form two seats 30 and 31 at different relative heights to support, respectively, the toothed ring and the cam-ring, which parts travel upon their respective seats. Projecting inward from the base are a series of brackets 32, located at proper intervals and designed to support the cylinder 4. These brackets 32 curve downward between their ends to give clearance for the toothed ring 8, and their horizontal portions have slots 33, through which the fastenings 34 pass, by means of which the interchangeable rings or plates 12 are attached to the said brackets. A pendent bracket 6 is secured to the base 1



at a convenient point and is provided at its lower end with a bearing in which is journaled a short shaft 35, having secured to its inner end a gear-wheel 5, which meshes with the toothed ring 8, so as to impart movement to the latter, said shaft having a crank 7 on its outer end for convenience in imparting motion to the operating parts when it is desired to perform work. This bracket 6 is detachably connected with the base 1, preferably by means of a bolt 36, passing through corresponding openings in the said bracket and a lateral extension of the base.

The cam-ring 37 has a horizontal flange 38 at its lower end, which obtains a bearing upon the annular seat 31, and which is provided with a curved slot 39 for the passage of the yarn-carrier 9, attached to and carried by the toothed ring 8, which carrier, by engaging the ends of the slots, imparts motion either of reciprocation or of rotation to the cam-ring. This curved slot 39 is located directly opposite the actuating-cams and is of a length corresponding to, approximately, the length of the V-cam 18 and is provided to enable the yarn-carrier to return to a position opposite the active end of the cam without imparting any movement to the cam-ring 37.

It must be remembered that in the formation of the heel of a stocking a certain number of the needles are thrown out of operation and that the yarn is carried back and forth over those needles left in working position, so as to form the requisite rows of stitches necessary in the turning of the heel. In the operation of the cam-ring 37 it must move past the last needle of the series a distance corresponding to the length of the V-cam 18, the yarn being carried a corresponding distance around the needles not used in forming the heel and which have previously been thrown out of operative position. Hence when moving the cam-ring in a reverse direction to form another row of stitches it is desirable that the yarn-carrier reverse its position relative to the cam 18 without moving the cam-ring 37. The provision of the slot 39 enables the yarn-carrier to change its position relative to the cam 18, as will be readily understood from what has just been stated.

The cam-ring 37 is composed of two parts 2 and 3, which are secured together by means of fastenings 40, which pass through lateral extensions of the upper part 3 and engage with corresponding projections on the part 2. The upper part 3 has an inner flange 41 at its upper end, which limits the upward movement of the needles 24, and one portion is widened, as shown at 42, to receive the V-cam 18 and the right and left hand switch-dogs 19 and 20, the latter being pivoted at their opposing ends and a short distance from the angle of the cam 18. The spaces between the opposing edges of the cam 18, flange 41, switch-dogs 19 and 20, and the track 42 form passages for the projecting ends of the needles in the operation of the machine. The

upper edge of the lower part 2 is widened so as to extend inward beyond the wall of the part 3, thereby providing a track 43, which limits the downward movement of the needles. That portion opposite the widened part 42 of the upper part 3 is depressed or reduced in width, as shown at 44, corresponding with the increased width of the part 42, so that unitedly the parts of the cam-ring will be of uniform height throughout their length. That portion of the part 2 opposite the free ends of the switch-dogs 19 and 20 may be formed on curved lines, as shown in Fig. 7, or it may be cut away and separate pieces 21 and 22 set therein, as shown in Fig. 6. In the latter construction these pieces 21 and 22 may be of tempered steel, so as to withstand wear. This construction is preferable in high-grade machines, as the life of the machine is prolonged. However, for general use the form shown in Fig. 7 will give satisfactory results and involves a cheaper construction. The V-cam 18 is vertically adjustable to enable the tension of the stitch to be varied within certain limits, its adjustment being effected by the following means: An oblong projection 45 is attached to the V-cam 18 and operates in a vertically-disposed slot 46 in the part 3, and a clamp-screw 47 passes through a pivoted lever 48 to form attachment between the said lever 48 and the projection 45. This lever 48 is pivoted at one end and the opposite end is bent outwardly, so as to be readily grasped when it is desired to operate the lever to move the V-cam 18. On loosening the clamping-screw 47 the V-cam 18 can be raised or lowered by means of the lever 48 in the manner set forth, and after the proper position of the said V-cam is obtained it can be held in place by retightening the clamping-screw 47, as will be readily understood.

The yarn-carrier comprises a vertical extension 49, which is attached at its lower end to the toothed ring 8, an arm 50, adjustably connected at its lower end to the vertical extension 49 by a binding-screw 51 passing through a slot in the lower end of the arm 50 and entering a threaded opening in the vertical extension 49, and a yarn-guide 10, which has its horizontal portion 52 slotted and secured to the upper end of the arm 50 by means of a binding-screw 53, the inner end being bent into an approximately inverted-U form, which is apertured for the passage of the yarn 54. By this construction the arm 50 can be raised and lowered to adjust the height of the yarn-guide 10 to the length of cylinder, and the said yarn-guide can be moved laterally to adapt its position to the diameter or size of the cylinder with which it coöperates when feeding the yarn to the needles.

A standard 16 rises vertically from the base 1 and has a horizontal arm 13 at its upper end, which is apertured at each end for the passage of the yarn. The take-up 15 is piv-



oted near its lower end to the inner portion of the arm 13 and is provided at its upper or free end with an eye 55, through which the yarn 54 passes. A rod 56 has pivotal connection with the lower end of the take-up 15 and its free end works through a guide 57 at the end of the arm 13, contiguous to the pivotal support of the said take-up. A coiled spring 58 is mounted upon the rod 56 and is confined between the guide 57 and the lower end of the take-up 15, and serves normally to hold the take-up 15 at the limit of its backward movement from the forward end of the arm 13. A yarn-lock 14 is pivoted to the arm 13 and has an eye 59 at its free end, through which the yarn 54 passes, and is provided with a portion 60, which extends over the arm 13 and is adapted to grip the yarn between the said overhanging portion 60 and the arm 13. The take-up 15 and the yarn-lock 14 are of such relative lengths that when all the needles of the machine are in operation the eye 55 will occupy a position between the eye 59 and the opening 61 in the outer end of the arm 13, thereby depressing the free end of the yarn-lock 14 and disengaging its clamping portion 60 from the yarn, so as to permit the free passage of the latter. However, when only a portion of the needles are in operation, as when knitting a heel in a stocking, the take-up will prevent any slack in the yarn when the yarn-carrier 9 carries the yarn past those needles not in operation, so as to permit the V-cam 18 to completely pass by the last needle of the series used for forming the heel. When the take-up moves backward and away from the arm 13, it lifts the outer end of the yarn-lock 14 and causes the inner portion 60 to clamp the yarn, thereby preventing the take-up from drawing the yarn from the bobbin 17 instead of compensating for the slack in the yarn which would otherwise occur.

The rings 12 will be provided in different sizes, and so constructed as to be interchangeably connected with the brackets 32 of the base, thereby admitting of cylinders of different sizes being fitted to the same base of a single machine. It will be understood that the cylinders and cam-rings 37 will be provided in corresponding sizes, so that when a cylinder is replaced by one of larger or smaller dimensions a cam-ring of corresponding size to cooperate therewith will also be provided and adapted to be applied to the base. All that is necessary to adapt the cam-rings of different sizes to the base is to vary the width of the flange 38, which for larger cylinders will be narrow and for smaller cylinders wider, as will be readily understood.

The operation of the machine does not differ materially from machines of this type—that is, so far as the yarn is supplied to the needles and the manner of looping and forming the stitches are concerned. Assuming that the cam-ring 37 is continuously rotated in one direction, the passage of the lower ends of the needles will be that indicated by the arrows

in Fig. 6, which is over the right-hand switch-dog 19 and under the left-hand switch-dog 20. As the projecting ends of the needles pass over the right-hand switch-dog and under the right-hand portion of the V-cam 18, the needles will be reciprocated, so as to form the loop and slip the stitch, and in their passage from the angle of the cam 18 to the right-hand portion of the switch-dog 19 the said needles will remain inactive. On rotating the cam-ring 37 in a reverse direction the needles will be reciprocated by traveling over the switch-dog 20, as will be readily understood. These switch-dogs 19 and 20 operate by gravity and automatically close the instant the needles pass from beneath their lower edges to the elevated portion of the track 43. When it is required to form a heel, as in knitting stockings, the number of needles not required for use are drawn to their highest position, so as not to be engaged by the V-cam 18, and those needles required to form the rows of stitches necessary to produce the heel are alternately acted upon by the switch dogs 19 and 20 and the corresponding end portions of the V-cam 18. During the process of forming the heel the cam-ring is turned back and forth by moving the crank 7 to the right and to the left the proper distance, so as to move the V-cam 18 the length of the needles in use and a further length corresponding to the extent of the said cam 18, so that it may wholly clear the last needle of the series in each direction of its movement. It must be remembered that the yarn-carrier always occupies a position opposite the advancing end of the V-cam 18. Hence when said end passes the last series of the needles in use for forming the heel it is obvious that the yarn will be advanced. After the rear end of the V-cam 18 has cleared the last needle of the series, the movement of the toothed ring 8 is reversed, so as to carry the yarn-carrier 9 from that end of the cam 18 which was previously the advancing end to a point opposite the rear end of the said cam, which now becomes the advancing end on the return movement of the rim to form a new row of stitches. The slot 39 of the flange 38 of the cam-ring admits of this movement of the yarn-carrier, as hereinbefore set forth. While the yarn-carrier is moving so as to change its relative position, the take-up will come into play and prevent any slack in the yarn.

From the foregoing it will be seen that the operation of the machine is comparatively simple and that heels can be turned in stockings in a rapid manner without requiring the exercise of skill on the part of the operator. From what has been said it is obvious that changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed as new is—



1. In a circular-knitting machine, the combination with the cylinder provided with vertically-reciprocating needles, of a cam-ring composed of an upper and a lower part, the top edge portion of the lower part extending inwardly a proper distance from the inner side of the upper part to form a track for the bent ends of the needles to travel upon in the operation of the machine, substantially in the manner specified.

2. In a circular-knitting machine, the combination with the cylinder provided with vertically-reciprocating needles, of a cam-ring formed of an upper and a lower part, the lower part having its top edge extending inwardly from the sides of the upper part to form a track, and the said upper part having an inner flange to cooperate with the track and having a widened portion which is fitted into a corresponding depression in the top edge of the said lower part, a V-cam attached to the widened portion, pivoted switch-dogs located upon opposite sides of the V-cam, and wear-plates secured opposite the free ends of the switch-dogs and removably held in place, substantially as set forth for the purpose described.

3. In a circular-knitting machine, the combination of a base having bracket extensions projected from its inner edge and curving downwardly and upwardly and terminating in horizontal portions formed with curved slots, a toothed ring operating in the depressed portion of the brackets, a plate de-

tachably and adjustably connected with the slotted ends of the aforesaid brackets, a knitting-cylinder mounted upon the said plate, and a cam-ring supported upon the base and operatively connected with the toothed ring, substantially as set forth for the purpose described.

4. The herein shown and described take-up mechanism for knitting-machines, comprising a standard having a horizontal arm provided at its ends with guide-eyes and having a guide at its rear end, an arm having pivotal connection with the horizontal arm between the ends of the latter and having a portion projecting a short distance beyond its pivot, a rod having pivotal connection with the projected end portion of the pivoted arm and operating loosely through the said guide, a spring mounted upon the rod and confined between the said guide and the lower portion of the pivoted arm, whereby the latter is capable of being thrown beyond a vertical line, and a yarn-lock having pivotal connection with the horizontal arm and acting jointly therewith to clamp the yarn when the pivoted arm moves upward to take up slack, substantially in the manner specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

ASHLEY J. GULICH.

Witnesses:

JOHN H. SIGGERS,  
E. G. SIGGERS.