

No. 697,078.

Patented Apr. 8, 1902.

G. E. ELLIS.
KNITTING MACHINE.
(Application filed June 21, 1901.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.

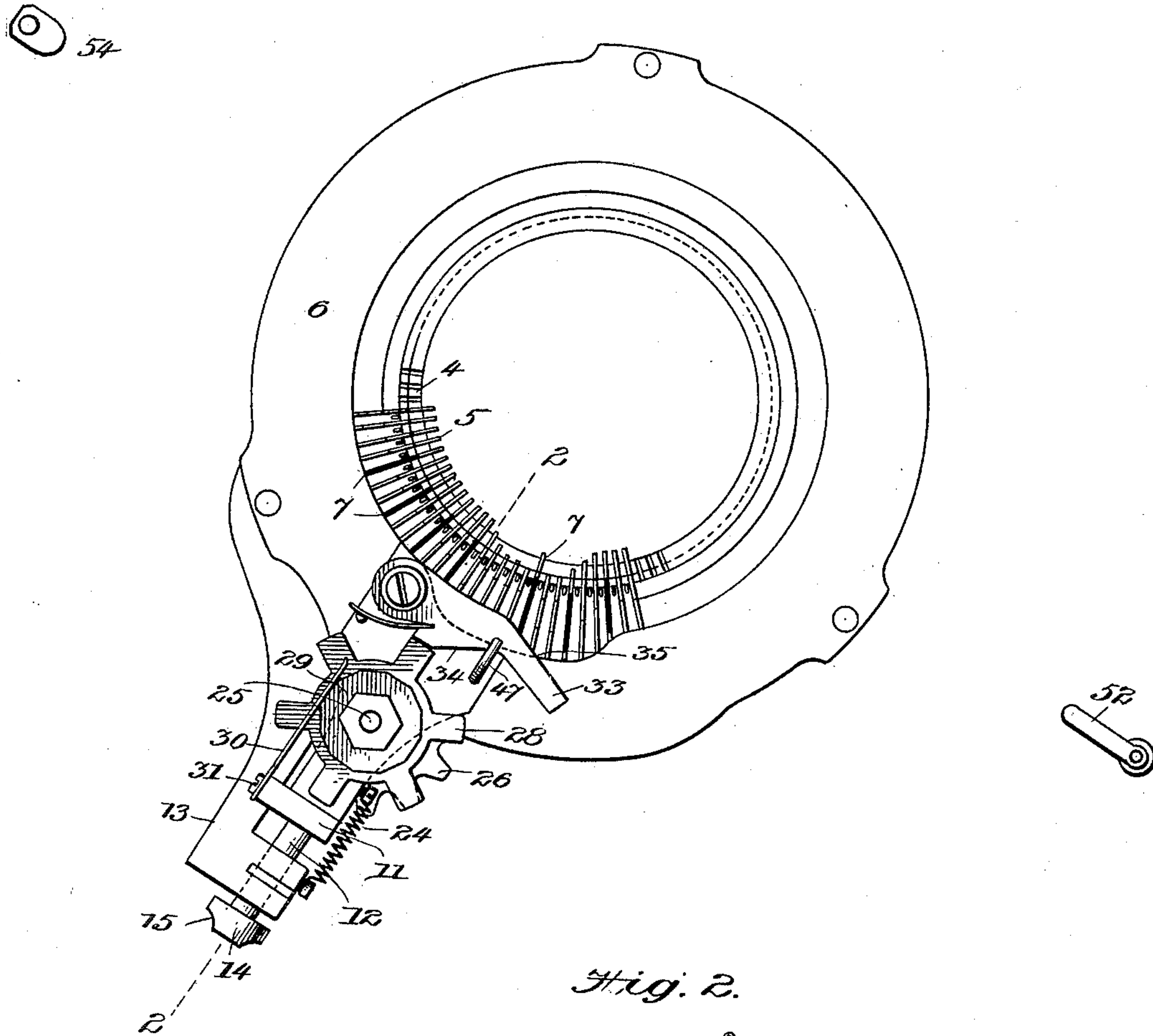
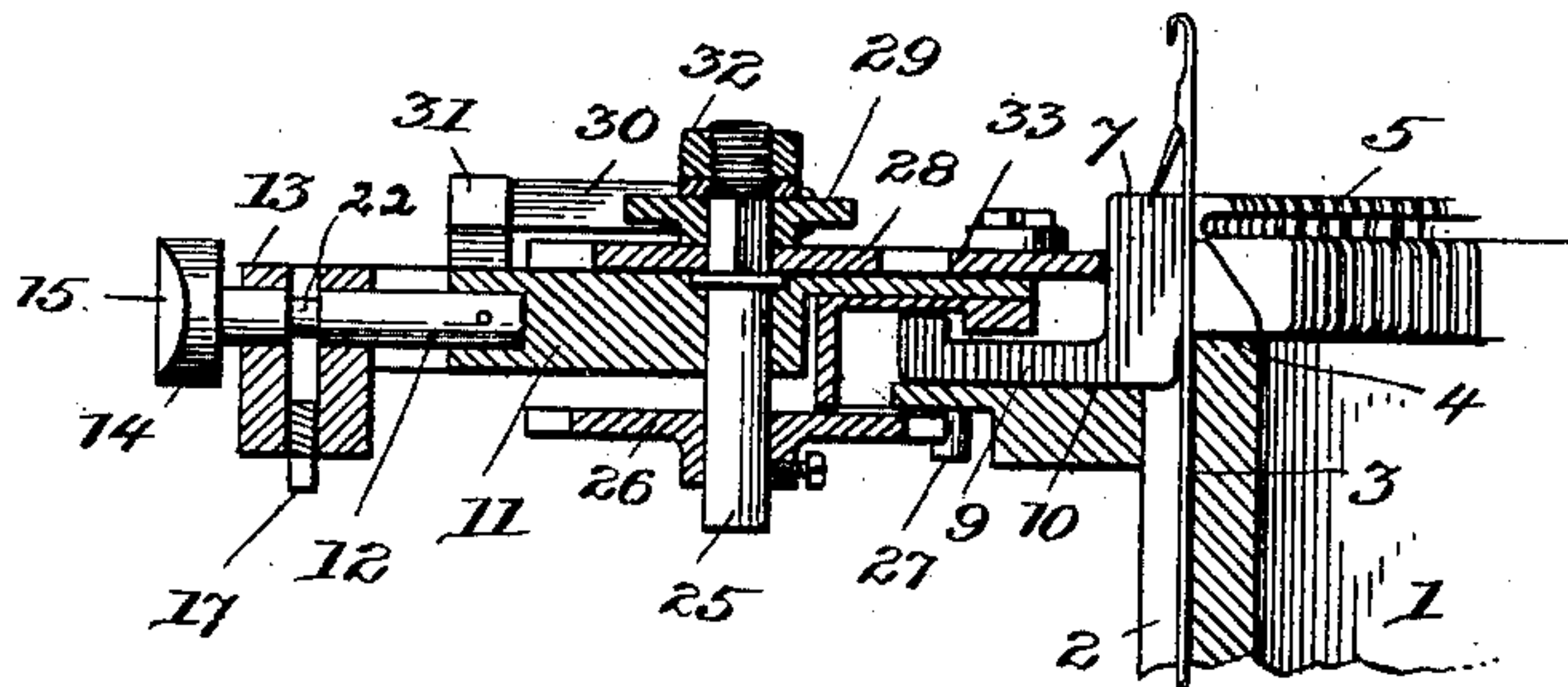


Fig. 2.



Witnesses.

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3 Sheets—Sheet 2.

Fig. 3.

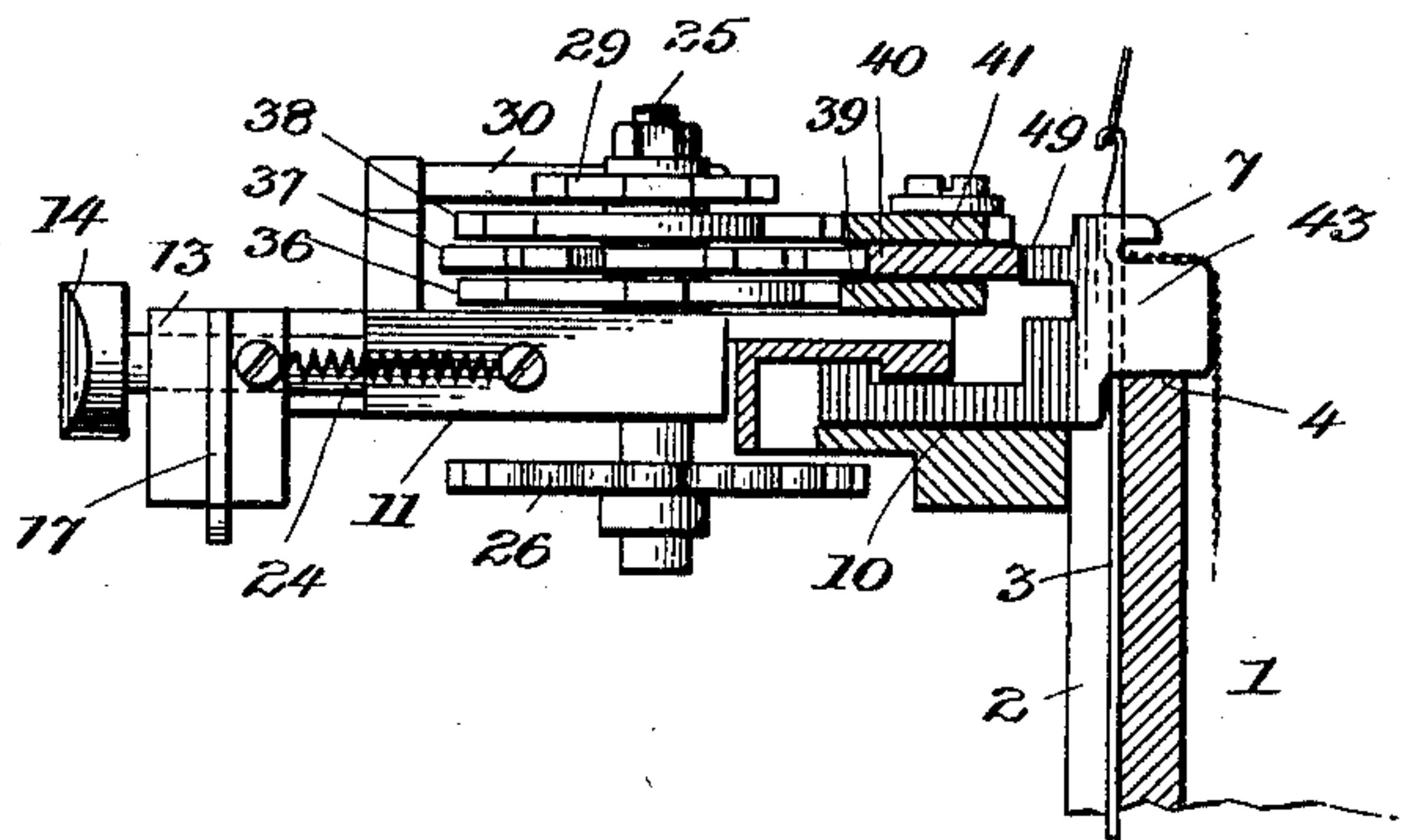


Fig. 4.

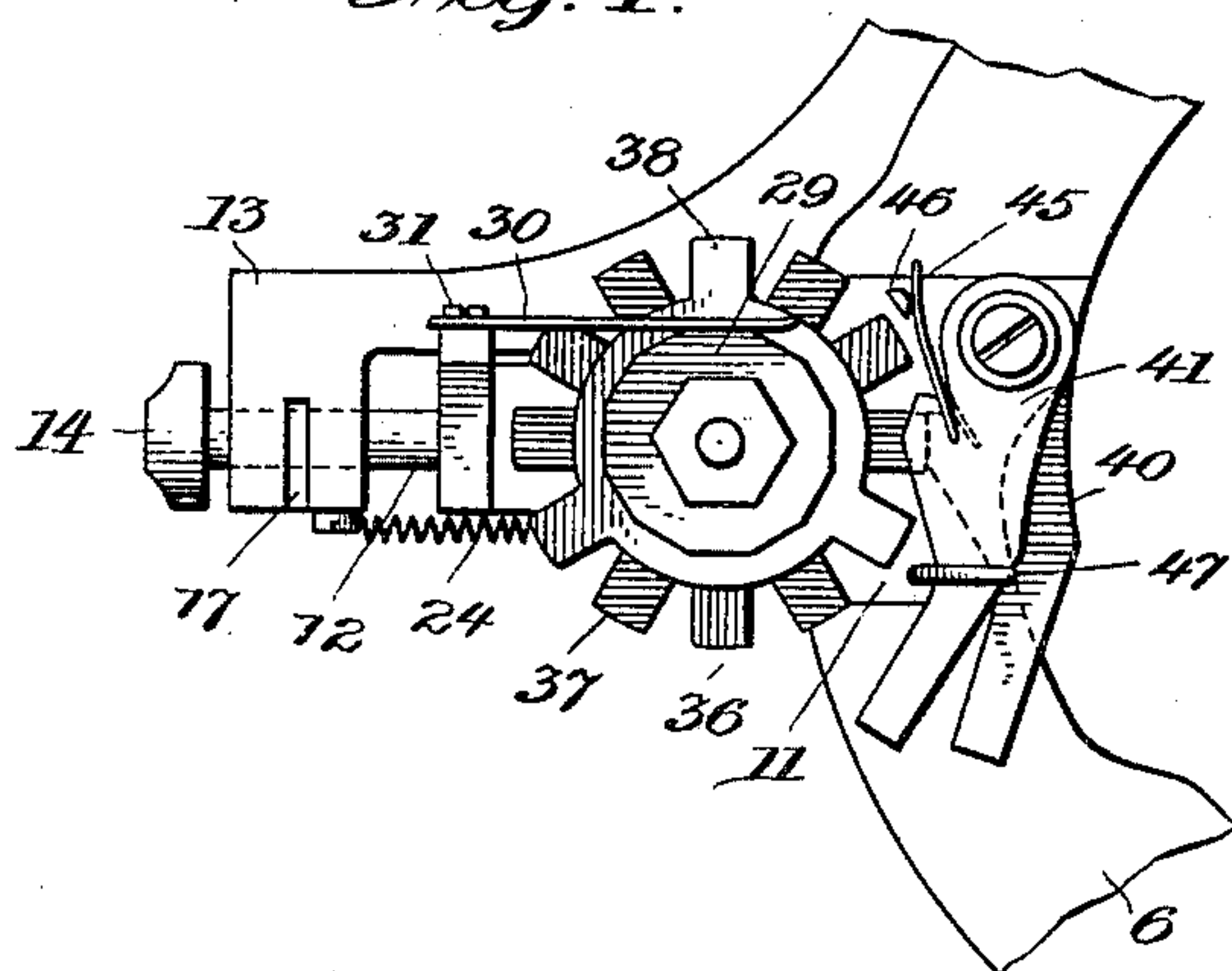


Fig. 5.

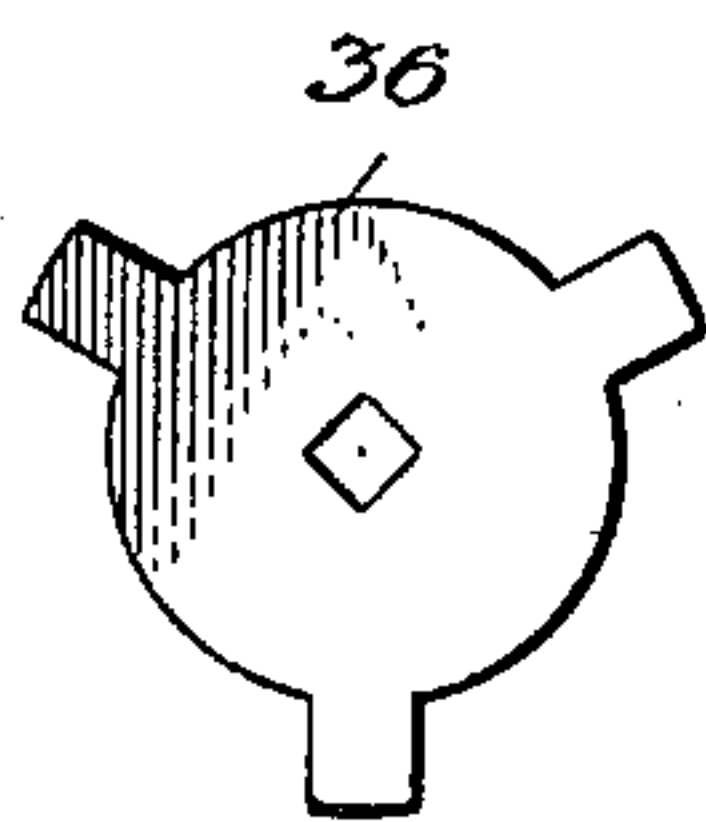


Fig. 6.

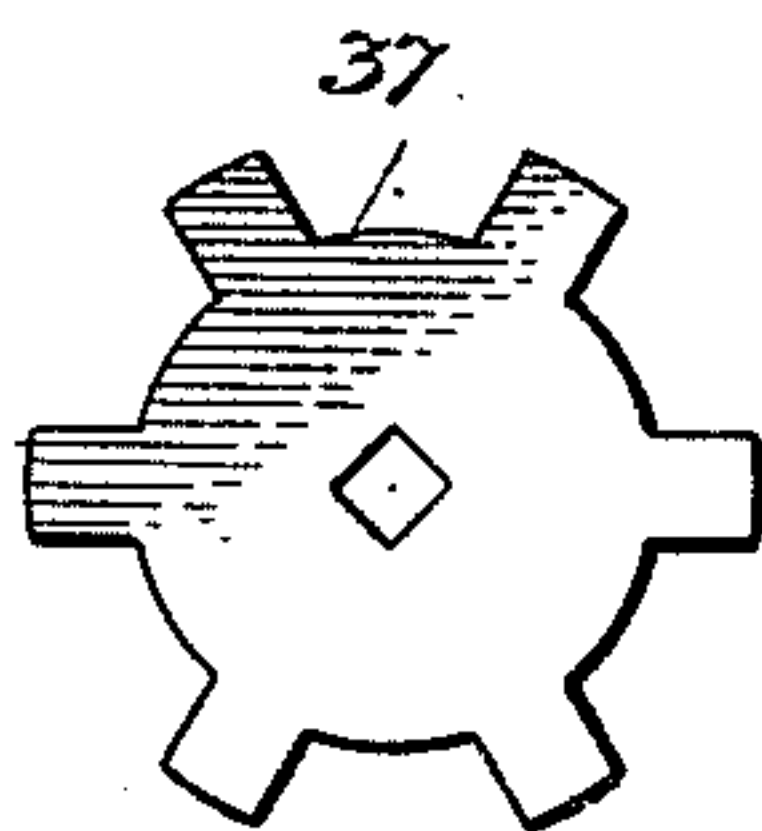
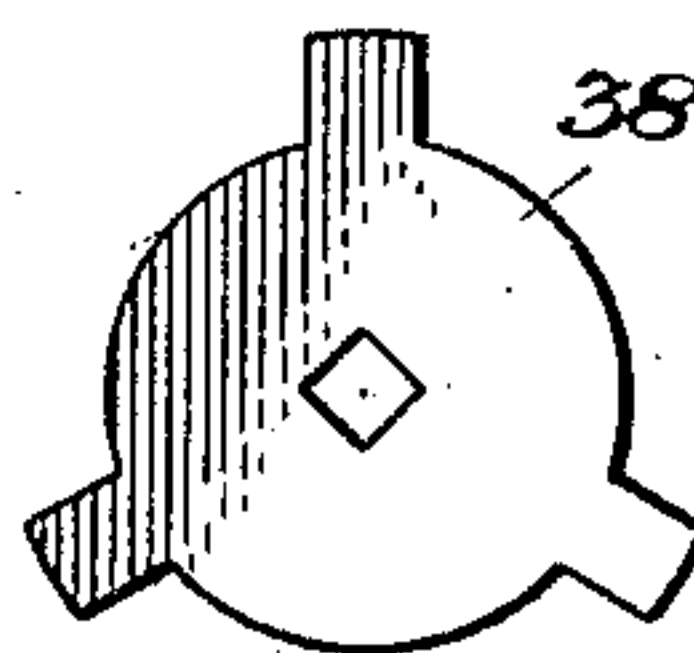


Fig. 7.



Witnesses.

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3 Sheets—Sheet 3.

Fig. 8.

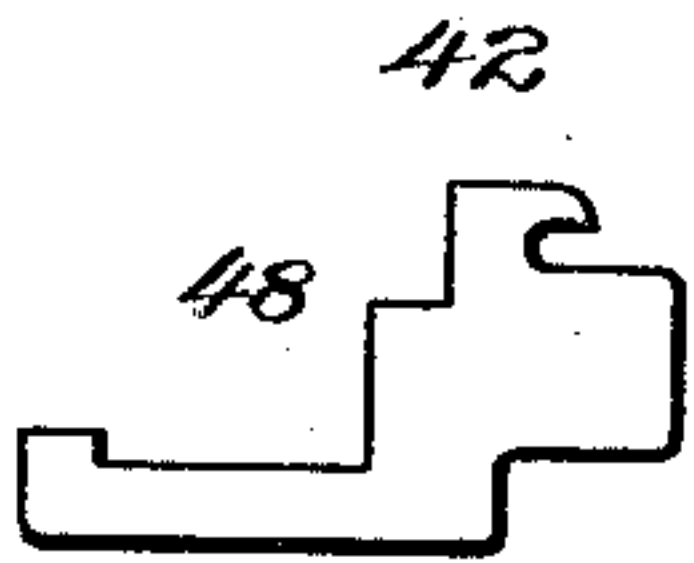


Fig. 9.

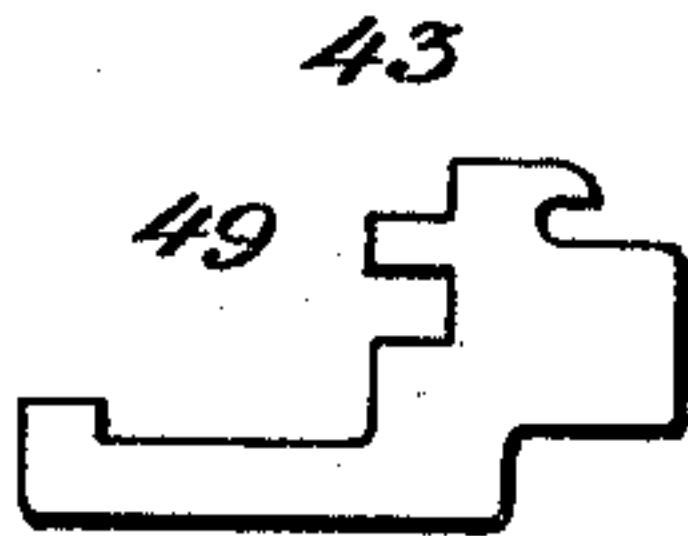


Fig. 10.

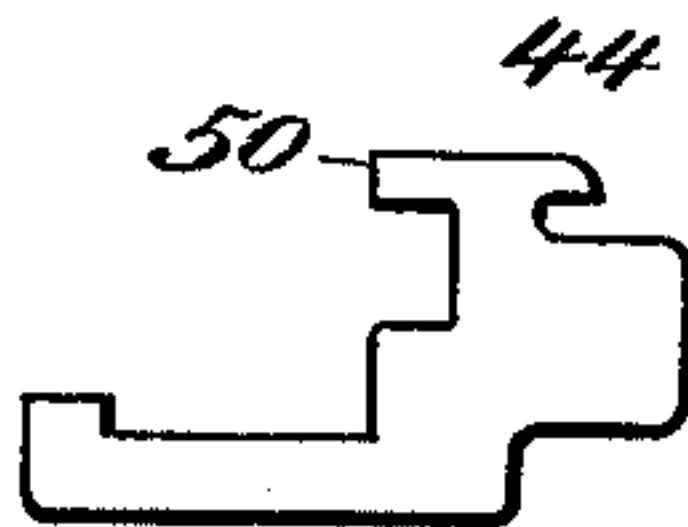


Fig. 11.

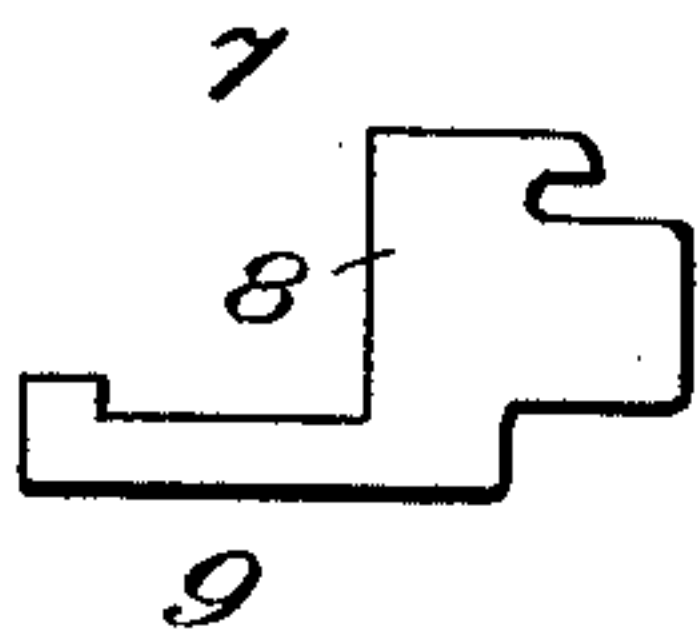


Fig. 12.

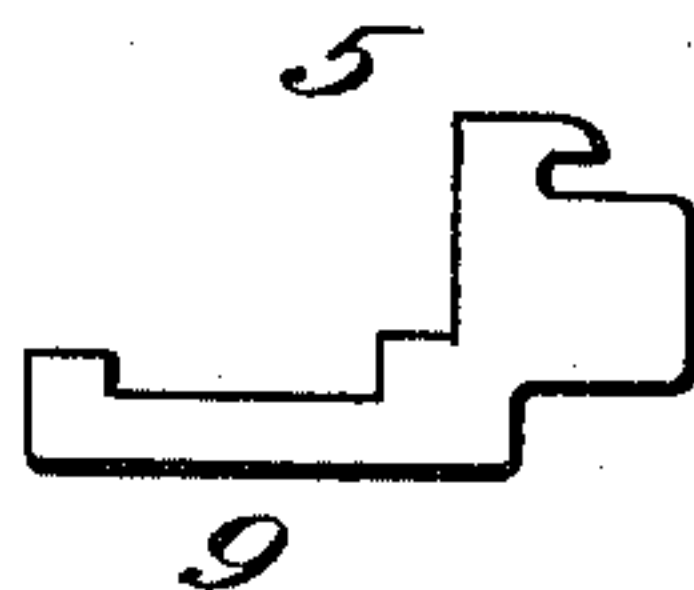


Fig. 13.

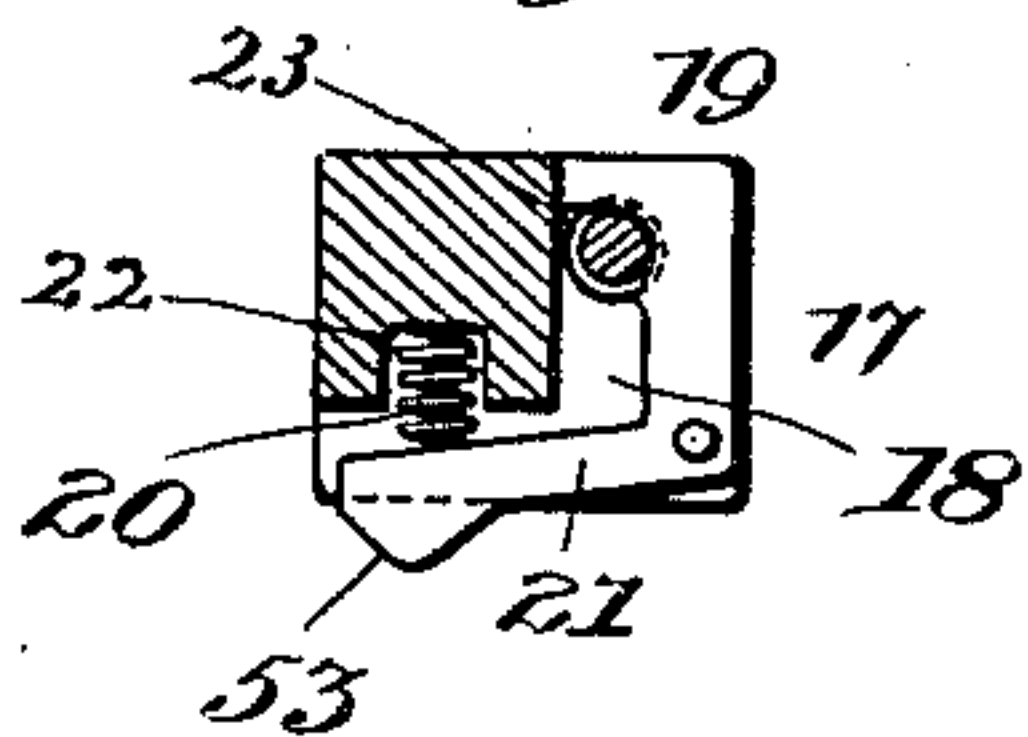


Fig. 14.

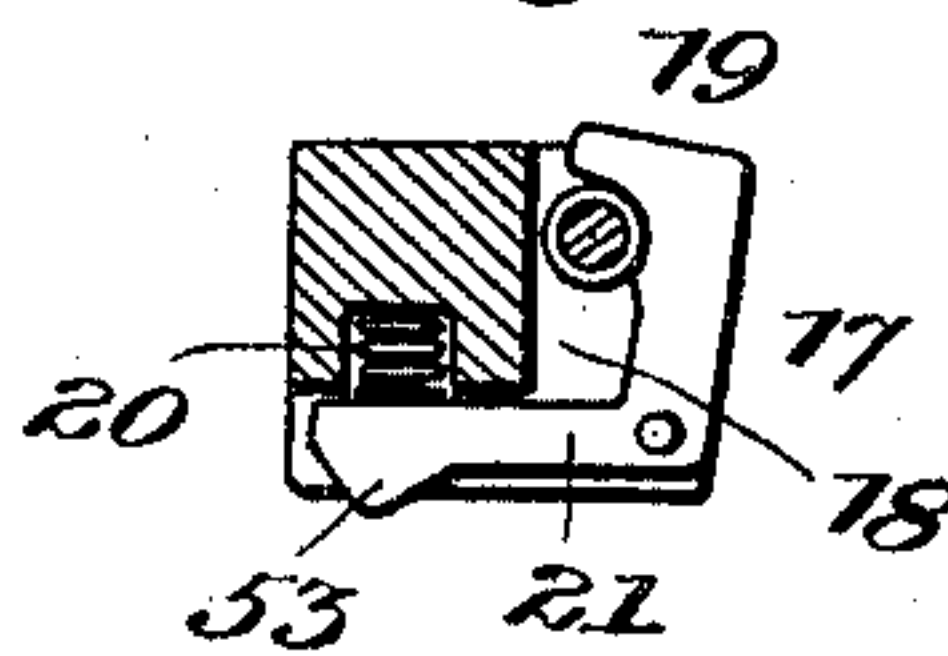


Fig. 15.

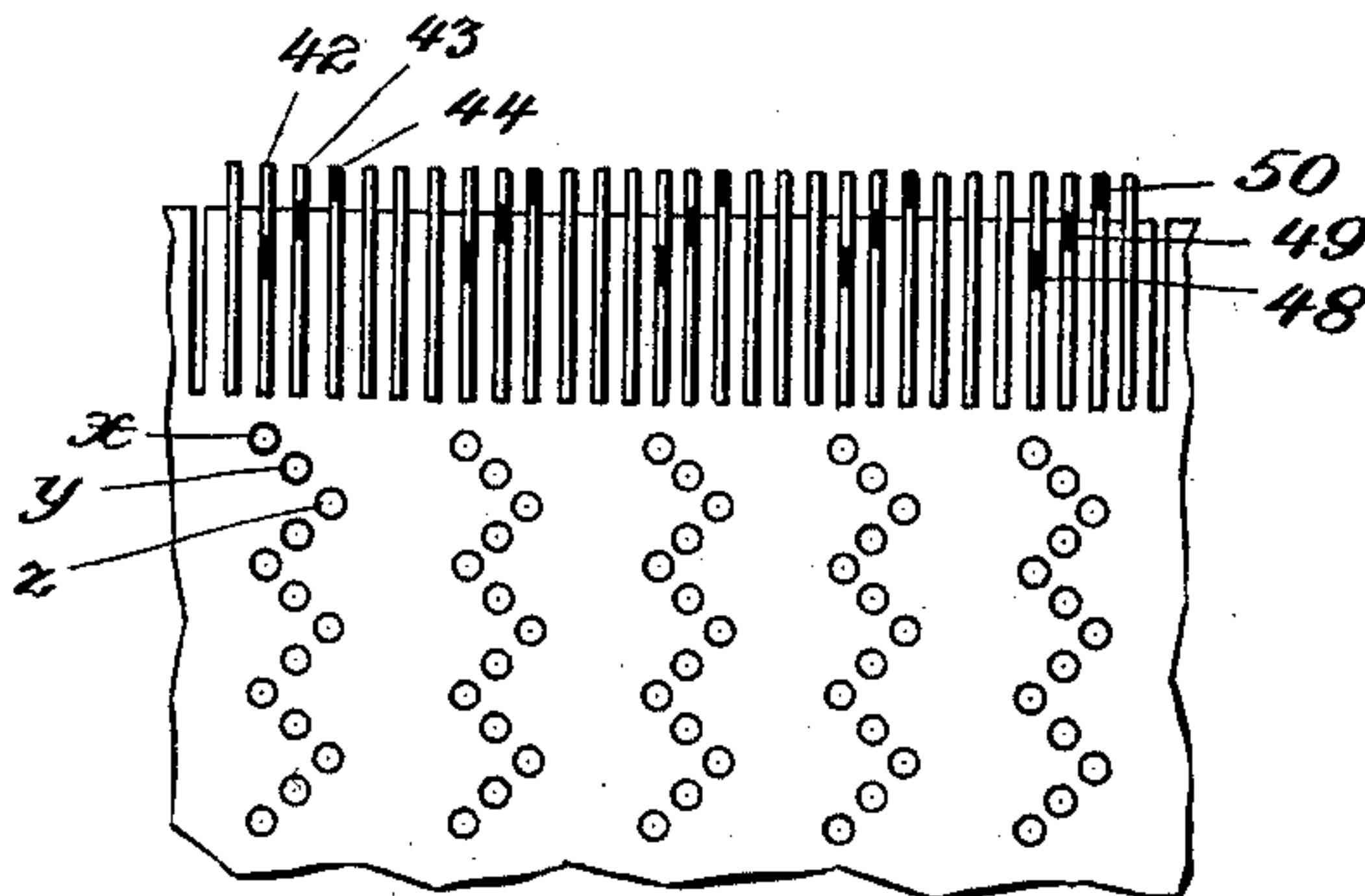
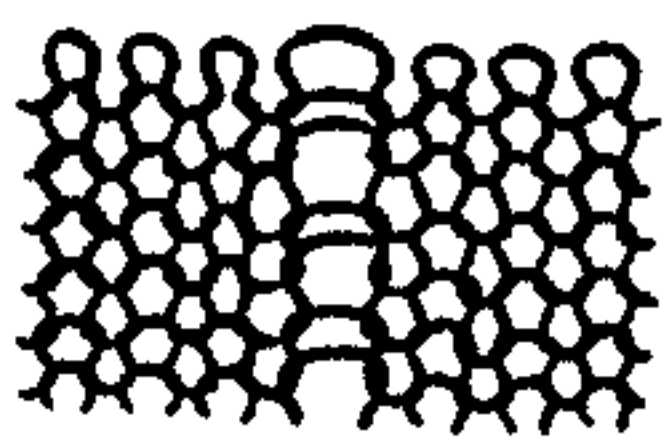


Fig. 16.



Witnesses.

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UNITED STATES PATENT OFFICE.

GEORGE E. ELLIS, OF PHILADELPHIA, PENNSYLVANIA.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 697,078, dated April 8, 1902.

Application filed June 21, 1901. Serial No. 65,389. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. ELLIS, a citizen of the United States, and a resident of the city of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to certain improvements in knitting-machines, and particularly to that class known as "circular-knitting" machines, such as are used for knitting hosiery.

The main object of this invention is to provide in machines of this character mechanism so constructed and operated as to change the stitch from a regular knit mesh to an open or lace work mesh at predetermined times, so as to form open or lace work patterns of different designs in the fabric in conjunction with the regular knit work without removing the fabric from the machine or stopping the operation of the same.

Various other objects, uses, and advantages will be readily apparent on reference to the description and drawings, which form a part of this specification.

My invention consists in certain novel features of construction and in the combination and arrangement of the mechanism which operates to perform certain functions, such as are hereinafter fully set forth, and particularly pointed out in the claims made hereto.

Referring to the accompanying drawings, Figure 1 is a plan view of a portion of a knitting-machine cylinder, showing my invention applied thereto. Fig. 2 is a sectional elevation taken about on the line 2 2 of Fig. 1. Fig. 3 is a view similar to Fig. 2, showing a series of cams and cam-operating wheels for actuating the special forms of detents. Fig. 4 is a plan view of the same. Figs. 5, 6, and 7 are detail views of the toothed wheels for actuating the cams. Figs. 8, 9, and 10 are detail views of the special forms of detents used when it is desired to form the open or lace work mesh in diagonal or zigzag rows. Fig. 11 is a detail view of the form of detent used when straight rows of lace or open work are desired. Fig. 12 is a detail view of one of

the regular sinkers or web-holders. Fig. 13 is a detail section illustrating the trip-lever which holds the cam-carriages in position. Fig. 14 is a similar view showing the lever tripped. Fig. 15 is a diagrammatic view illustrating the detents in position for producing open or lace work in zigzag effect. Fig. 16 is an enlarged view of a piece of the knitted fabric, showing a row of open-work such as produced on my improved machine.

In the said drawings I have illustrated only so much of a knitting-machine as has been deemed necessary to properly show the application of my improvements, as these improvements are not confined to any particular class of knitting-machine and can in fact be applied to almost any type of machine employing reciprocating needles. The needle-cylinder 1 is of the ordinary type and is provided on its outer surface with the longitudinally-disposed slots 2, in which the needles 3 are adapted to reciprocate by means of the usual cams. (Not illustrated.) The upper edge of the needle-cylinder 1 is provided with the radially-disposed slots 4, into which fit and slide the sinker-bars or web-holders 5. These sinker-bars may be sliding bars, as illustrated in the drawings, or they may be swinging sinker-bars, such as are used in some types of knitting-machines; but this is immaterial, as this feature forms no part of my present invention. The revolving cam-head 6 is provided for operating the sinker-bars in the usual and well-known manner.

As before stated, my present invention resides, mainly, in means for holding or preventing the thread from being drawn down regularly by the needles at certain intervals, so as to provide an elongated or open mesh between the regular knit meshes at predetermined points in the fabric. This is accomplished by providing a series of fingers or detents adapted to project between the needles at certain intervals and arrest the thread as it is being drawn down by the needle in advance of said detent and before the sinker-bars are actuated to hold down the web and gage the transverse measurement of the loops. These detents and the mechanism for automatically actuating the same may be described as follows: The detents in this instance are made in the same shape substan-

tially as the web holders or sinkers 5, with the exception that the rear edges 8 extend out farther than the similar edges of the web-holder, as will be seen on reference to Figs. 11 and 12 of the drawings. Both the web-holders and detents are provided with the extension-arms 9, which rest on the sinker-bar bed 10 and are also both actuated by the revolving cam-head 6. These detents 7 are inserted between the needles at certain intervals, as in the manner illustrated in Fig. 1 of the drawings, when it is desired to produce the open or lace work stitches in longitudinally-disposed rows.

Dovetailed or otherwise secured to the cam-head 6 is a sliding carriage 11, having a guide-rod 12, which passes through a bracket 13, which is secured to the cam ring or head 6. The outer end of the rod 12 is provided with a head 14, having beveled edges 15, so that during the rotating of the head 6 this rod and its carriage 11 are thrown inwardly toward the cylinder 1 by means of a cam or projection 54, which is located in the path of said head 14. A trip-lever 17 is pivoted in a recess 18, provided in the bracket-arm 13, and its upper recessed end 19 bears normally against the rod 12 by reason of a coil-spring 20, which is confined in a socket 22, provided in the bracket, and exerts its tension against the arm 21 of the trip. An annular groove 23 is provided in the rod 12, which the recessed portion 19 of the trip engages when the carriage 11 is pushed in, thus holding the said carriage in its set position. A spring 24 is secured at one end to the carriage and at its other end to the bracket 13 and serves to move the carriage outwardly when released by the trip-lever.

Journalled loosely in the carriage 11 is a vertically-disposed shaft 25, having a toothed sprocket-wheel 26 rigidly secured on its lower end. The sprocket-wheel 26 is so located that when the carriage 11 is pushed in the teeth of this sprocket will be in the path of a pin 27, carried by the cam-ring 6, so that upon each revolution of said cam-ring the wheel and its shaft 25 will be moved the distance of one tooth. On the upper end of the shaft 25 is secured a wheel 28, having in this instance six teeth or projections, as illustrated in Figs. 1 and 2 of the drawings. This wheel 28 is preferably secured on the shaft 25 by providing it with a squared opening and forming the upper end of the shaft correspondingly square. On the top of the wheel 28 is a brake-wheel 29, having twelve flattened sides corresponding to the number of teeth and notches in the wheel 28. A flat spring 30 bears against one of the flattened sides of the brake-wheel under tension, having its end secured to a projection 31, carried by the carriage 11. The object of this brake-wheel is to prevent the shaft 25 from moving more than one-twelfth of a revolution when the same is moved by the pin 27

engaging the sprocket-wheel 26. The number of teeth on the sprocket correspond with the number of flattened faces on the brake-wheel. The wheels 28 and 29 are held on the shaft 25 preferably by means of a lock-nut 32 and can be removed from said shaft when it is desired to place other wheels thereon, as will be described in detail hereinafter.

On the upper surface of the carriage 11, adjacent its inner end, is pivoted a cam-plate 33, having an outer cam-face 34, which is adapted to be engaged by the teeth of the wheel 28. The front edge of the plate 33 is also provided with a cam-face 35, which is so formed and located as to engage the detents 7 and push them inwardly before the cam-ring 6 actuates the sinkers 5. The cam-face 35 is only in the path of the detents 7 when it is moved into that position by the action of the teeth of wheel 28 engaging the face 34 of said cam-plate, so that in the construction shown in Figs. 1 and 2 the detents 7 would be actuated only upon every second revolution of the cam-ring 6.

The arrangement of the wheel 28 and cam-plate 32, above described, is used only when it is desired to have the lacework appear in the knitted fabric in straight longitudinally-disposed rows. The number of rows and the distances between such rows is determined by the spacing of the detents 7 between the needles, as will be described more fully hereinafter.

The arrangement illustrated in Figs. 3 and 4 of the drawings is substantially the same as that already described, with the exception that three sets of wheels, as 36, 37, and 38, are mounted on the shaft 25 in place of the single wheel 28, and three sets of cam-plates, as 39, 40, and 41, are used in place of the single cam-plate 33. In this arrangement instead of using the detent 7 I employ three different sets of detents, as 42, 43, and 44. The object of these special forms of detents is for the purpose of effecting a change in the design of the open or lace work from straight longitudinally-disposed to zigzag or other shaped rows, the manner in which this is effected being particularly shown in the diagrammatic view, Fig. 15, which will be fully described hereinafter.

The lower wheel 36 is provided with three teeth of equal distance apart, and the middle wheel 37 is provided with six teeth and the upper wheel 38 with three teeth, all of which are mounted upon the shaft 25 in such a manner that radial lines drawn from the centers of the teeth to the center of the shaft 25 would be equidistant, making in all twelve teeth which register with the twelve spaces between the teeth of the wheel 26. The cams 39, 40, and 41 are arranged one above the other, so as to come within the respective planes of the wheels 36, 37, and 38. These cams are all of the same shape and are each provided with a spring 45, the free end of which bears

against a pin 46, which tends to keep them normally out of the path of the detents 42, 43, and 44. A staple 47 is provided on the carriage 11 for limiting the outward movement of the cams. The detents 42 are cut away so as to leave an edge 48, this edge 48 being in the same plane as the lower cam-plate 39, so that during the operation of the machine this detent will only be actuated by the lower cam 39. The detent 43 is cut out so as to leave a projection 49, which is in the same plane with the middle cam-plate 40, and the detent 44 is cut out so as to leave a projection 50 at its upper rear edge, which is in plane with the upper cam-plate 41.

From the above description it will be seen that certain sets of detents are actuated by one of the three cams—as, for instance, the detents 42 are actuated only when the lower cam 39 is thrown inwardly by one of the teeth in the wheel 36, while the detents 43 are actuated only when the cam 40 is thrown inwardly by the teeth of the middle wheel 37, and the detents 44 are actuated only when the upper cam 41 is thrown inwardly by the upper wheel 38. Thus if it were desired to provide the fabric with open or lace work effect in zigzag lines, such as illustrated diagrammatically in Fig. 15, a detent, as 42, would be placed between the needles at a certain point and a detent 43 between the second and third needles and a detent 44 between the third and fourth needles. After skipping a certain number of spaces another set of detents, comprising 42, 43, and 44, are arranged between adjacent needles in the same manner as just described, and so on around the entire cylinder, if it is desired to have the lace-work rows entirely around the stocking.

During the operation of the machine the pin 27 on the revolving cam-head 6 would engage the wheel 26 on each revolution, so that in the first knitted course the enlarged loop x would be formed by the detents 42, which would be actuated by the cam-plate 39, through the medium of one of the teeth in the wheel 36. On the second course the enlarged loop y would be formed to the right of loop x by the detent 43, which is actuated by the cam-plate 40, through the medium of one of the teeth on the wheel 37. In the third course the enlarged loop z would be formed to the right of the loop y by the detent 44, which would be actuated by the cam-plate 41, through the medium of one of the teeth on the wheel 38. In the fourth course the detent 43 is again actuated by the cam 40, through the medium of the middle wheel 37, because this wheel has twice as many teeth as the upper and lower wheels, thus making the loop in this fourth course to the left of the last enlarged loop z , while the loop in the fifth course would be made by detents 42, thereby making a zigzag row of open or lace work as the courses are continued, such as clearly illustrated in Fig. 15 of the drawings. The design or location

of the open-work stitches can be changed at the will of the operator by arranging the position of the detents or by taking out or adding such detents.

From the above description it will be seen that these open or lace work stitches may be formed either in zigzag or straight rows, or they might be arranged to form diamond-shaped rows and various other designs by simply changing the position of location of the different sets of detents. When it is desired to have the lacework-stitches in longitudinally-disposed rows, the arrangement used in Figs. 1 and 2 of the drawings is used, in which only one wheel, as 28, and one cam-plate, as 33, are employed, and in this event the detent 7 (shown in Fig. 11) or the detent 42 (shown in Fig. 8) must be used. These detents are placed between needles wherever it is desired to have an open-work row, and on every other revolution of the cam-ring 6 the cam-plate 33 will be thrown into the path of these detents through the medium of the teeth on the wheel 28, thus producing straight rows of longitudinally-disposed open or lace work stitches.

If it should be desired to form the knitted fabric with the open or lace work rows only on the front part of the stocking, leaving the rear leg portion of closely-knitted meshes, an arm 52 is provided at a fixed point on the machine-frame, which is in the path of the cam 53, formed on the bottom of the arm 21 of the trip-lever 17, so that during the revolution of the cam-ring 6 this arm 52 will strike against the cam-face 53 and trip the lever 17, thus allowing the carriage 11 to move outwardly under the action of the spring 24, and thereby withdraw the sprocket-wheel 26 from the path of its actuating-pin 27, thus rendering the actuating mechanism for the detents inoperative. On the other side of the needle-cylinder at a point about opposite the projection 52 is a cam 54, which is so located with reference to head 14, carried by the carriage-rod 12, as to strike against the cam-face 15 of said head when the carriage 11 has been thrown out by the tripping of the lever 17, and thus push the said head 14 inwardly and reset the carriage, so that its mechanism will again be in position to actuate the detents. It will thus be seen that when the projections 52 and 54 are placed in the path of the moving carriage the detent-actuating mechanism will be in operative position during one-half of the revolution of the machine-head and inoperative during the remaining half of the said revolution.

While I have shown and described the particular mechanism employed by me for actuating the detents between the needles, I do not wish to be limited to these exact details, as various changes might be made in the construction and arrangement of these parts without affecting the broad principles of my invention or departing from the spirit and scope thereof.

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

1. In a knitting-machine, the combination
5 with the needles and mechanism for operating the same, of projecting fingers or detents adapted to pass between certain needles at certain intervals and hold the thread up while the needle in advance of it is drawing said
10 thread down thereby forming an enlarged or open mesh between closely-knitted meshes, and mechanism for operating certain detents during the knitting of one course and different detents during the knitting of other
15 courses for the purpose of changing the alignment of the enlarged or open meshes, substantially as described.

2. In a knitting-machine, the combination with the needles and their operating mechanism, of detents arranged between the needles
20 at predetermined points, a cam carried by the revolving head of the machine adjacent to the detents, and mechanism for holding said cam in the path of the detents on one or
25 more revolutions of the head and then automatically releasing the same, for the purpose substantially as described.

3. In a knitting-machine, the combination with the needles and their operating mechanism, of detents arranged between the needles
30 at predetermined points, a cam carried by the revolving head of the machine adjacent to the detents, and mechanism for holding said cam in the path of the detents on one
35 revolution of the head and releasing the same on the next revolution for the purpose substantially as described.

4. The combination with the needles and their operating mechanism, of detents arranged in series between the needles at predetermined points, a series of cams carried
40 by the revolving head of the machine, each of said cams adapted to engage a different series of detents, and mechanism for operating
45 said cams, for the purpose described.

5. The combination with the needles and their operating mechanism, of detents arranged in series between the needles at predetermined points, a series of cams carried
50 by the revolving head of the machine, each of said cams adapted to engage a different series of detents on each revolution of the head, and mechanism for operating said cams alternately, for the purpose described.

55 6. The combination with the needles and their operating mechanism, of detents arranged in series adapted to pass between needles at predetermined points, a series of cams carried by the revolving head of the machine,
60 each of said cams adapted to engage a different series of detents, and mechanism for throwing the said cams into engagement with the detents upon certain revolutions of the head, for the purpose substantially as described.
65

7. The combination with the needles and their operating mechanism, of detents arranged in series adapted to pass between needles at predetermined points, a series of cams carried by the revolving head of the machine,
70 each of said cams adapted to engage a different series of detents, and mechanism for throwing the said cams into engagement with the detents alternately upon each revolution of the head, for the purpose substantially as described.
75

8. The combination with the needles and their operating mechanism, a sinker-bar bed, a series of detents adapted to move radially in
80 said bed between the needles at certain intervals, a revolving cam-head, a movable carriage supported on said cam-head, a pivoted cam-plate carried by the carriage adjacent to the detents, mechanism for moving the cam-plate in the path of the detents at predetermined times and releasing the same, for the purpose substantially as described.
85

9. The combination with the needles and their operating mechanism, a sinker-bar bed, a series of detents adapted to move radially
90 in said bed between the needles at certain intervals, a revolving cam-head, a movable carriage supported on said cam-head, a pivoted cam-plate carried by the carriage adjacent to the detent, mechanism for moving the cam-plate in the path of the detents during one
95 revolution of the cam-head and releasing the same during the next revolution, for the purpose substantially as described.

10. The combination with the needles and
100 their operating mechanism, a sinker-bed, a revolving cam-head for actuating the sinkers, a series of detents arranged between certain needles, a sliding carriage secured on the cam-ring, a pivoted cam-plate carried by the
105 said carriage adjacent to the detents, a toothed wheel mounted on said carriage having its teeth adapted to engage the cam-plate and throw it in the path of the detents, and means for actuating the said toothed wheel so as to
110 release the cam-plate at predetermined times, substantially as described.

11. The combination with the needles and their operating mechanism, a sinker-bed, a revolving cam-head for actuating the sinkers,
115 a series of detents arranged between certain needles, a sliding carriage secured on the cam-ring, a pivoted cam-plate carried by the said carriage adjacent to the detents, a toothed wheel mounted on said carriage having its
120 teeth adapted to engage the cam-plate and throw it in the path of the detents, and means for actuating the said toothed wheel so as to release the cam-plate on every other revolution of the cam-head, substantially as described.
125

12. The combination with the needles and their operating mechanism, a cam ring or head for operating the sinker-bars, a sinker-bar
130 bed, a series of detents adapted to pass be-

tween certain needles, mechanism for actuating the said detents in advance of the sinker-bars, and means for rendering the detent-actuating mechanism inoperative, for the purpose described.

13. The combination with the needles and their operating mechanism, a cam ring or head for operating the sinker-bars, a sinker-bar bed, a series of detents adapted to pass between certain needles, mechanism for actuating the said detents in advance of the sinker-bars and means for automatically rendering the detent-actuating mechanism inoperative and again operative at predetermined times, for the purpose described.

14. The combination with the needles and their operating mechanism, of radially-disposed detents adapted to pass between certain needles in advance of the web-holders, mechanism for actuating said detents alternately, and means for rendering the detent-actuating mechanism inoperative and operative alternately during each revolution of the cam-

head of the machine, for the purpose described.

15. The combination with the needles and their operating mechanism, a sinker-bar bed, a revolving cam-head for operating the sinkers, a series of detents arranged at intervals in the sinker-bar bed, a sliding carriage secured to the cam-head, a series of pivoted cam-plates mounted on said carriage adapted to engage certain of the detents, and means for automatically withdrawing the carriage to render the cam mechanism inoperative during a portion of each revolution of the cam-head and resetting the same during the remaining portion of said revolution, for the purpose described.

In witness whereof I have hereunto set my hand this 12th day of June, A. D. 1901.

GEORGE E. ELLIS.

Witnesses:

JNO. T. CROSS,
CHARLES H. SPECKMAN.