

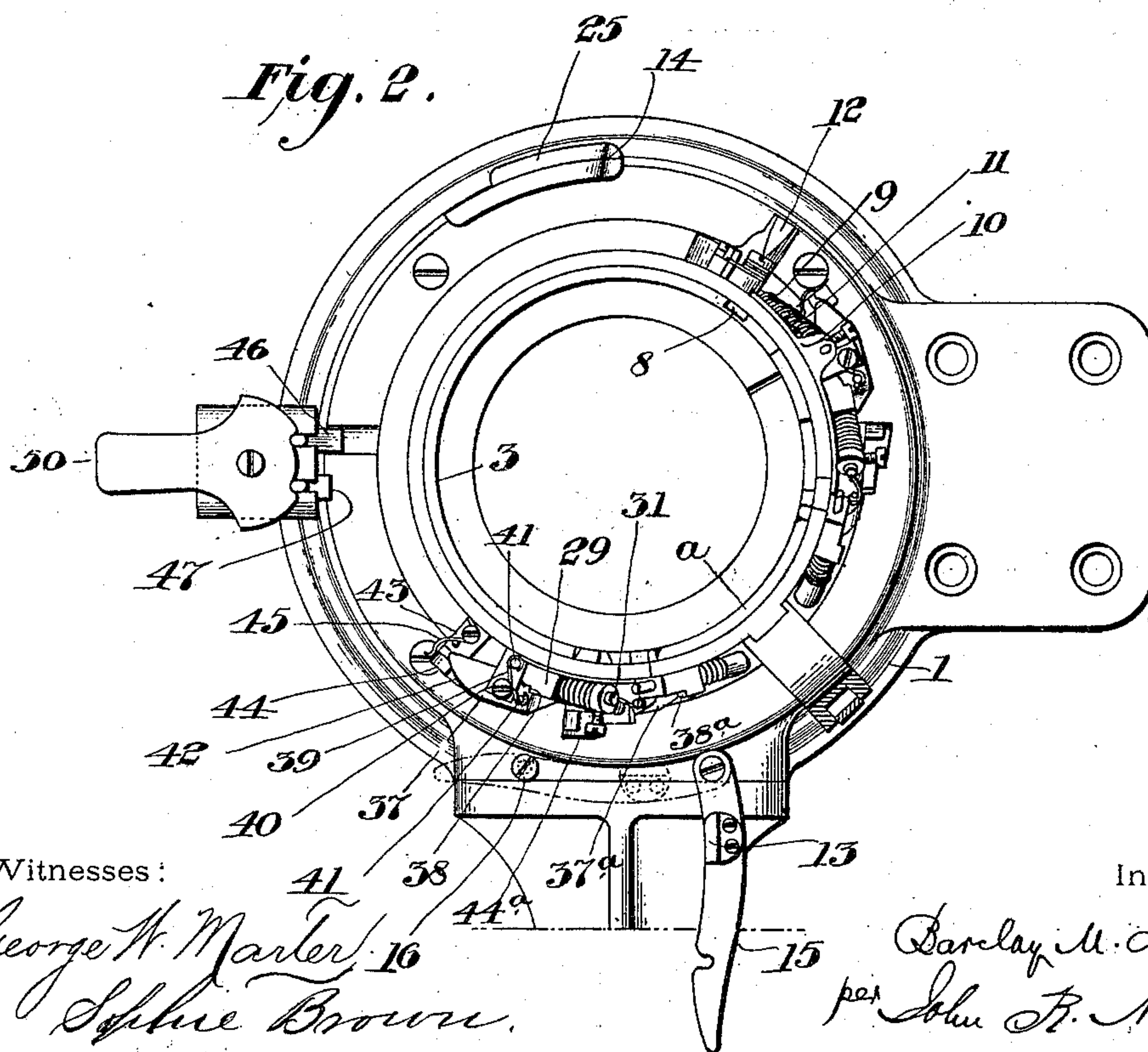
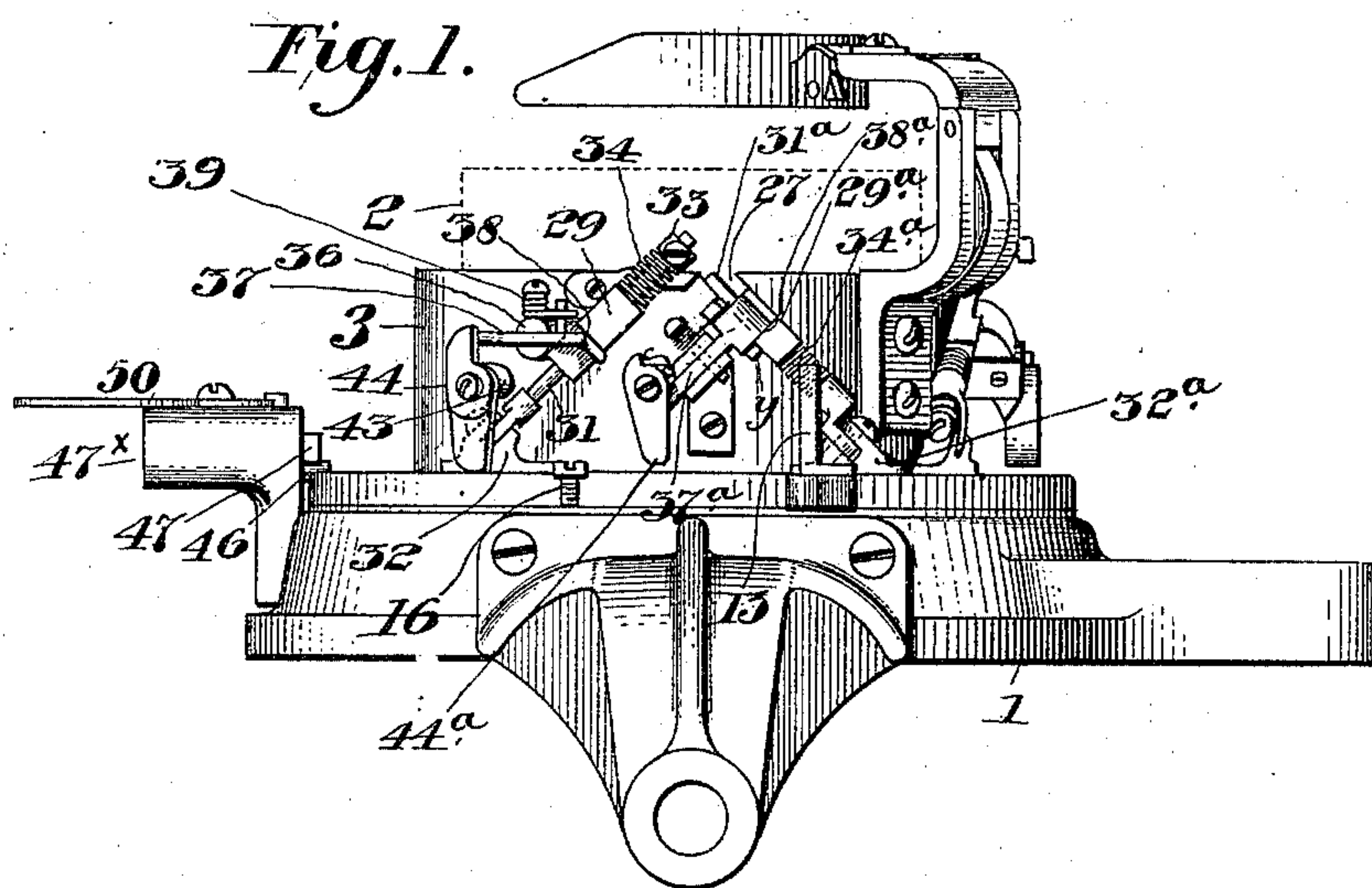
(No Model.)

3 Sheets—Sheet 1.

B. M. DENNEY.
CIRCULAR KNITTING MACHINE.

No. 540,151.

Patented May 28, 1895.



Witnesses :

Inventor.

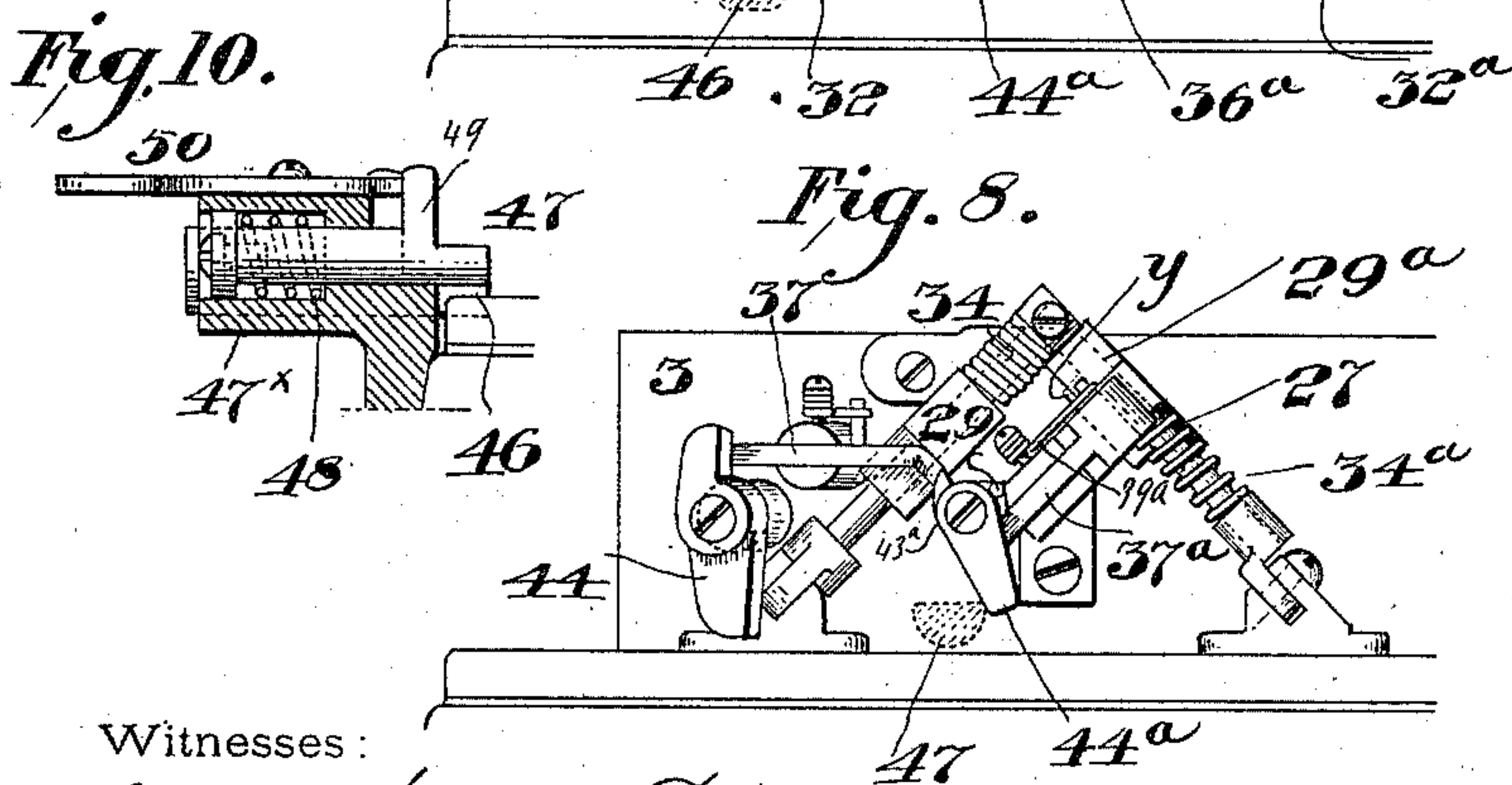
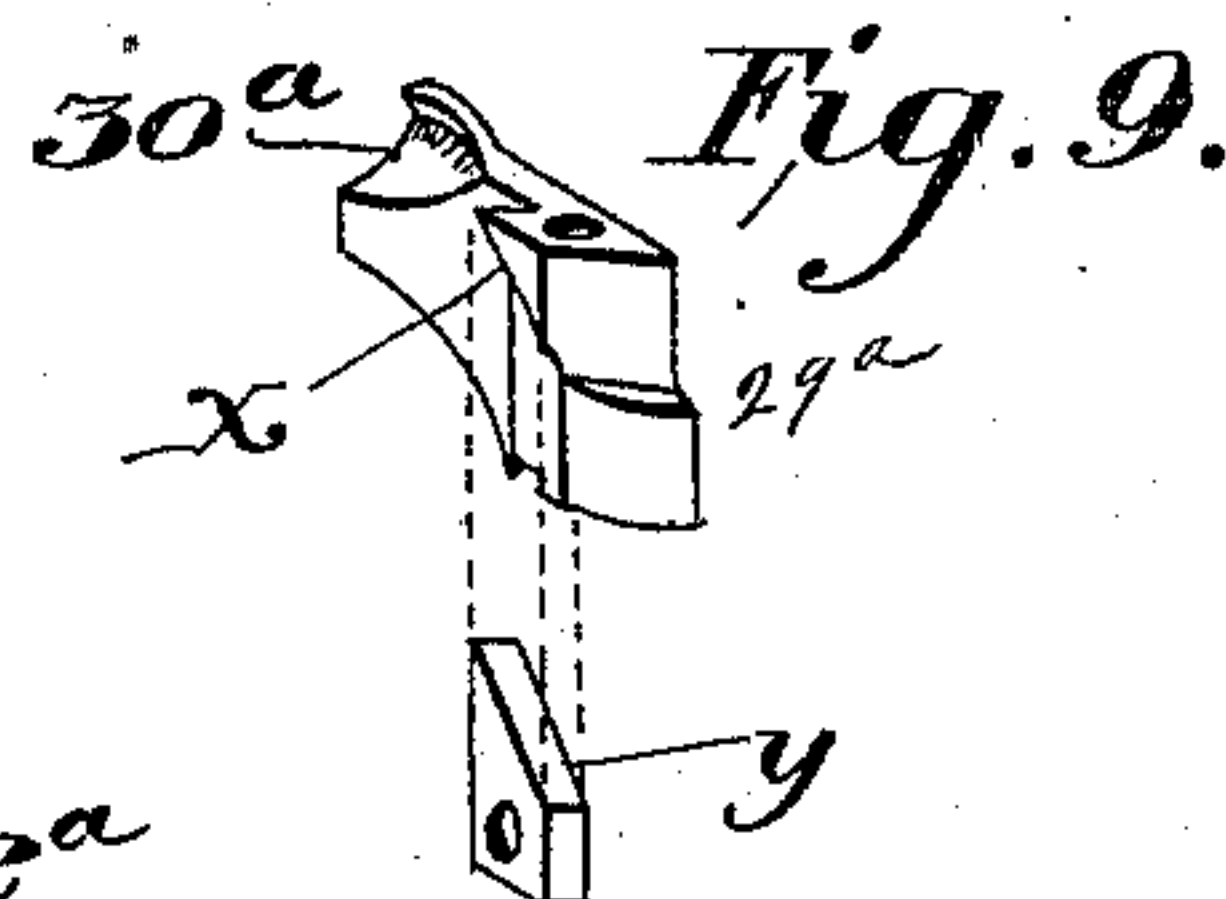
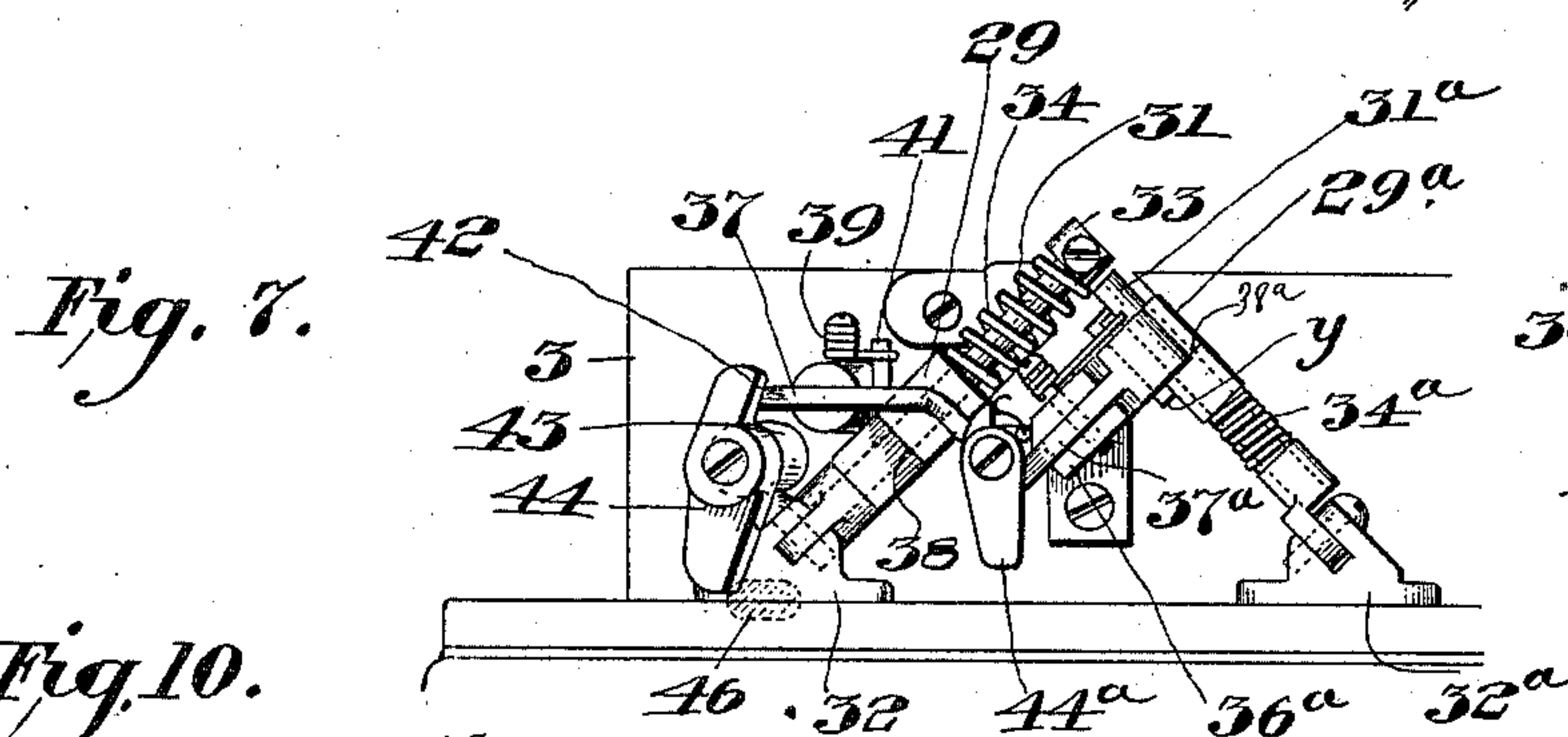
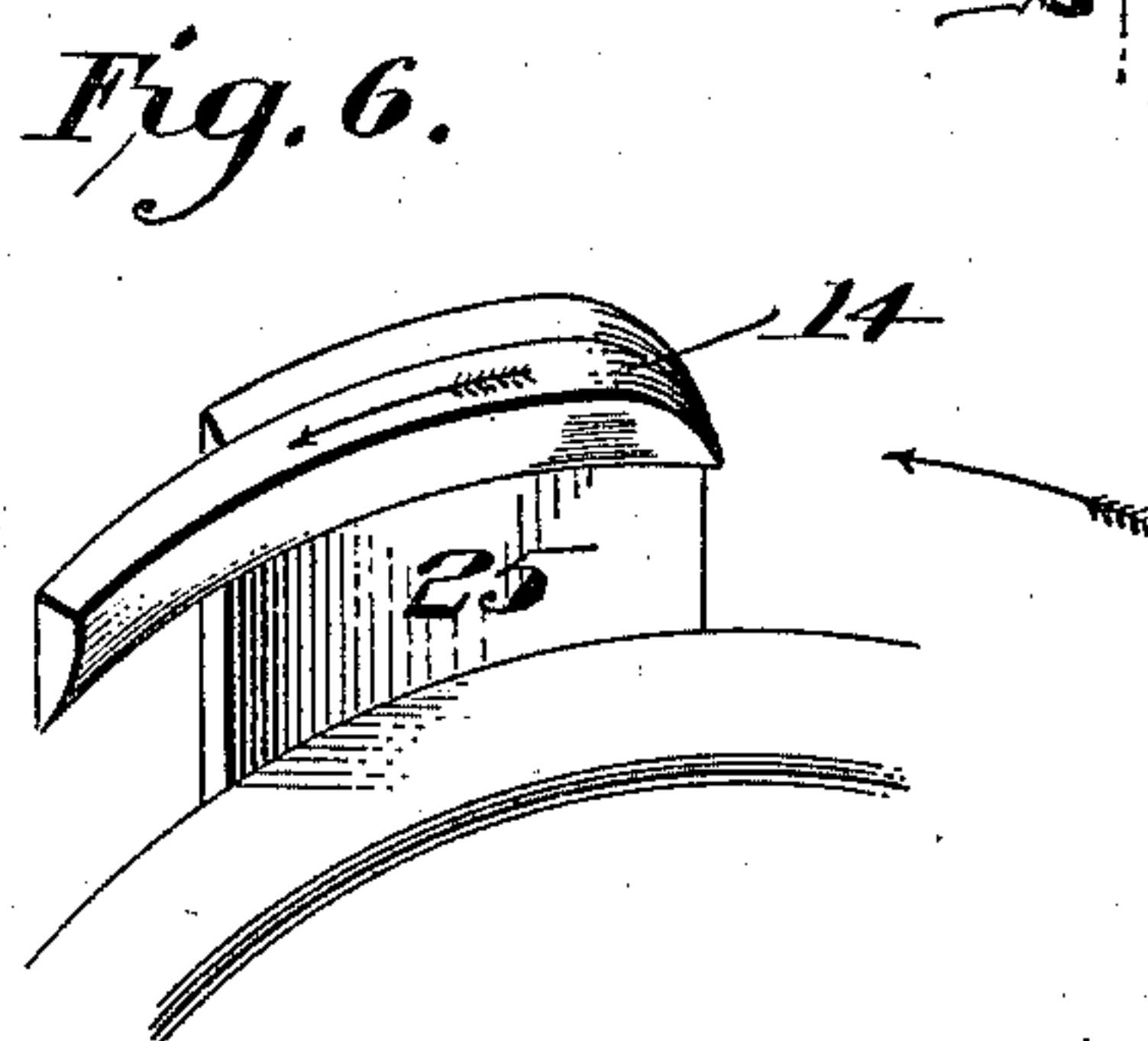
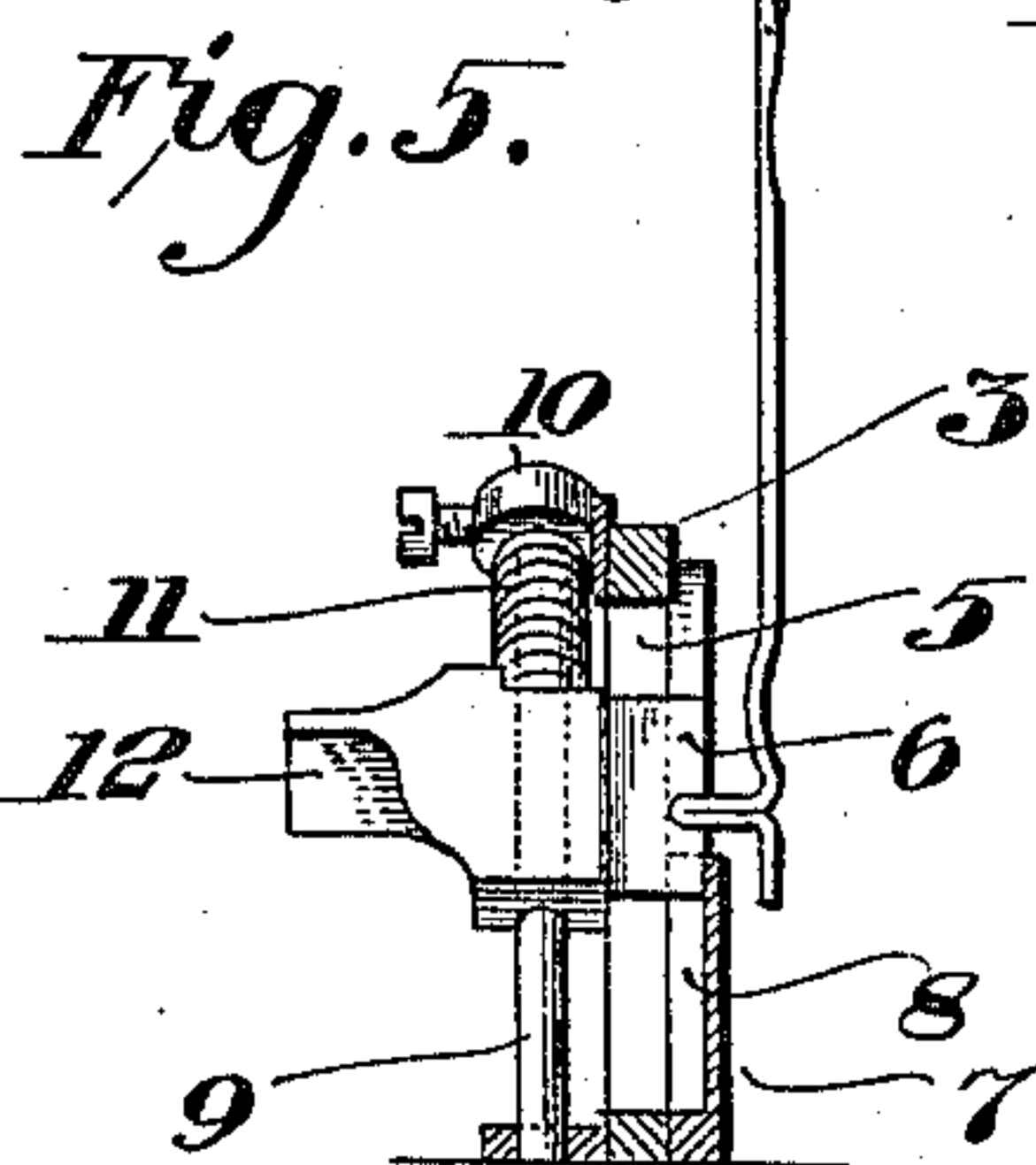
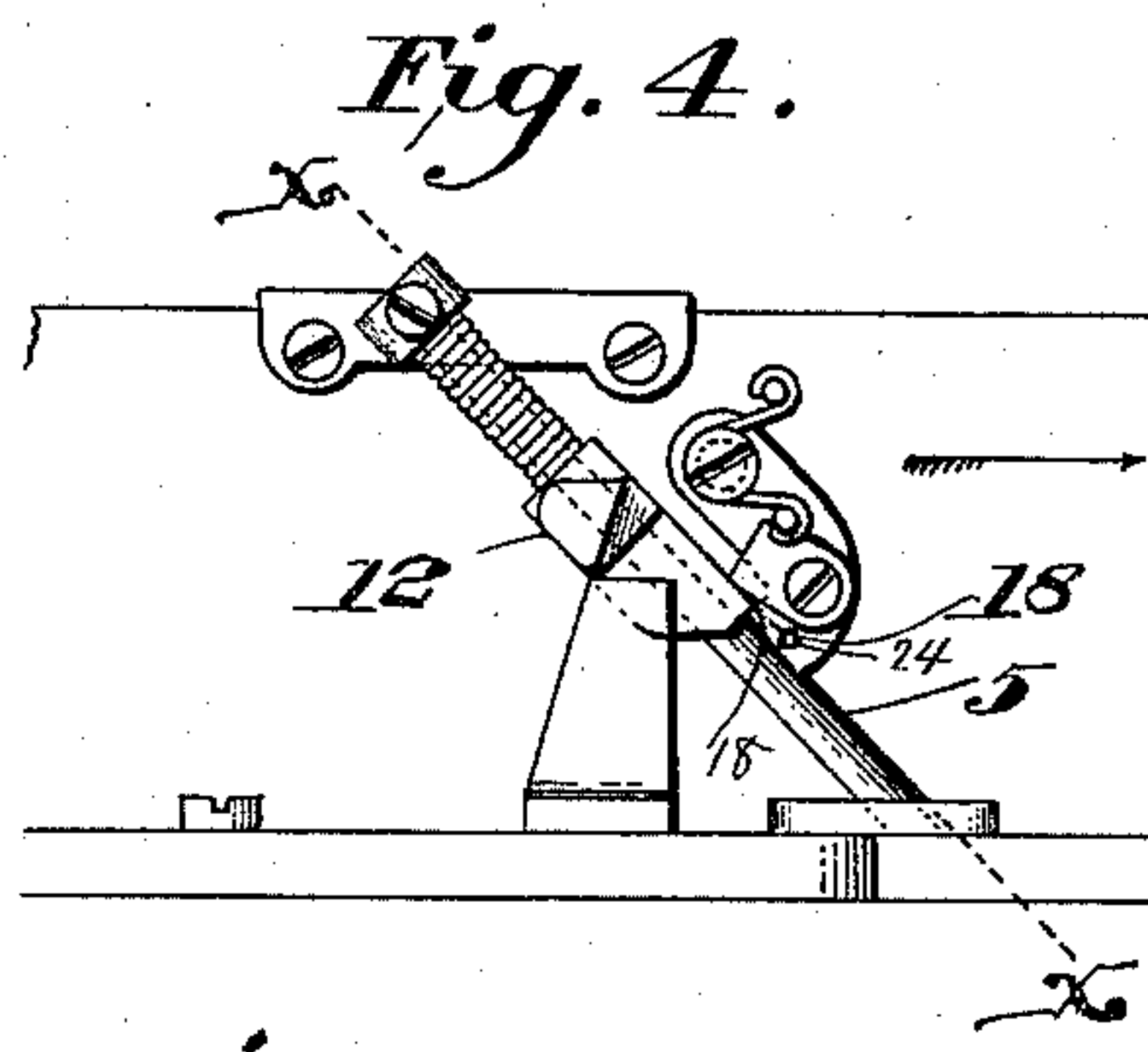
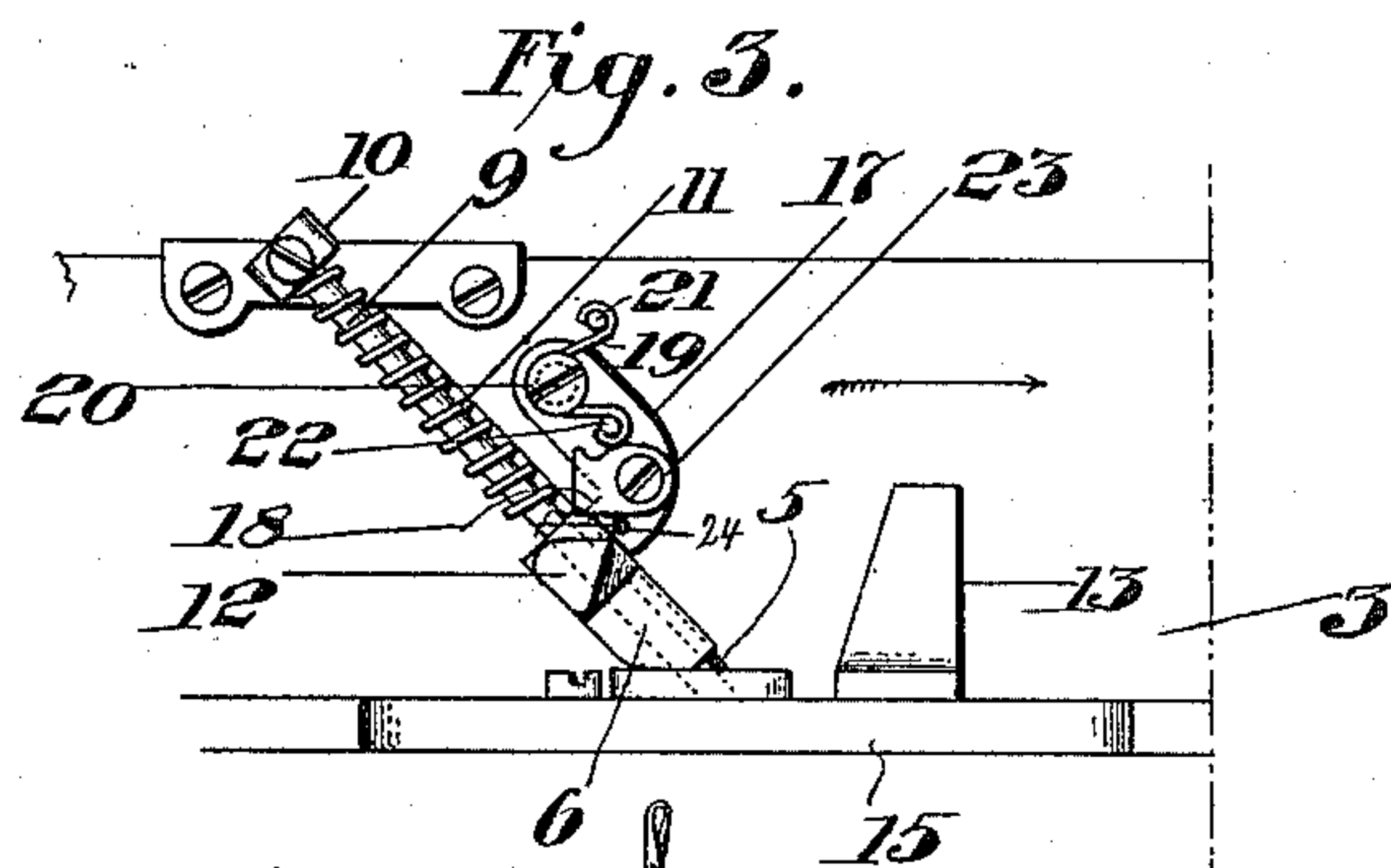
Barclay M. Denney
per John F. Nolan.

Attorney.

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Witnesses:

George W. Marten.
Sophie Brown.

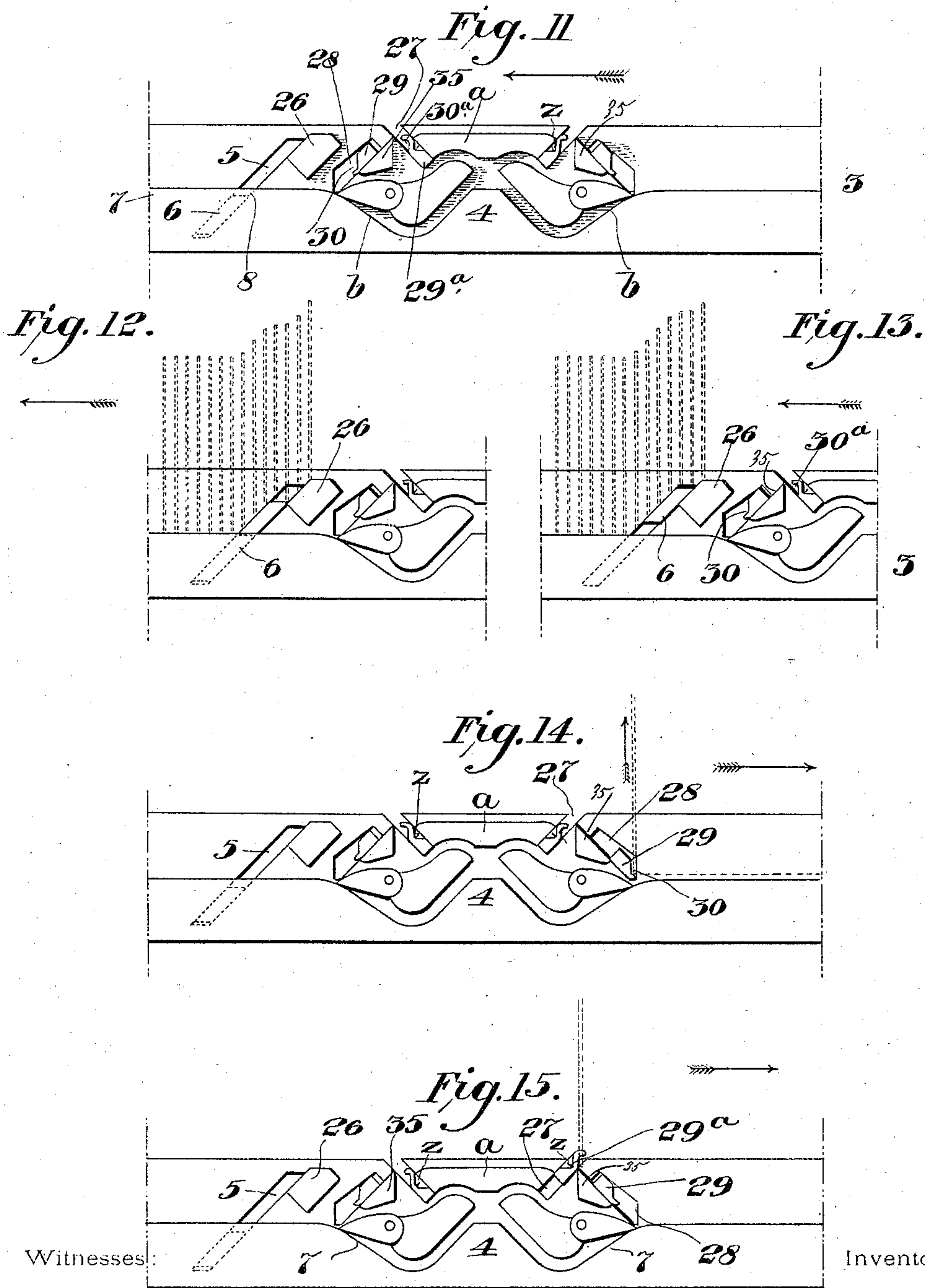
Inventor.

Barclay M. Denney,
per John B. Nolan
Attorney.

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George H. Marter
Sophie Brown

Barclay M. Denney
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Attorney.

UNITED STATES PATENT OFFICE.

BARCLAY M. DENNEY, OF CAMDEN, NEW JERSEY.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 540,151, dated May 28, 1895.

Application filed August 9, 1893. Serial No. 482,743. (No model.)

To all whom it may concern:

Be it known that I, BARCLAY M. DENNEY, a citizen of the United States, residing at the city and county of Camden, in the State of New Jersey, have invented certain new and useful Improvements in Circular-Knitting Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates more especially to those knitting machines that are provided with devices for directing needles into and out of operative position, at predetermined intervals, during the process of fashioning the web, as for instance, in the knitting of the heel and toe parts of stockings.

A machine of this class forms the subject of an application for Letters Patent of the United States, filed by me October 8, 1891, Serial No. 408,082, to which reference may be had.

The present matter may be described as an improvement upon my former machine, with the view of rendering the same more substantial and durable in construction and more efficient in operation; and to this end the invention comprises novel features of construction and organization that will be hereinafter described and definitely claimed.

Referring to the annexed drawings, Figure 1 is a partial side elevation of a circular-knitting machine embodying my improvements. Fig. 2 is a plan thereof. Figs. 3 and 4 are details of the needle-deflecting devices, the latter being shown in their down or idle and in their up or active positions, respectively. Fig. 5 is a partial section, as on the line *xx* of Fig. 4. Fig. 6 is a view of a secondary cam for action upon the said needle-deflecting device. Figs. 7 and 8 are partial side elevations of the cam-cylinder and adjuncts, showing the needle elevating and depressing devices in the different positions they are caused to assume. Fig. 9 is a view of one of the needle-depressing cams detached in connection with a beveled deflecting piece therefor. Fig. 10 is a section of the tripping device. Figs. 11 to 15, both inclusive, are diagrams illustrating the positions and actions of the needle-controlling cams at various stages of the operation.

The numeral 1 designates the bed of a circular knitting machine; 2, the fixed needle-cylinder; 3, the rotatable cam-cylinder, and 4 the knitting cams. These parts are well-known.

One feature of the invention, which I shall now proceed to describe, embodies a construction for raising a series (usually one-half) of needles in succession above the path of the knitting cams preparatory to performing reciprocating work, as, for instance, in the knitting of a heel or toe.

In the wall of the cam-cylinder, at a suitable point beyond the knitting cams, is formed a diagonal slot 5, through which extends from the exterior of the cylinder a needle deflecting cam 6 that is movable lengthwise of the slot, the operation of this cam being determined by devices exteriorly of the cylinder. The slot extends below the top of the usual needle-rest 7 the latter being channeled or recessed coincident with the slot (as at 8) so as to receive the deflecting cam. Through the outer portion of the cam freely extends a diagonal guide rod 9 rigidly secured to the cylinder. This rod is disposed adjacent to and parallel with the slot 5, so that the cam 6 may be moved in the direction of the slot. Interposed between the cam and the lug 10 to which the upper end of the rod is secured, is a spiral spring 11 which acts normally to depress said cam and maintain its inner portion below the top of the needle rest 7. In this position, the cam is out of action. (See Fig. 11.) When, however, said cam is raised, to project sufficiently above the needle-rest, it lies in the track of the needle heels supported upon the rest. Hence, during the revolution of the cylinder the cam abuts against the needle heels in its path and deflects them upwardly beyond the path of the knitting cams, as indicated in Fig. 12.

When the requisite number of needles has been thrown out of action, if the cam 6 be raised still farther so as to move its lower edge above the line of the succeeding needle heels, the position of the latter will be unaffected by the said cam 6, and hence they will be operated by the knitting cams. (See Fig. 13.) If the cam 6 be maintained in this elevated position until the needles in engagement therewith have escaped the cam, and then be

moved down to its original position, it will be obvious that the series of needles acted upon by the cam, and those only, will be thrown upward positively and uniformly, to the same plane.

Although there are various means whereby the movements of the deflecting cam at the predetermined periods may be effected, I have illustrated in the accompanying drawings a construction for this purpose that I have found, by experience, to be very efficient and desirable, as follows: Projecting outwardly from the cam 6 is a tappet stud arm 12, which is adapted at the proper intervals during the revolution of the cylinder to impinge against suitably-disposed cams 13 and 14 on the bed of the machine, and thus to be successively raised. The primary raising cam 13, as it may be termed, is movable into and out of the path of the arm 12 as desired. In the present instance, this cam 13 is secured to a pivoted lever 15 on the bed of the machine, a suitably-disposed screw or pin 16 in said bed snugly registering with a notch in the lever, when the latter is moved inward, and thus maintaining the lever with its cam, in the inward or active position.

The forward or acting edge of the cam 13 is inclined at such an angle that when the arm 12 abuts against the same, during the traverse of the cylinder, said arm with its connections will be raised in a vertical plane, or substantially so. Thus the needles in the path of the cam 6 will be immediately acted upon thereby. The cam 13 is of sufficient height to effect the movement of the cam 6 into the path of the needle heels on the needle rest as indicated in Fig. 4, and as above described, whereupon said cam 6 is temporarily locked in this position by means of a suitable latch. This latch comprises an arm 17 pivoted on the cylinder adjacent to the slot 5 and provided on its inner edge with a shouldered portion 18, which is held normally against the outer side of the cam 6 by the action on the arm 17 of a torsional spring 19, the body of the latter encircling the pivot pin 20 while its ends are secured to studs 21, 22, on the cylinder and arm respectively. Pivoted on the arm 17 so as to project normally beyond the shoulder thereon is a tumbler 23, the lower edge of which bears upon a stop 24. Thus, while the tumbler cannot drop below this stop, the former may be moved upward sufficiently to clear the shoulder. By this construction it will be seen that when the deflecting cam is raised, its outer lower edge immediately upon passing the shoulder 18 will be engaged by the latter and thereby locked in position, the tumbler during the movement being pressed upward by the proximate edge of the deflecting cam. It will also be seen that if the cam 6 be subsequently raised slightly higher so that its outer lower edge will clear the contiguous corner of the tumbler, the tumbler will drop by gravity to its normal position, whereupon, if the cam 6 be freed, its outer

projecting corner will bear against the opposed edge of the tumbler and thus force the latch arm outward sufficiently to disengage the shoulder 18 from the cam, thereby permitting said cam to resume its original or idle position in readiness for a succeeding operation. When the tappet stud escapes the cam 13, the cam 6 is locked in the raised or active position. Hence the deflecting cam, during the advance of the cam cylinder, directs out of action the successive needles in its path. As this cam approaches the end of the series of needles to be up-thrown, the stud engages the beveled end of the secondary cam 14 fixed to a post 25 rising from the bed plate as it may be termed, which cam 14 thereupon raises the stud sufficiently to move the lower inner edge of the deflecting cam above the plane of the succeeding needle heels. Continuing the movement of the cylinder, the stud rides upon the upper horizontal edge of the cam 14 and is held up thereby. Hence the deflecting cam 6 during this period uniformly elevates the needles in engagement therewith. When the stud is raised by and upon the cam 14, the outer portion of the deflecting cam is freed from the shoulder on the latch arm as above described, and, therefore, when the arm escapes the cam 14, the deflecting cam is depressed to its original position by the action of the spring 11. This done, the primary cam 13 is thrown out of action.

I preferably secure on the inner side of the cylinder adjacent to the deflecting cam, a similarly inclined cam 26, the function of which is to direct the needles upward still farther when they are discharged from the cam 6. See Figs. 11 to 15 both inclusive.

Another feature of my invention relates to a construction whereby the needles used in the operation of fashioning the heel and toe parts of the stocking may be automatically moved out of and into action, at the proper intervals during the reciprocation of the cam cylinder, that is, after the series of needles formerly described has been moved out of operative position. This construction is as follows: Oppositely inclined slots 27, 28 similar to those illustrated in my aforesaid pending application, are cut in the cam cylinder at or adjacent to each end of the knitting cams, through which slots project certain needle-controlling devices that are connected with and controlled by mechanism on the exterior of the cylinder. The two sets of devices are identical in construction and operation, excepting that they occupy reversed positions and hence a description of one set only will be sufficient. Reference will here be made to that set on the leading end of the knitting cams, assuming the latter to be moving in the direction indicated by the arrow in Fig. 14. The slot 27 extends diagonally from the top of the cylinder to and below the nose of the upper cam *a* of the knitting cams, while the oppositely disposed slot 28 rises from the summit of the lateral raising cam *b*.

Extending into and through the slot 28 is a needle-elevating cam 29 the lower forward corner of which is preferably notched or recessed as at 30. Through the outer portion of this cam freely extends a diagonally-disposed guide-rod 31 the lower end of which is pivoted to a bracket 32 on the outer flange of the cam-cylinder, to the end that said rod with the cam 29 thereon, may be moved toward or away from the cylinder. This rod constitutes a guide for the cam in its longitudinal movement within the slot. On the upper end of the rod is a collar or head 33 between which and the outer portion of the cam is interposed a spiral spring 34 which tends to normally depress the cam to the bottom of the slot. When the needle-elevating cam occupies this position the inner recessed portion thereof is in the line or track of the heels of the active needles, and hence said portion abuts against the first heel in its path during the traverse of the cam cylinder, (as indicated in Fig. 14) which cam, with the needle in engagement therewith, is thrust upward against the pressure of the spring. When the said cam has reached the limit of its upward movement, its recessed portion, bearing against the heel of the needle, moves the cam outward, thereby freeing the needle. A cam 35 fixed adjacent to the slot 28, receives the needle when it is released from the cam, and forthwith conducts that needle out of action—that is, above the line of action of the knitting cams.

In order that the cam 29 shall be conditionally locked in the elevated position when the needle is freed therefrom, so that the said cam will not descend and thus interfere with the succeeding needles during the stroke of the cylinder, I pivot on a stud 36 projecting outwardly from the cylinder a latch lever 37 and provide the outer portion of the cam 29 with a shoulder 38 with which one arm of said lever is adapted to engage when the arm 29 is raised. This arm of the lever is held yieldingly against the cam by means of a torsional spring 39 the body of which encircles a screw 40 on the post, while its ends bear against pins 41 on the post and lever arm respectively. See Fig. 2. This spring not only maintains the lever in position normally to engage the shoulder on the cam, but it also automatically presses said cam to its inward position when the engaged needle is released. It will be obvious that when the needle elevating cam is locked by means of the latch lever, if the outer arm 42 of the latter be pressed inward, said cam will be released, whereupon the compressed spring 34 expanding, will depress the cam to its active position in readiness for a succeeding operation.

Pivoted to a stud 43 fixed on the cylinder, adjacent to the latch lever, is a vertically disposed trip lever 44 the upper member of which is held normally against the outer edge of the lever arm 42 by means of a suitably-disposed spring 45, Fig. 2. This edge of the

arm 42 is beveled as shown, so that if the lower end of the trip lever be properly moved the upper end thereof will bear against the opposed beveled edge of the arm 42 and thus unlatch the cam. The means which I prefer to employ for operating this trip lever will be hereinafter described. It will be obvious that if during each reciprocation of the cam cylinder the cams 29 on the opposite ends of the knitting cams, be alternately released, a needle will be lifted out of action at the alternate ends of the successive courses, and hence a gradual narrowing of the web will be effected. If the said inactive needles be depressed into action in reverse order to their elevation a corresponding widening of the web will follow to complete the toe or heel pouch.

It will be observed that the slot 28 enlarges toward its lower end, so as to permit a little play of the cam 29 at this point. The object of this is to enable the said cam to be readily moved upward by contact with a needle heel against its lower rearward corner, should said cam be accidentally or prematurely depressed.

The devices which I employ for moving the inactive needles into play are virtually the same as the elevating devices above described, save that the conditions of the depressing cams 29^a are reversed. The needle depressing cam extends into and through the slot 27 its upper forward corner being notched as at 30^a similarly to the lower corner of the cam 29. It is likewise mounted on a diagonal guide rod 31^a pivoted in a bracket 32^a on the exterior flange of the cam cylinder. A spiral spring 34^a interposed between a shoulder on the lower portion of the rod and the under side of the outer portion of cam 29^a acts normally to raise said cam to the top of the cylinder so that the recessed portion of the cam will intersect the plane occupied by the heels of the up-thrown needles, as indicated in Fig. 15. Thus said portion will abut against the first needle-heel in its path during the rotation of the cylinder, the cam with the engaged needle being thereupon pressed downward against the force of the spring 34^a. The outer portion of the cam is provided with a beveled shoulder *x* which bears against a correspondingly beveled piece *y* on the wall of the cylinder 3 so that as the cam is being depressed, said piece will act to retract the cam from engagement with the heel of the needle. The parts are so constructed that the heel of the needle does not escape the cam 29^a until it (said heel) is in operative position, that is in the track of the knitting cams. When the needle escapes the depressing cam, the latter is conditionally locked in position similarly to the needle raising cam, that is to say, a spring actuated latch-lever 37^a pivoted exteriorly to the cylinder engages a shoulder 38^a on the outer portion of the cam. The spring 39^a which actuates the latch lever also serves, as in the other instance, normally to press the

cam into the cylinder. A vertically disposed trip lever 44^a pivoted on a fixed stud 43^a adjacent to the latch lever is adapted to bear against the beveled edge of the outer arm of the latch lever, at predetermined intervals, for the purpose of unlatching the cam, thus permitting the spring 34^a to throw said cam into action.

It will be obvious that if during each reciprocation of the cam-cylinder after the completion of the narrowing process, the needle depressing cams on the opposite ends of the knitting cams be alternately brought into operation, the afordescribed widening of the web will be accomplished. It will be observed that the upper corner of the cam 29^a is notched or recessed as at *z*. The object of this is to permit a raised or inactive needle upon being struck by this corner of the cam, to deflect the latter outward, and thus escape the same, should such cam be accidentally or prematurely raised.

The means which I prefer to employ for the purpose of periodically actuating the trip levers of the respective cams, comprise a pair of studs 46, 47, which may be moved into or out of the paths of the said levers. Preparatory to the narrowing operation, the stud 46 is projected into the path of the levers 44, so that during the reciprocation of the cam cylinder, said levers will alternately abut against and be operated by the stud. Upon the completion of this operation, the stud 46 is retracted, and its fellow projected into the path of the trip levers 44^a. Hence in the following reciprocations of the cylinder the latter levers will be actuated by the stud 47. These studs in their construction and operation are identical with those of the like parts set out in my other application referred to—that is to say, the studs are fitted to shouldered holes in a bracket 47^x rising from the base of the machine; suitably disposed springs 48 serving normally to retract the studs. Extending from the latter through slots in the top of the bracket are studs 49 which are engaged by the cam shaped end of a lever 50 pivoted on the bracket. When the lever is in the central position both studs are retracted, but when it is moved to the right or left, the corresponding stud is projected into the path of those trip levers to be acted upon thereby.

The word "lock" is used in the claims in a sense to comprehend the supporting or the fastening of the deflecting cam out of action, irrespective of the particular means employed.

I claim as my invention—

1. The combination with a cam carrier and its cams, of a needle deflecting cam diagonally disposed in said carrier, and means whereby it may be raised diagonally into or be depressed diagonally out of the normal track of the needles, substantially as described.

2. The combination with a cam carrier and its cams, of a normally inactive needle deflecting cam disposed diagonally in said carrier so as to be lengthwise movable into the

track of the needles, and means exteriorly of the carrier adapted to move said cam into action in a vertical plane during the rotation of said carrier, substantially as described.

3. The combination with a cam carrier, and its cams, of a normally inactive needle deflecting cam disposed diagonally in said carrier so as to be movable into the track of the needles, and means exteriorly of the carrier adapted to move said cam into action in a vertical plane during the rotation of said carrier, means to lock said cam in action, and means to free the same, at a predetermined period; substantially as described.

4. The combination with a cam carrier, and its cams, of a normally inactive needle deflecting cam disposed diagonally in said carrier so as to be movable into the track of the needles, and means exteriorly of the carrier adapted to move said cam into action in a vertical plane during the rotation of said carrier, means to lock said cam in action, means to raise it above the normal track of the needles, maintain the same therein a predetermined period, and then release the said cam; substantially as described.

5. The combination with a cam carrier and its cams, of a normally inactive needle deflecting cam diagonally disposed in said carrier, an arm extending therefrom exteriorly of the carrier, a fixed cam against which said arm is adapted to abut, and by which it is adapted to be raised vertically, during the traverse of the carrier, into the normal track of the needles, together with means adapted to lock said cam in the active position; substantially as described.

6. The combination with a cam carrier and its cams, of a normally inactive needle deflecting cam diagonally disposed in said carrier, an arm extending therefrom exteriorly of the carrier, a fixed cam against which said arm is adapted to abut, and by which it is adapted to be raised vertically, during the traverse of the carrier, into the normal track of the needles, means adapted to lock said cam in the active position, means adapted to be actuated at a predetermined period to release said locking means and a second fixed cam adapted to raise the needle-deflecting cam above the track of the needles, maintain it therein a predetermined period, and finally release the same; substantially as described.

7. The combination with a cam carrier and its cams, of a normally inactive needle-deflecting cam disposed diagonally in said carrier, a guide rod upon which said cam is mounted, a spring tending to depress said cam, an arm extending from the latter, a fixed cam adapted to raise said deflecting cam vertically against the action of the spring, means to lock said cam in the raised position, and means to unlock the cam at a predetermined period; substantially as described.

8. The combination with a cam carrier and its cams, of a diagonally disposed cam in said carrier, means for raising said cam, a spring

actuated latch arm mounted exteriorly of the carrier and adapted to engage said cam when it is elevated, together with a tumbler on said latch arm adapted to permit the disengagement of the latch arm and cam; substantially as described.

9. The combination with a cam carrier provided with a diagonal slot therein extending below the needle-rest, the latter being provided with a groove or channel coincident with said slot, of a diagonally disposed needle-deflecting cam, fitted to said slot and groove, and means adapted to project said cam at predetermined intervals above the needle-rest; substantially as described.

10. The combination with a cam-carrier and its cams, of a diagonally sliding needle engaging cam and means adapted normally to project said cam yieldingly into the carrier, whereby it will be engaged by a needle-heel in its path and be moved diagonally and outwardly thereby; substantially as described.

11. The combination with a cam carrier and its cams of a diagonally sliding needle engaging cam spring devices adapted normally to press the same yieldingly in the path of the knitting needles, whereby said cam will be engaged by a needle-heel in its path and be moved diagonally and outwardly thereby, a latch device to lock the said cam out of action, and trip devices to release said latch, substantially as described.

12. The combination with a cam-carrier and

its cams of a diagonally sliding needle-engaging cam, a vibratory guide rod therefor mounted exteriorly of the carrier, a spring acting to maintain said cam normally in action, and a spring-actuated latch adapted to lock said cam out of action, and to project the same normally into the carrier, substantially as described.

13. The combination with a cam carrier and its cams of a diagonally movable needle depressing cam notched or recessed in each upper corner thereof (as at 30^a and *z*), means adapted normally to project said cam yieldingly into the carrier, and means to maintain said cam yieldingly elevated; substantially as described.

14. The combination with a cam carrier and its cams of a needle elevating cam, having a diagonally reciprocative movement, an outward and inward movement, and a slight upward movement at predetermined periods, together with a vibratory guide device, for said cam, a spring to maintain the latter normally depressed, and means to maintain the same yieldingly projected into the carrier; substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

BARCLAY M. DENNEY.

Witnesses:

JOHN R. NOLAN,
S. BROWN.