

No. 623,097.

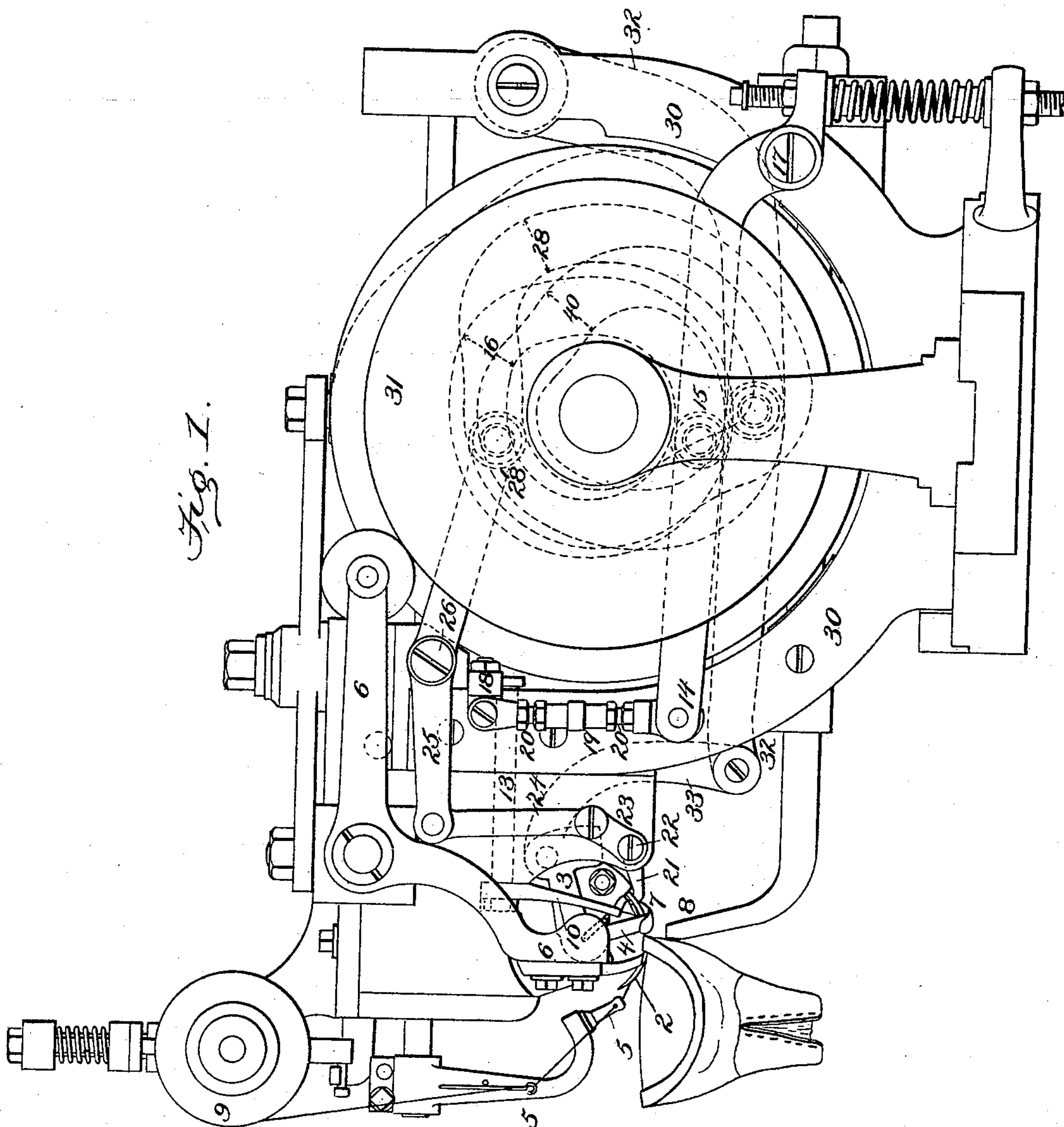
Patented Apr. 11, 1899.

F. A. MILLS.  
SEWING MACHINE.

(Application filed Dec. 11, 1895.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses

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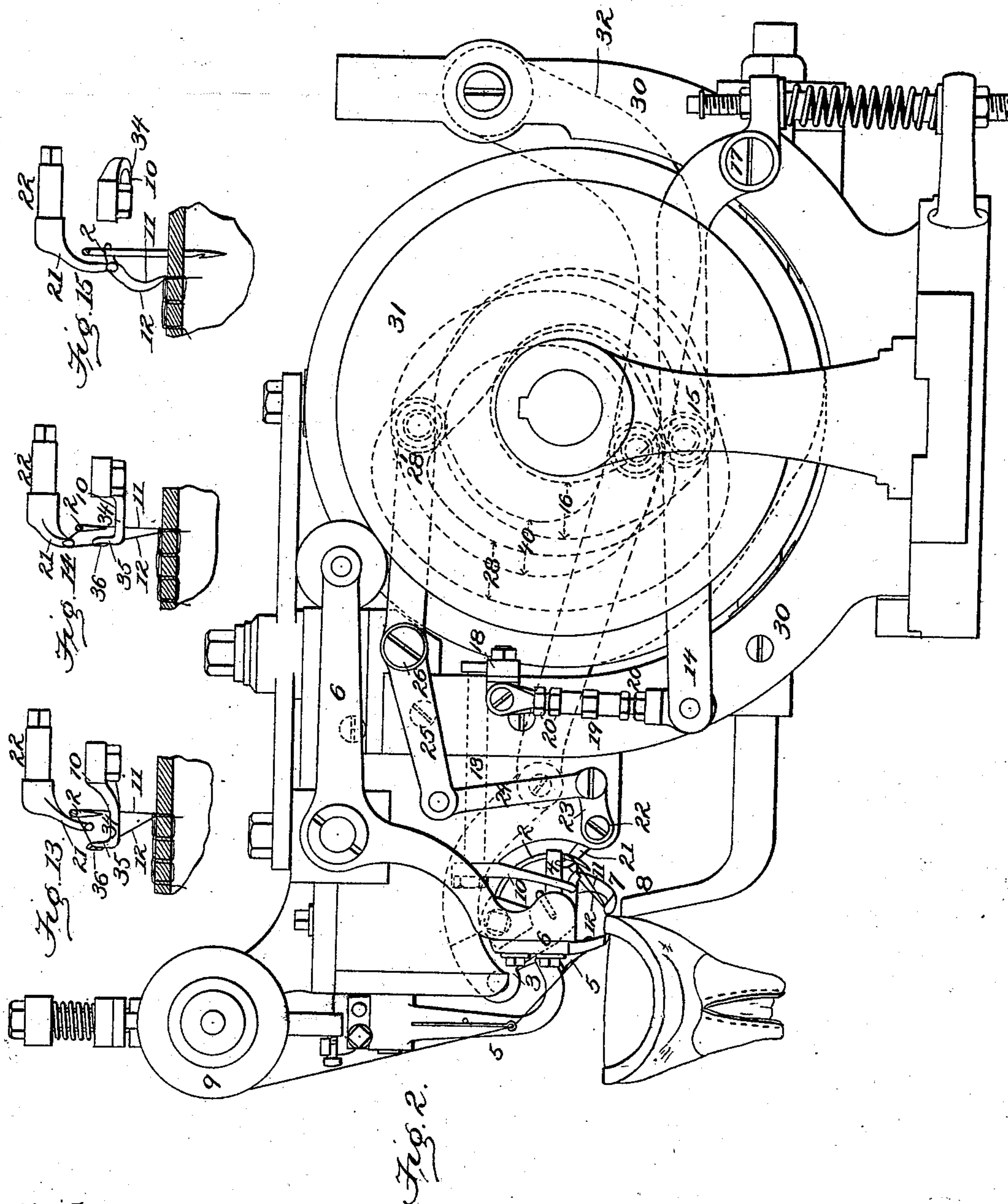
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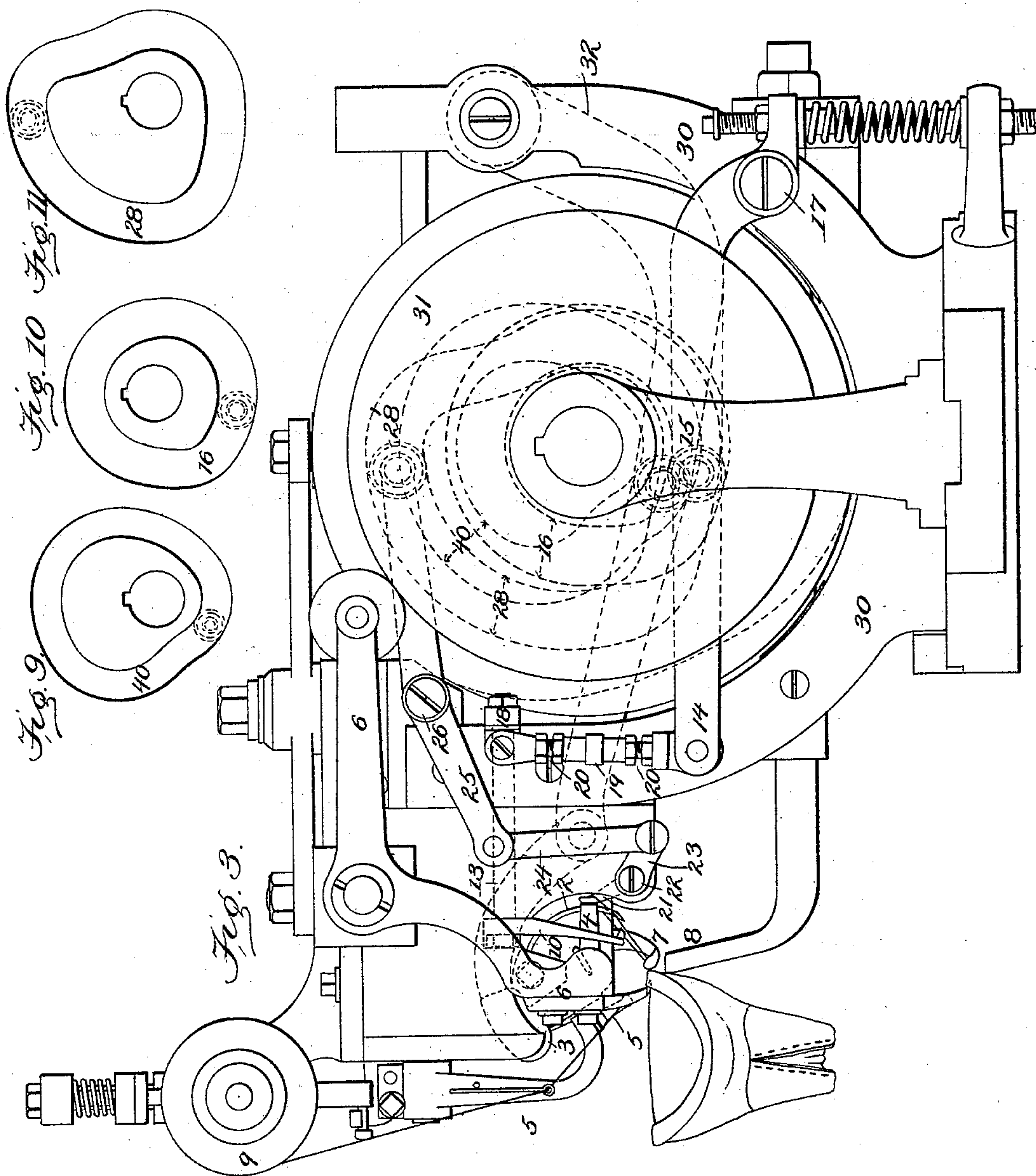
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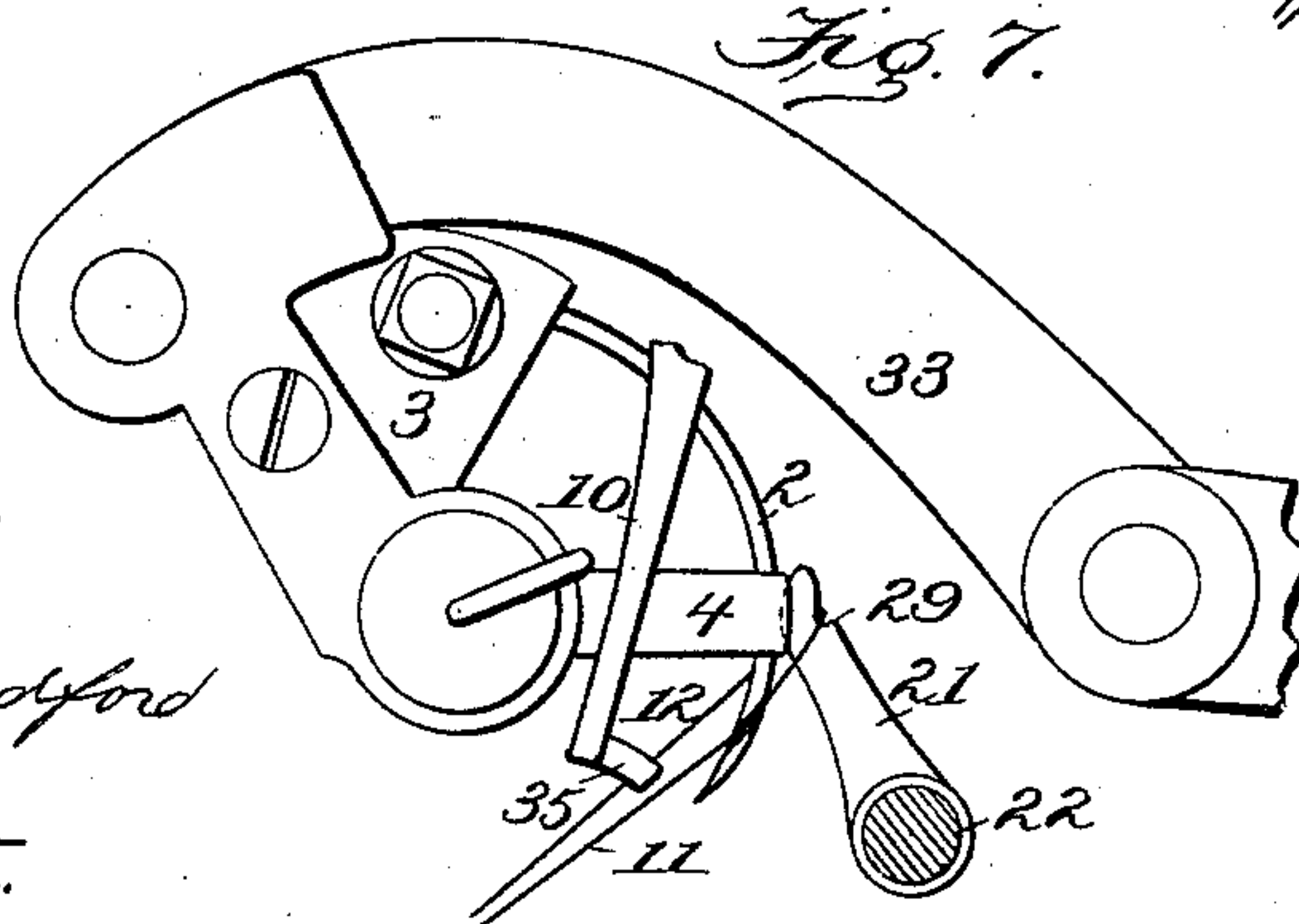
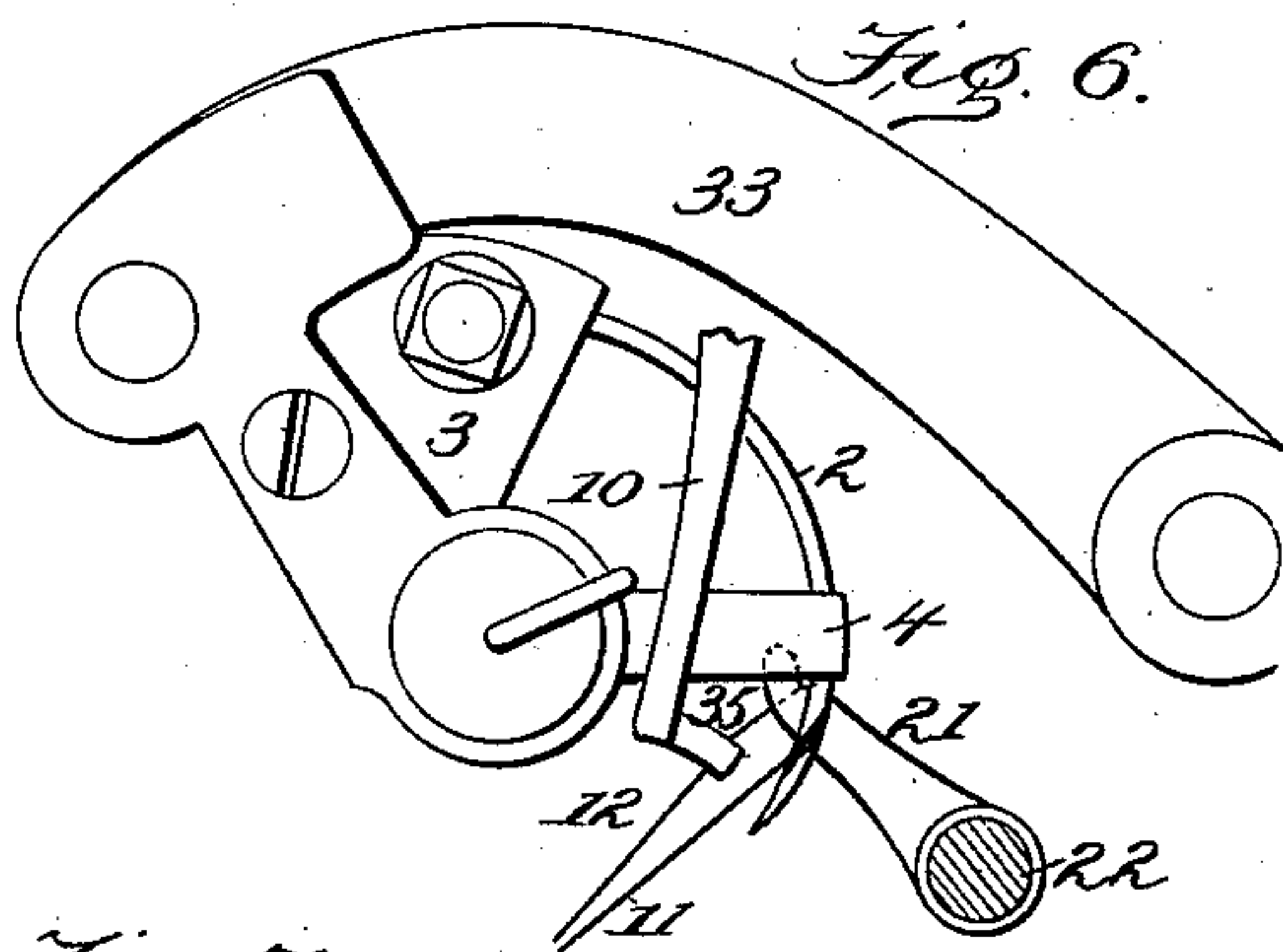
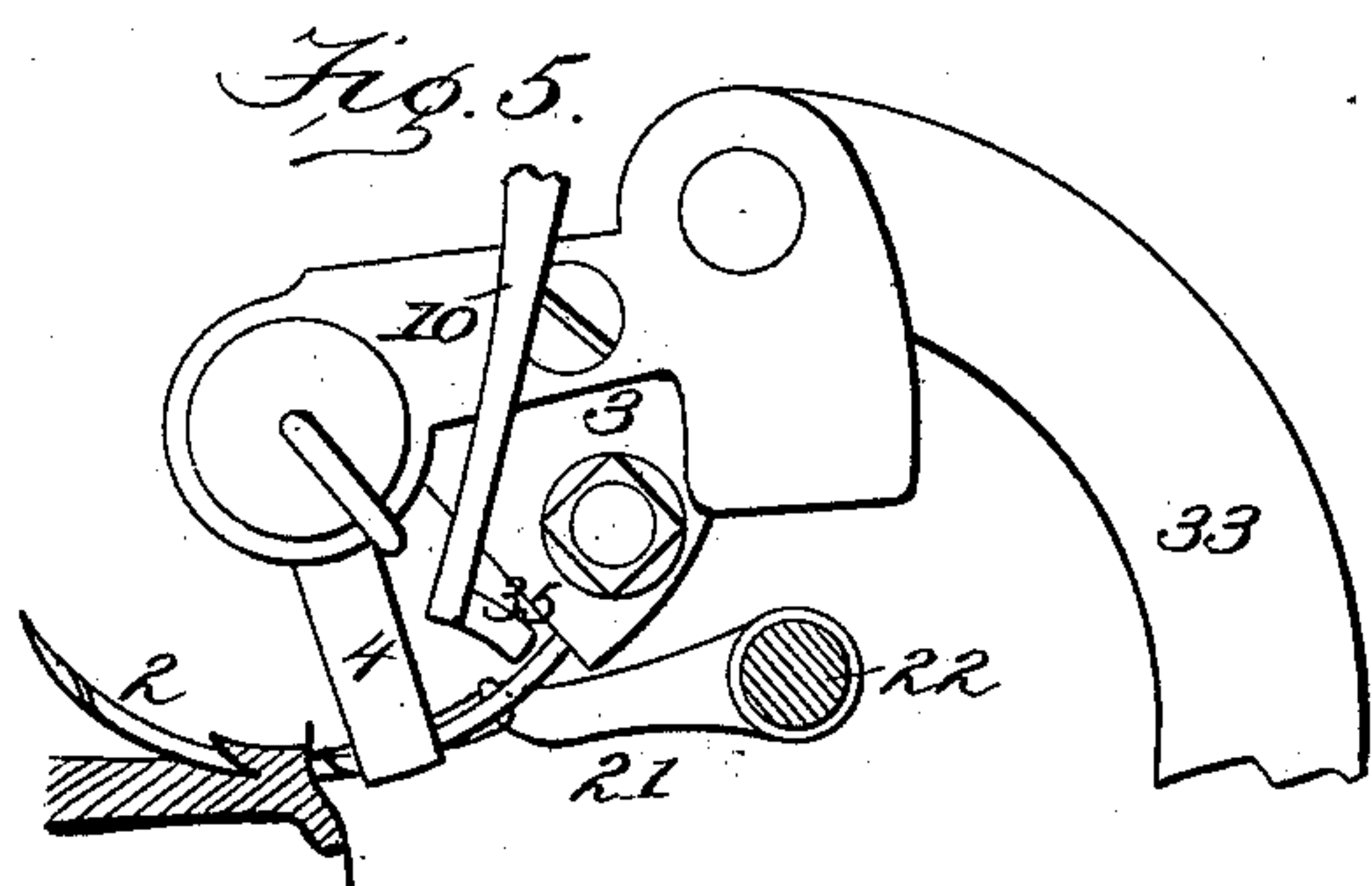
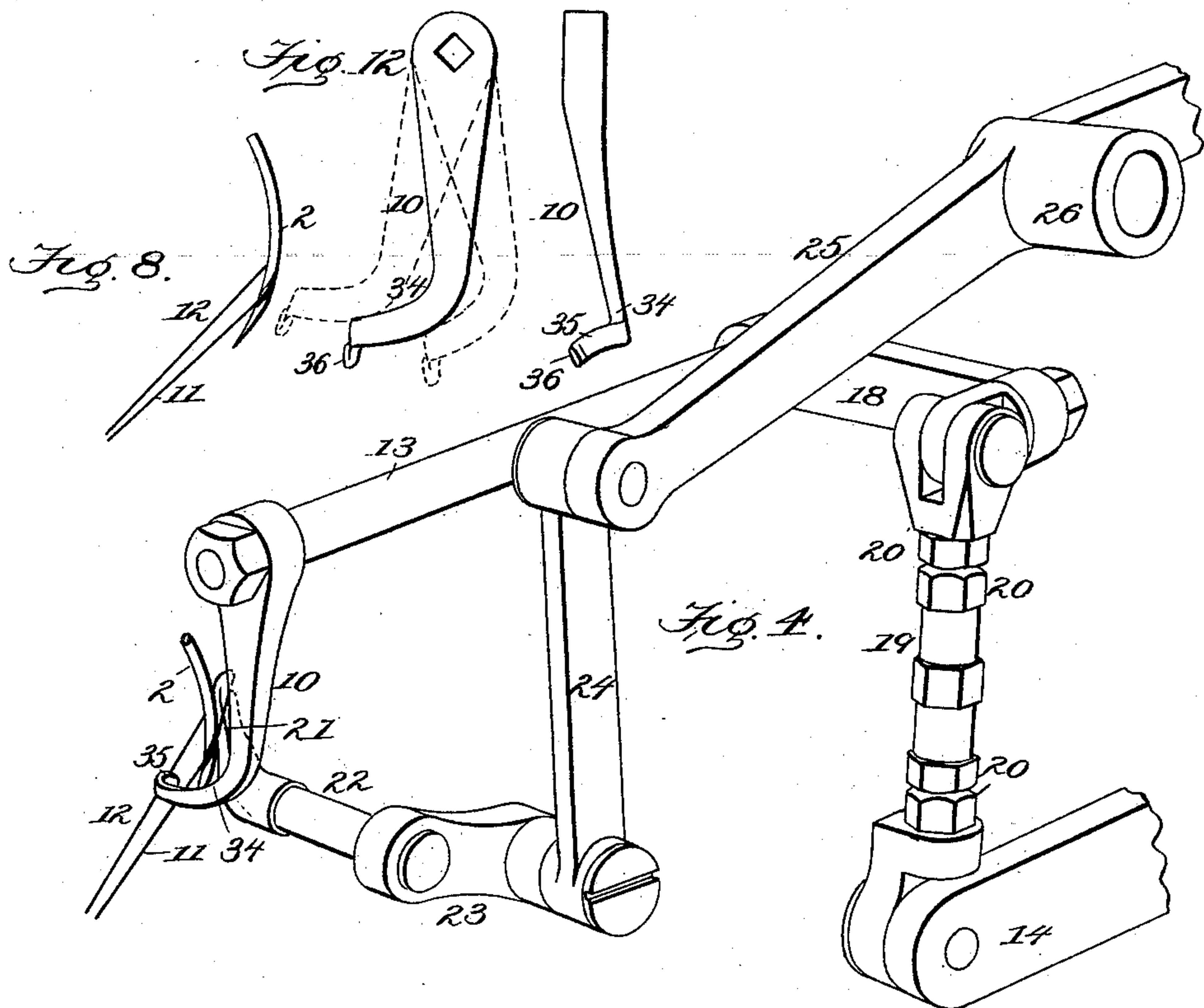
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4 Sheets—Sheet 4.



witnesses

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# UNITED STATES PATENT OFFICE.

FRANCIS A. MILLS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE MILLS SEWING MACHINE COMPANY, OF MAINE.

## SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 623,097, dated April 11, 1899.

Application filed December 11, 1895. Serial No. 571,800. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS ARTHUR MILLS, a citizen of the United States, and a resident of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Sewing-Machines, of which the following is a specification.

My invention is directed to improvements in sewing-machines particularly designed for turned and for welted shoes; and my said improvements consist of certain novel parts and combinations of parts, which are particularly pointed out in the claims concluding this specification.

I have represented in the accompanying drawings a machine embodying my invention in the form in which I prefer to employ it; but it will be understood that my invention is not limited to the forms herein shown or to its use in the particular machine shown.

Referring to the drawings, Figure 1 is an elevation of the right side of the machine, the parts being in the positions they occupy at the time the needle is in the work to receive the thread in the barb of the needle. Fig. 2 is a similar view in which the parts are shown in the positions they occupy prior to setting the stitch, the loop having been opened to allow entrance therein of the stitch-tightening instrument. Fig. 3 shows a similar view in which the parts occupy the positions they do in tightening and setting the stitches. Fig. 4 shows in perspective the loop-opener and the stitch-tightener in their relation to each other and to the needle and the lever connections for the loop-opener and tightener. Figs. 5, 6, and 7 show the mechanism for manipulating the loop after it has been pulled through the work to set and to tighten the stitch in the positions seen, respectively, in Figs. 1, 2, and 3. Fig. 8 shows the position of the loop on the needle to receive the action of the loop-opener. Figs. 9, 10, and 11 show the operating-cams for the stitch-tightening mechanism. Fig. 12 shows different side views of the loop-opening finger. Figs. 13, 14, and 15 are detail views of the stitch-tightening device.

The machine shown has its operating parts organized in a suitable frame structure.

2 is the barbed needle; 3, the needle-carrier;

4, the needle-guide; 5, the looper; 6, the feed device; 7, the back-gage; 8, the slide-rest, and 9 is the tension device, all of which have operating connections for imparting to them their proper functions in the operation of sewing the shoe. These members and their operation being well known in the art, it is deemed unnecessary to particularly describe them herein.

While I have shown my invention embodied in the form which I prefer, I wish to be understood as not limiting myself to such form or to the use of my invention in the particular machine shown, as it is obvious that my invention for tightening and setting stitches can be used with other forms and constructions of machines for forming the well-known chain or loop stitch.

The mechanism which I have designed and applied to the machine for tightening and setting stitches consists, primarily, of two devices, one a loop-opener and the other a stitch tightener or take-up, both operating separately and also conjointly.

The loop-opener consists of an arm or finger 10, arranged to operate upon the loop 11 between the needle and the work and is adapted to engage one part or side 12 of the loop and open it to one side on the needle, so that it will be held open to allow the stitch-tightening instrument to enter within the loop to perform its function. The loop-opener 10 is mounted for operation upon a shaft 13, supported in horizontal position in that part of the machine which contains the sewing mechanism, and is by suitable connections caused to vibrate in pendent relation above and at right angles to the line of the loop. These connections may be a lever 14, having a roll 15, and a suitable cam 16, engaging the roll to actuate the lever in the proper time for the purpose stated. This lever has its fulcrum 17 preferably at the rear of the machine and at its front end is adjustably connected to the loop-opener shaft 13 by an arm 18, whereby the loop-opening finger can be timed to engage and open the loop in proper relation to the movements of the needle. The means shown for making this adjustment is a pivotally-connected right-and-left screw-coupling 19, having jam-nuts 20, whereby the coupling



is lengthened and shortened, which causes the loop-opening finger to engage the loop sooner or later to correspond with the movements of the needle. The cam 16 for operating the loop-opening-finger connections is so formed and timed as to cause said finger to engage and to open the loop after the needle has pulled the loop, so that it can be engaged by the opening-finger. During the engagement of the loop-opening finger with the loop the needle remains substantially at rest long enough to allow the loop to be opened and the stitch-tightening instrument to enter the loop and pull the same back of the needle to tighten and set the stitch. At the time the stitch is about to be tightened the action of said cam will cause the loop-opener to return substantially in line with the needle and with the loop while the stitch is being tightened. The loop-opening finger will then move to its starting position to allow the needle, needle-guide, and needle-carrier to move forward.

The stitch-tightening instrument consists of an arm or finger 21, arranged, preferably, to enter within the open loop between the needle and the loop-opener, and is adapted to engage the loop of the needle and to pull it out of the barb of the needle and from the work to tighten and set the stitch. This stitch-tightening device is mounted upon a horizontal shaft 22, supported in position in that part of the machine which contains the sewing mechanism, and is by suitable connections caused to vibrate substantially in the line of the loop. These connections may be a crank-arm 23 and a link 24, connecting a lever 25, which is fulcrumed at 26 upon the machine, and a suitable cam 28, engaging a roll 28' of said lever to actuate the lever at the proper time for engaging the loop in proper relation to the movements of the needle. The cam 28 for operating the stitch-tightening finger 21 is so formed and timed as to cause the said finger to enter within the loop after the needle has pulled the loop through the work and the opening-finger has performed its function. Having entered the loop, the tightening-finger will be caused to engage the loop and pull upon it, so as to carry it back of the needle and by such pulling action upon the loop tighten and set the stitch. During this stitch-tightening function the loop-opening finger will be caused to return substantially in line with the loop to allow a more effective pull upon the loop by the tightening-finger. The stitch having been tightened, the tightening-finger will be caused to move forward to give a sufficient slack in the loop to permit of the feed of the shoe the length of a stitch, and in this position the finger will remain at rest until the loop-opener has moved back to its starting position to permit the needle, the needle-guide, and the needle-carrier to move forward to the work. As the point of the needle reaches and is about to enter the work the stitch-tightening finger will be caused to move in advance of the needle-carrier and

give up the loop. Simultaneously with this movement of the tightening-finger the needle will be moving through the work to receive the next loop and to repeat the operation of forming the next stitch.

It will be noticed, referring to Fig. 7, that the way in which the stitch-tightener engages the loop causes the latter to be maintained in its proper relation with the needle, and for this purpose I prefer to provide the tightening instrument with a notch 29 to receive and prevent the loop from slipping down upon the tightener and out of the groove of the needle.

I prefer to make the barb on one side of the needle and a groove extending therefrom toward the point around to the opposite side, so that when the needle has pulled the loop to its full limit the strands of the loop will be open, one a little obliquely above the other, as seen in Fig. 8, and thereby hold the loop in an open position, so that one strand 12 will be struck by the loop-opening finger 10 and opened to one side of the needle, as seen in Fig. 6.

Referring to the relative positions of the loop-opener and the stitch-tightener, I prefer to arrange the former in a pendent position, so as to engage the loop from above, and the stitch-tightener standing up, so as to enter the loop from beneath; but it is obvious that these devices may be otherwise arranged.

Referring to the connections for operating the loop-opener and the stitch-tightener, I prefer to use arms arranged to give a rocking motion to the shafts of said loop-manipulating parts, and it will be understood that such rocking movements are caused by the engagement of the lever-actuating parts of these connections with cam-grooves, so that the loop-opener and stitch-tightener will be positively actuated in all their movements.

It is important to notice that the stitch-tightening instrument is mounted in the frame back of the stitch-forming mechanism, so as to be out of the way of the loop-forming mechanism, which permits the actuating end of the stitch-tightening instrument to move toward the work to give up the loop while the needle is pulling the succeeding loop through the work, and during this operation the thread will slip around the finger.

I prefer to hang the loop-opening finger so that its acting end will stand curving toward the loop and terminate in a bend toward the needle standing slightly downward and having a lip standing on a bevel at the end. The curve 34 is to allow the finger to pass beneath the needle-guide when moving to open the loop. The bend 35 is to allow the stitch-tightening instrument to pass in line with this bend to enter and engage the loop without striking the opening-finger, and the bevel-lip 36 is to hold the strand of the loop in proper position in opening it, as seen in Figs. 6 and 13, in which the tightening instrument is seen between the loop-opener and the needle. I have illustrated the supporting structure of



the machine as having the form of an inverted arch 30, and within this arch suitable cylinders 31 are mounted for containing operating-cams of the stitch-forming mechanism and of the other operating members.

In the drawings the proper relation of the cam-paths is shown in dotted lines, not only as to their relation with each other, but also as to their relation to the respective positions of the loop-opener, the stitch-tightener, and the needle. In Figs. 9, 10, and 11 these cam-paths are separately shown, the needle-actuating cam being Fig. 9, the loop-opener-actuating cam being Fig. 10, and the stitch-tightener-actuating cam being Fig. 11.

The needle-carrier is connected with an operating-lever 32, fulcrumed in the arched frame by a coupling-link 33, said lever being operated by the cam 40, and it will be seen and understood that the needle-carrier is mounted to have an oscillating movement to present the needle to the looper to receive the thread and pull it through the work, as shown in Fig. 1.

Referring to Fig. 12, the full lines show the position the loop-opener occupies at the time the stitch is being tightened, and which position is central or substantially in line with the needle and the loop, as seen in Figs. 3, 7, and 14. The dotted lines to the right show the starting position, which is during the operation of the needle receiving the loop and pulling it through the work, as seen in Figs. 1, 5, and 15, and the dotted lines to the left show the position the loop-opener has when holding open the loop, as seen in Figs. 2, 6, and 13.

Fig. 13 shows a detail view looking down, the stitch-tightening instrument and the loop-opening finger being in their respective positions when the stitch-tightening instrument has entered the loop and is about to engage the same. Fig. 14 shows a like view, the stitch-tightening instrument or take-up having tightened and set the stitch and the loop-opening finger having returned substantially in line with the needle and the loop, and Fig. 15 is a like view showing the stitch-tightening instrument as having moved forward to permit the loop to be pulled off of said instrument in the operation of forming the next stitch and the loop-opening finger moved to its starting position.

I believe myself to be the first to have devised and to have used a take-up which is caused to enter and engage the loop after it is drawn through the work by the needle and to draw upon said loop back of the needle. I also believe myself to be the first to design and to have used a spreader for opening the loop on the needle and to release said spreader from its engagement with said loop in advance of the forward movement of the needle in forming a loop-stitch, and I also believe myself to be the first to have arranged these finger devices for combinative operation to engage and to set and tighten a loop-formed

stitch, and therefore, without restricting myself to the details and to the general construction and arrangement of the parts hereinbefore described in illustration of my invention,

What I claim, broadly and specifically, and desire to secure by Letters Patent, is—

1. In a sewing-machine, the combination with a looper and a barbed needle and operating means therefor, a stitch-tightening instrument or take-up and a loop-opener, means to cause said loop-opener to engage and to open the loop, and means to cause said take-up to engage the opened loop to tighten and set the stitch in the way substantially as described.

2. In a sewing-machine, the combination with a looper and a barbed needle and operating means therefor, a loop-opener having its acting end formed to engage one side or strand of the loop, actuating means for said loop-opener, a stitch-tightening instrument arranged to enter and engage the open loop and means for operating said stitch-tightening instrument.

3. In a sewing-machine, the combination with a looper and a barbed needle and actuating means therefor, of mechanism for setting and tightening the stitch including a loop-opener arranged to engage one side or strand of the loop drawn through the work by the needle.

4. In a sewing-machine, the combination with the looper and a barbed needle and actuating means therefor, of a vibratory loop-opener and a stitch-tightening instrument, and means for causing said stitch-tightening instrument to engage the loop between the needle and the loop-opener.

5. In a sewing-machine the combination with a barbed needle and operating means therefor, of a stitch-tightening instrument arranged to enter and engage the loop and pull it away from and back of the needle and means for actuating said stitch-tightening instrument.

6. In a sewing-machine, the combination with a looper and a barbed needle and actuating means therefor, of a loop-opener and a stitch-tightening instrument arranged to operate on the loop on the needle side of the work substantially at right angles to each other to tighten and set the stitch and means for actuating said devices.

7. In a sewing-machine, the combination with a looper and a barbed needle and actuating means therefor, of a loop-opener arranged to operate upon the loop in front of the needle and a stitch-tightening instrument arranged to enter the loop in front of the needle and actuating means for said devices.

8. In a sewing-machine the combination with a looper and a barbed needle and actuating means, of a loop-opener and means for operating it across the line of the movement of the loop, a stitch-tightening instrument on the needle side of the work for entering and



engaging said loop, and means for operating said stitch-tightening instrument to pull upon the loop while moving backward.

9. In a sewing-machine, the combination with stitch-forming mechanism including a barbed needle, of a stitch-tightening instrument or take-up mounted on a fixed fulcrum back of the needle, and means to cause said instrument to enter the loop and pull it to tighten and set the stitch and to move forward to give up the loop to permit the needle to form the next stitch.

10. In a sewing-machine the combination with stitch-forming mechanism including a barbed needle, of a stitch-tightening instrument or take-up mounted on a fixed fulcrum back of the needle and a loop-opener to engage the loop at one side of the needle and means for actuating said opener and tightener, substantially as described.

11. In a sewing-machine, the combination with stitch-forming mechanism including a barbed needle, of a loop-opener arranged to engage the loop on the needle and a stitch-tightening instrument arranged to engage the loop and to take it from the barb of the needle, the acting ends of the loop-opener and the stitch-tightening instrument vibrating substantially at right angles to each other, and mechanism for actuating the said vibratory devices.

12. In a sewing-machine the combination with a looper and a hook-needle, and actuating means therefor, a stitch-tightening mechanism comprising two instruments to pull upon the loop, one operating in advance of the other to take the loop.

13. The combination in a sewing-machine, of a looper and hook-needle, a loop-opener, an instrument to engage the loop of thread and exert a strain upon it in the line of the loop pulled out by the needle, and actuating mechanism for said devices.

14. In a hook-needle sewing-machine, and in combination with stitch-forming mechanism including a hook-needle, a take-up arranged to enter and engage the loop after it is drawn through the work by the needle, and actuating mechanism whereby it is caused to draw upon the loop back of the needle.

15. In a sewing-machine, and in combination with stitch-forming mechanism including a hook-needle, of an instrument or take-up arranged to enter the loop and actuating means to cause said instrument to draw upon the loop back of the needle, after the latter has ceased its backward movement.

16. In a sewing-machine, and in combination with loop-stitch-forming mechanism including a hook-needle, a take-up having the form of a finger and actuating mechanism therefor whereby it is caused to enter the loop drawn out by the needle and to pull on the loop to give it a length greater than that given it by the needle.

17. In a sewing-machine and in combination with stitch-forming mechanism includ-

ing a hook-needle, an instrument or take-up consisting of a positively-vibratory finger located on that side of the work to which the loop is pulled by the needle and means to cause said finger to enter the loop after it has been pulled through the work by the needle and take and pull the loop away from and back of the needle.

18. In a sewing-machine and in combination with stitch-forming mechanism including a hook-needle, of an instrument or take-up having the form of a finger, and means whereby it is caused to enter the loop pulled by the needle, carry the loop back of the needle and remain within the loop during the tightening of the stitch.

19. The combination in a loop-stitch sewing-machine, of stitch-forming mechanism including a hook-needle, with an instrument consisting of a positively-vibratory finger located to engage one side of the loop drawn out by the needle, and an instrument consisting of a positively-vibratory finger, located and arranged to enter the loop after it has been opened and to pull it back from the barb of the needle.

20. In a sewing-machine and in combination with stitch-forming mechanism including a hook-needle, of a take-up arranged to enter the loop drawn out by the needle, and means for operating said instrument to cause it to move back with the needle and beyond the limit of its stroke to take, pull upon and support the loop back of the needle and to move forward with the needle to give up the loop in the formation of the next stitch.

21. In a sewing-machine, and in combination with loop-stitch-forming mechanism including a hook-needle, a loop-opening finger terminating in a construction adapted to seize the loop of thread drawn out by the needle, and actuating mechanism whereby said opener is caused to vibrate across the line of the loop to seize and open the loop on the needle.

22. In a sewing-machine, and in combination with stitch-forming mechanism including a hook-needle, of a loop-opener arranged to engage and open the loop drawn out by the needle and while the latter remains substantially at rest and to release such engagement in advance of the forward movement of the needle and a take-up arranged to enter the loop, move back with the needle to take the loop from it, and to move toward the work with the needle to give up the loop, and actuating mechanism for effecting these several movements.

23. In a sewing-machine, and in combination with stitch-forming mechanism including a hook-needle, of a take-up finger vibrating on a fixed fulcrum, arranged to enter the loop, and means whereby said finger is caused to pull the loop a greater distance than it is pulled by the needle and to support said loop.

24. In a sewing-machine, and in combination with loop-stitch-forming mechanism, in-



cluding a curved hook-needle, a take-up instrument to enter and engage the loop drawn out by the needle and form a support around which the loop slips in the formation of the 5 stitch, and actuating means.

25. For tightening and setting loop-stitches in sewing-machines and in combination with a thread-looper, a curved hook-needle and actuating mechanism therefor, of a trans- 10 versely-vibratory loop-opener and a stitch-tightening instrument arranged to enter and

manipulate the loop of thread drawn through the work by the needle, the said loop under such manipulation being thereby caused to draw the previously-formed loop into the 15 work for tightening and setting the stitches and actuating means for such instrument.

FRANCIS A. MILLS.

In presence of--

A. E. H. JOHNSON,  
A. ROLAND JOHNSON.