Jan. 2, 1923.

1,440,556

J. SCHREIBER.

SEWING MACHINE.

FILED MAY 21, 1921.

17 SHEETS-SHEET 1

Fig. 1.

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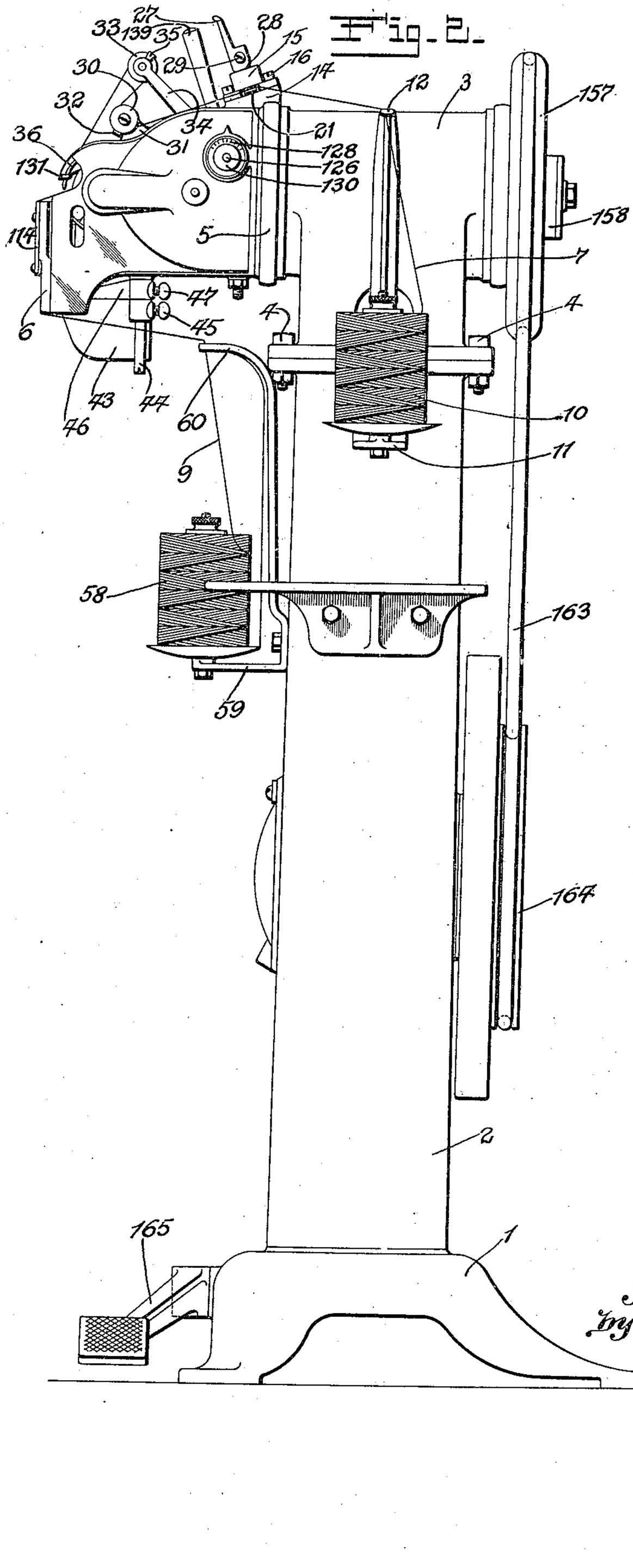
Fig. 2.



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FILED MAY 21, 1921.

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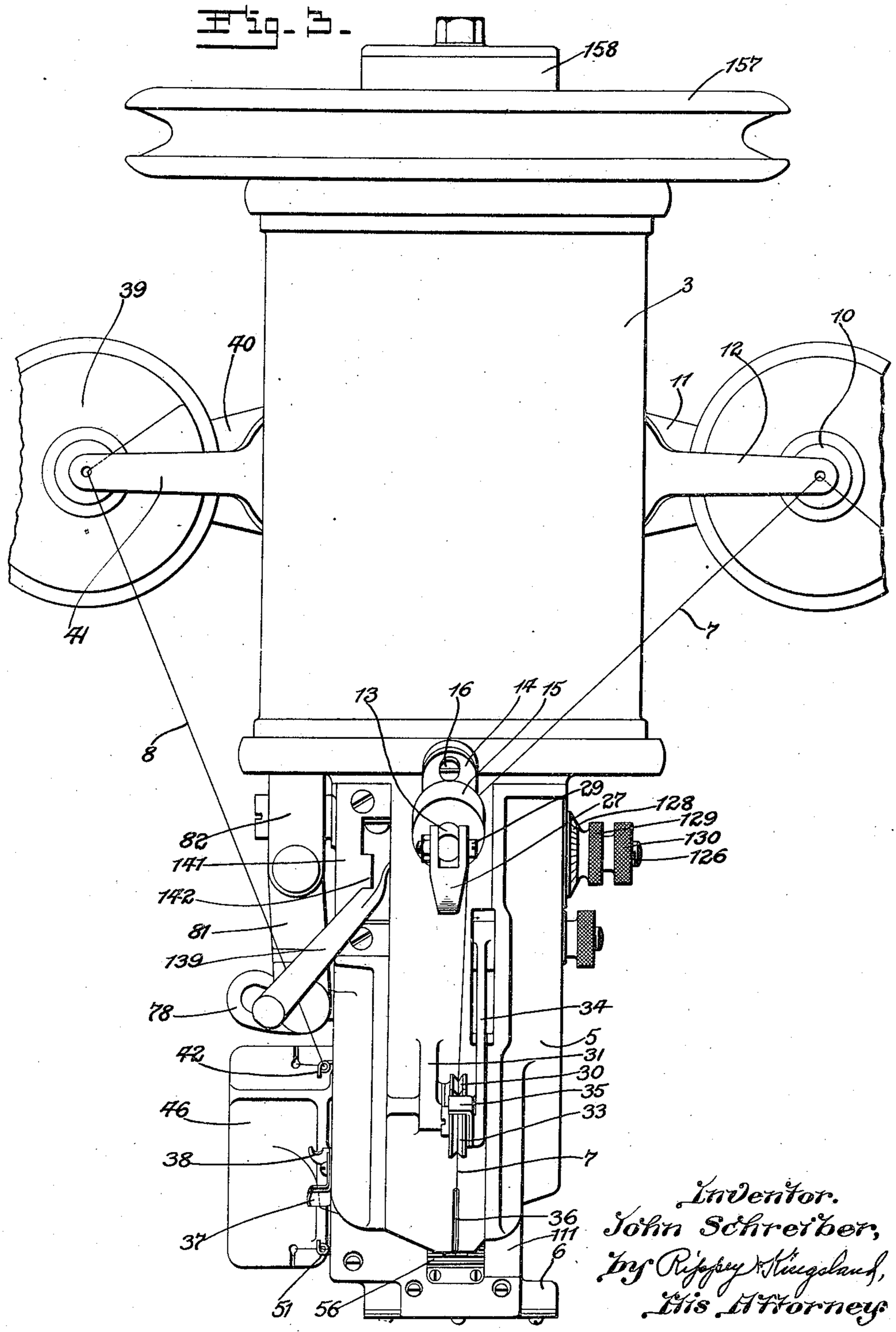
Fig. 2.



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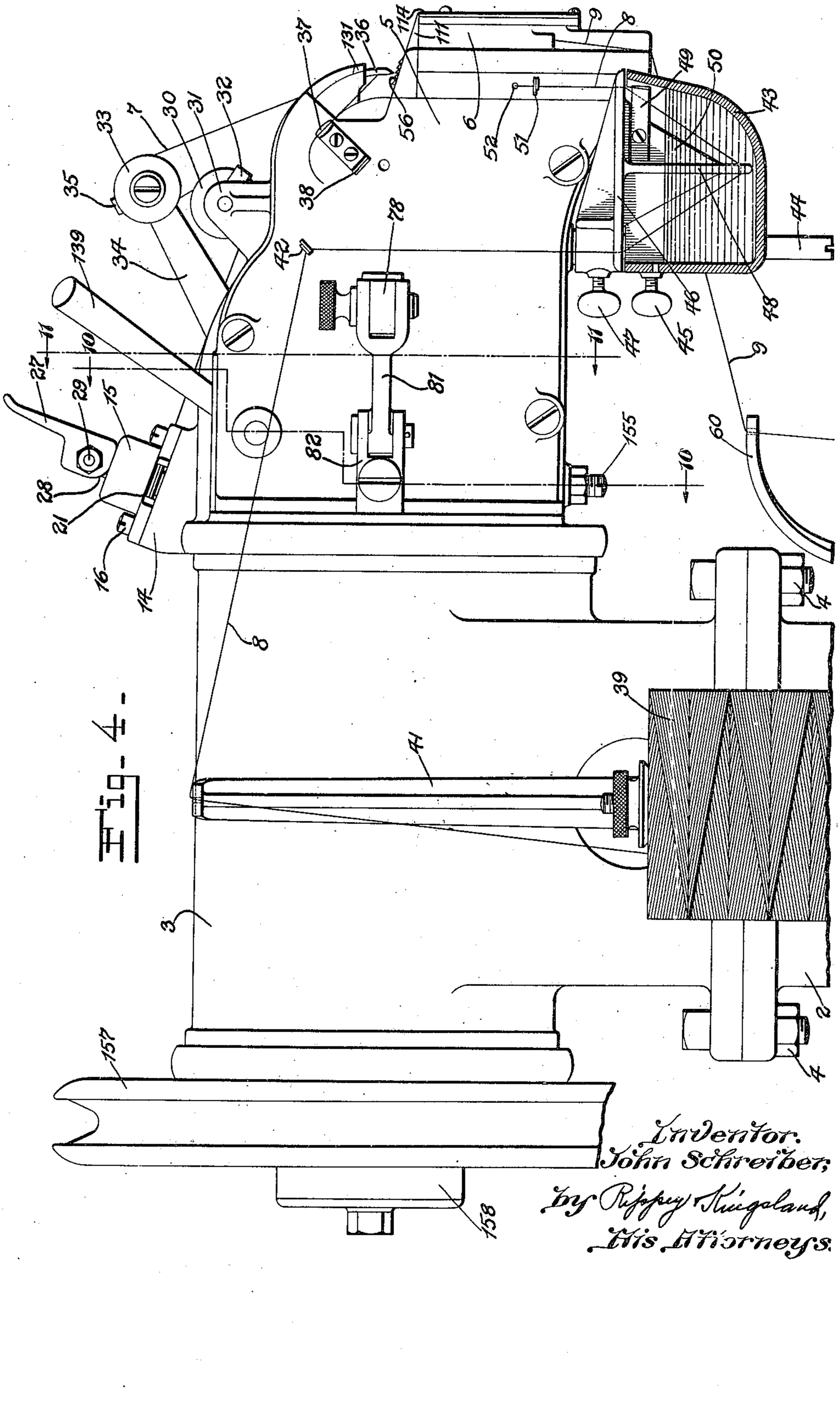

Fig. 4.

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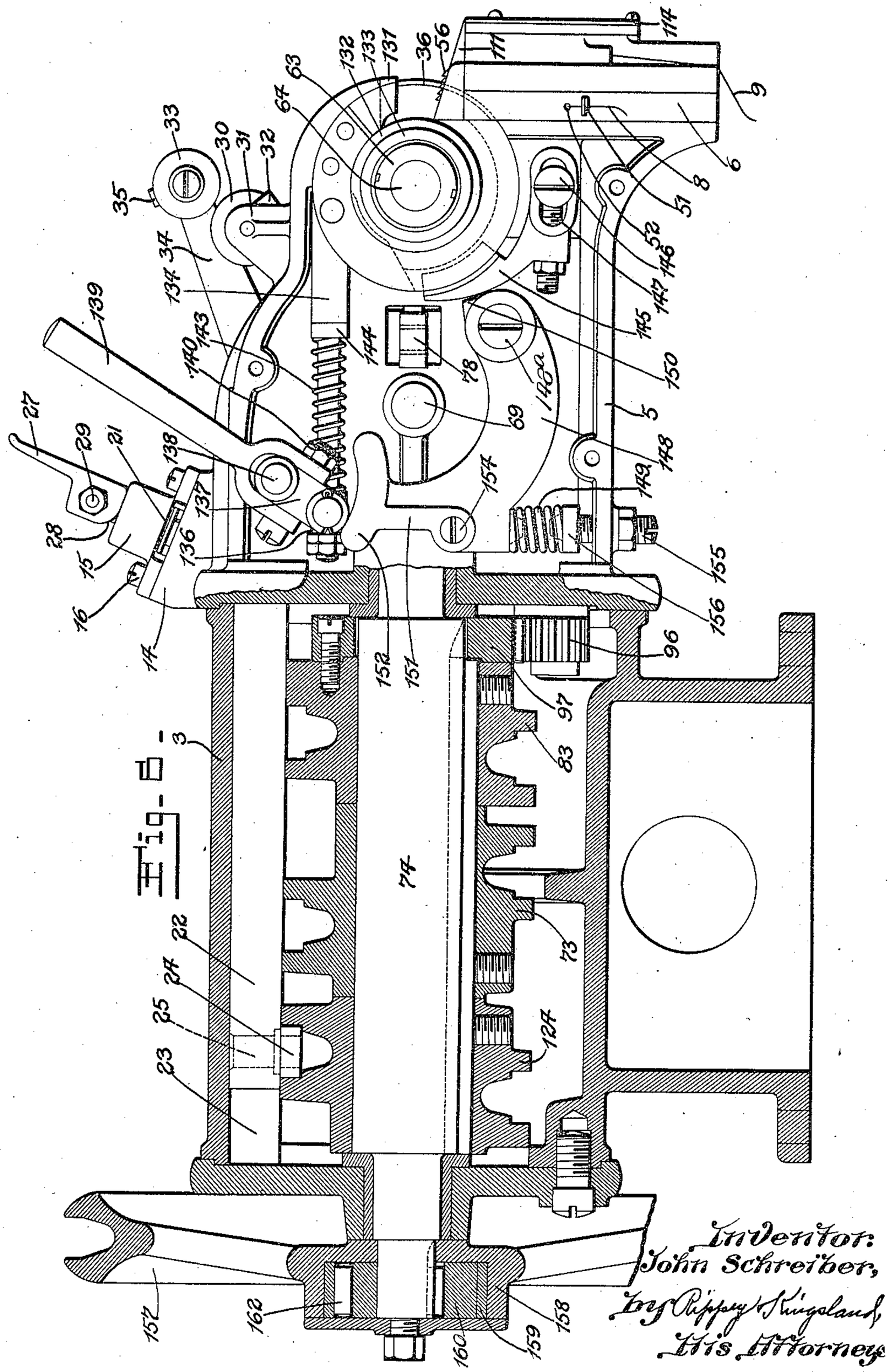

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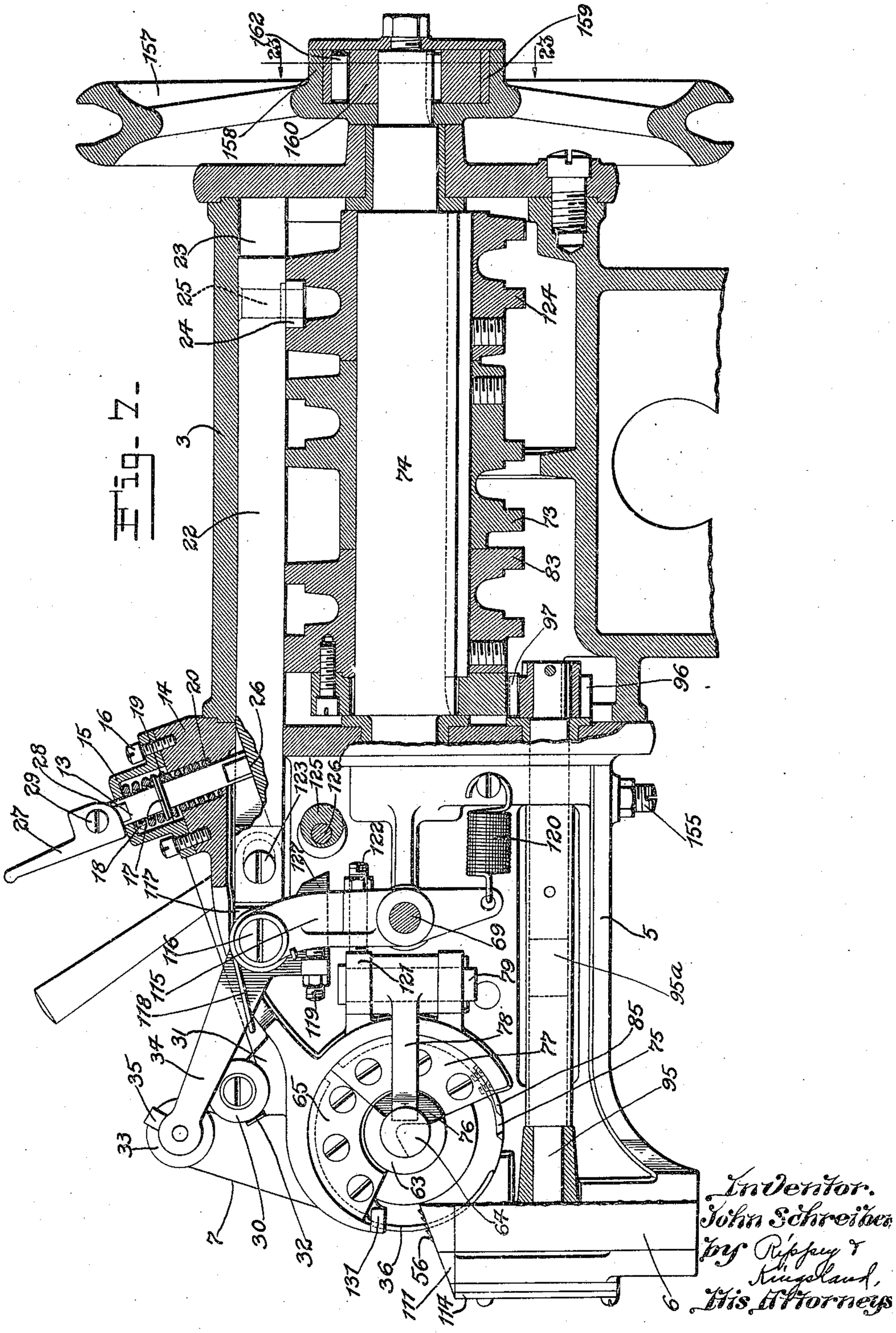
Fig. 7.



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SEWING MACHINE.
FILED MAY 21, 1921.

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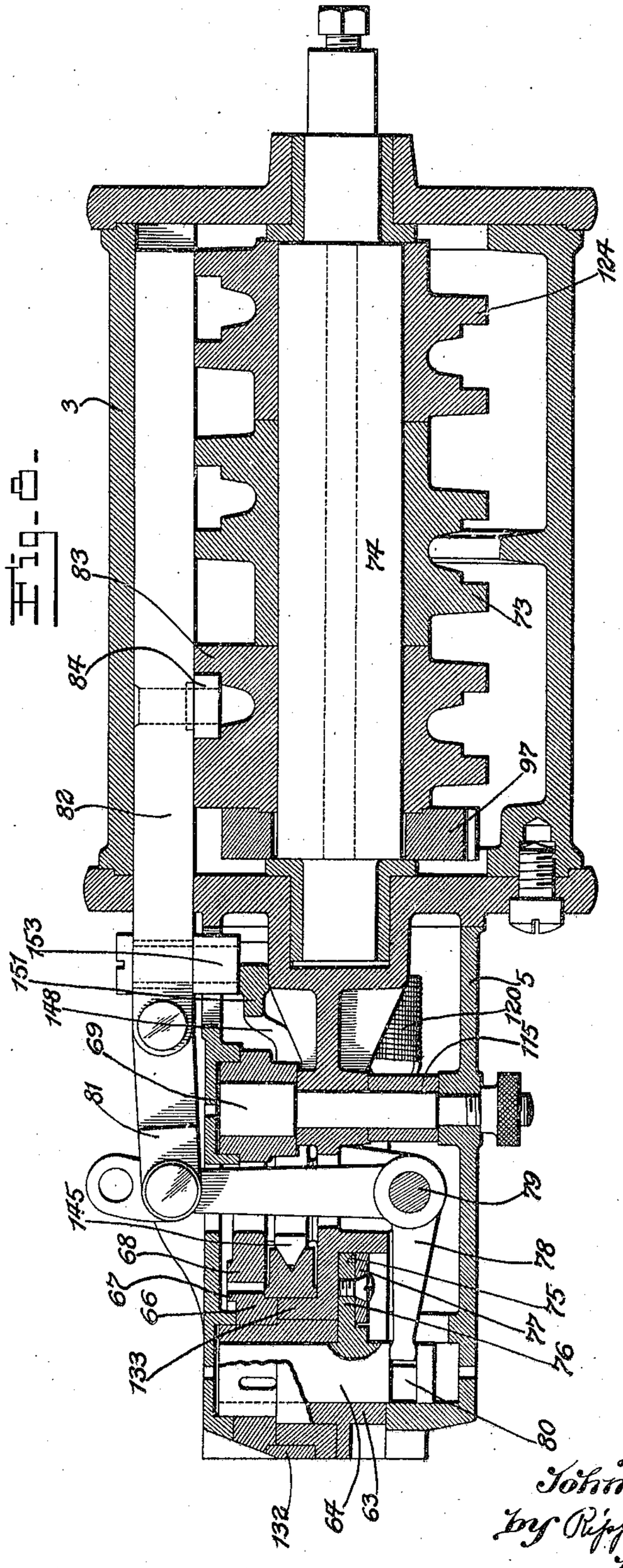
Fig. 8.



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Jan. 2, 1923. 1,440,556

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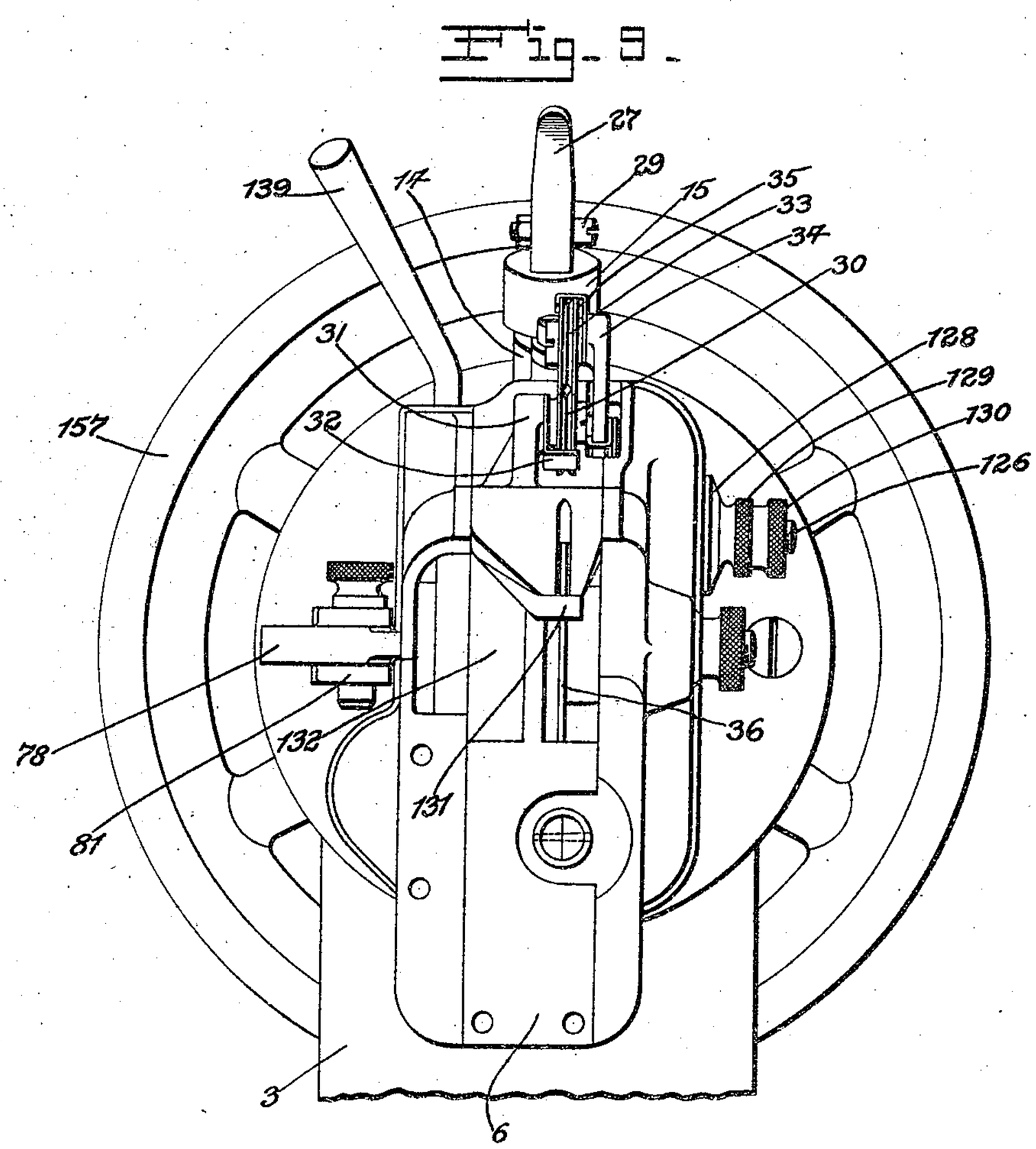
SEWING MACHINE.
FILED MAY 21, 1921. 17 SHEETS-SHEET 9

Fig. 9.



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SEWING MACHINE.
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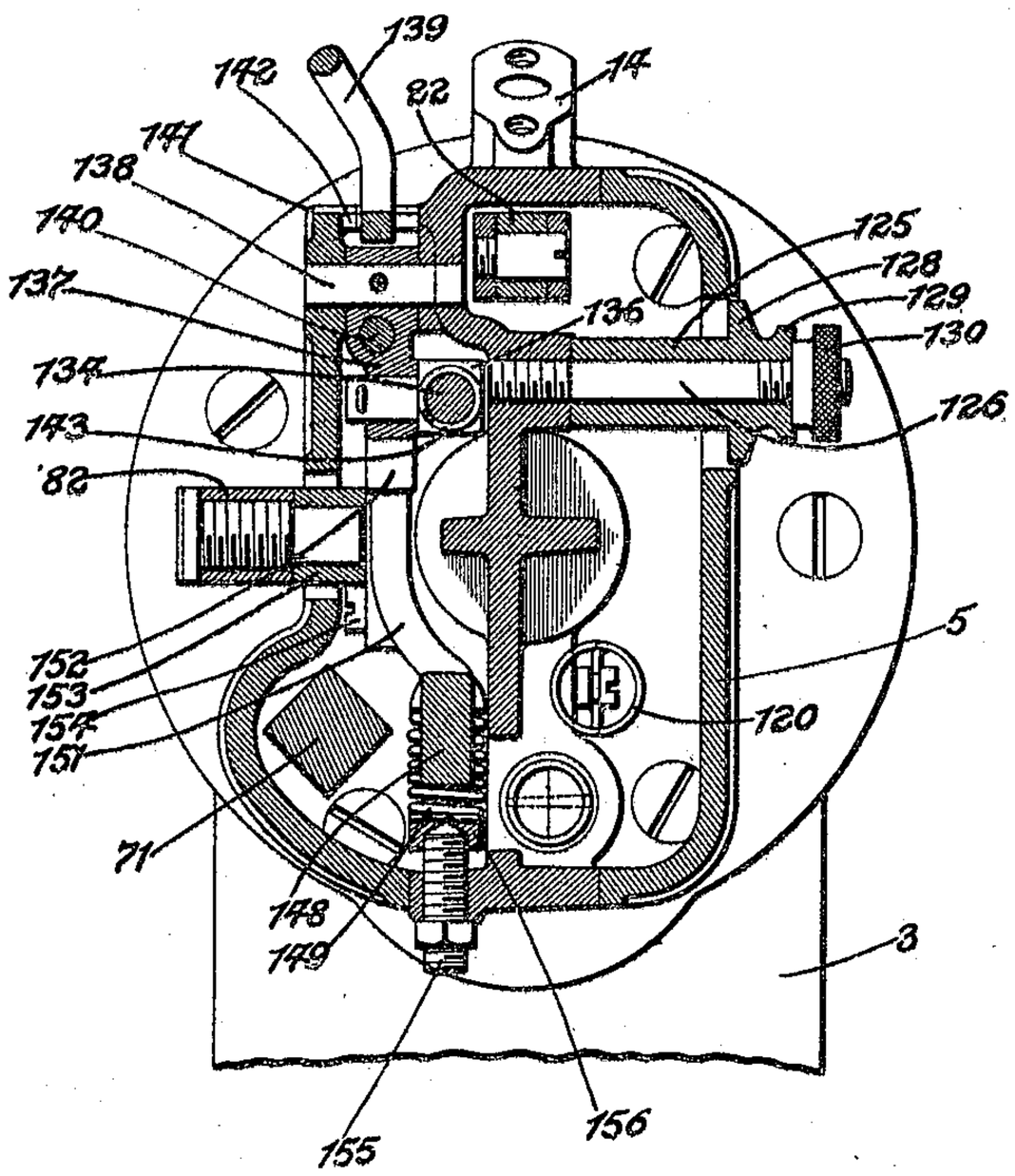
Fig. 10.



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FILED MAY 21, 1921.

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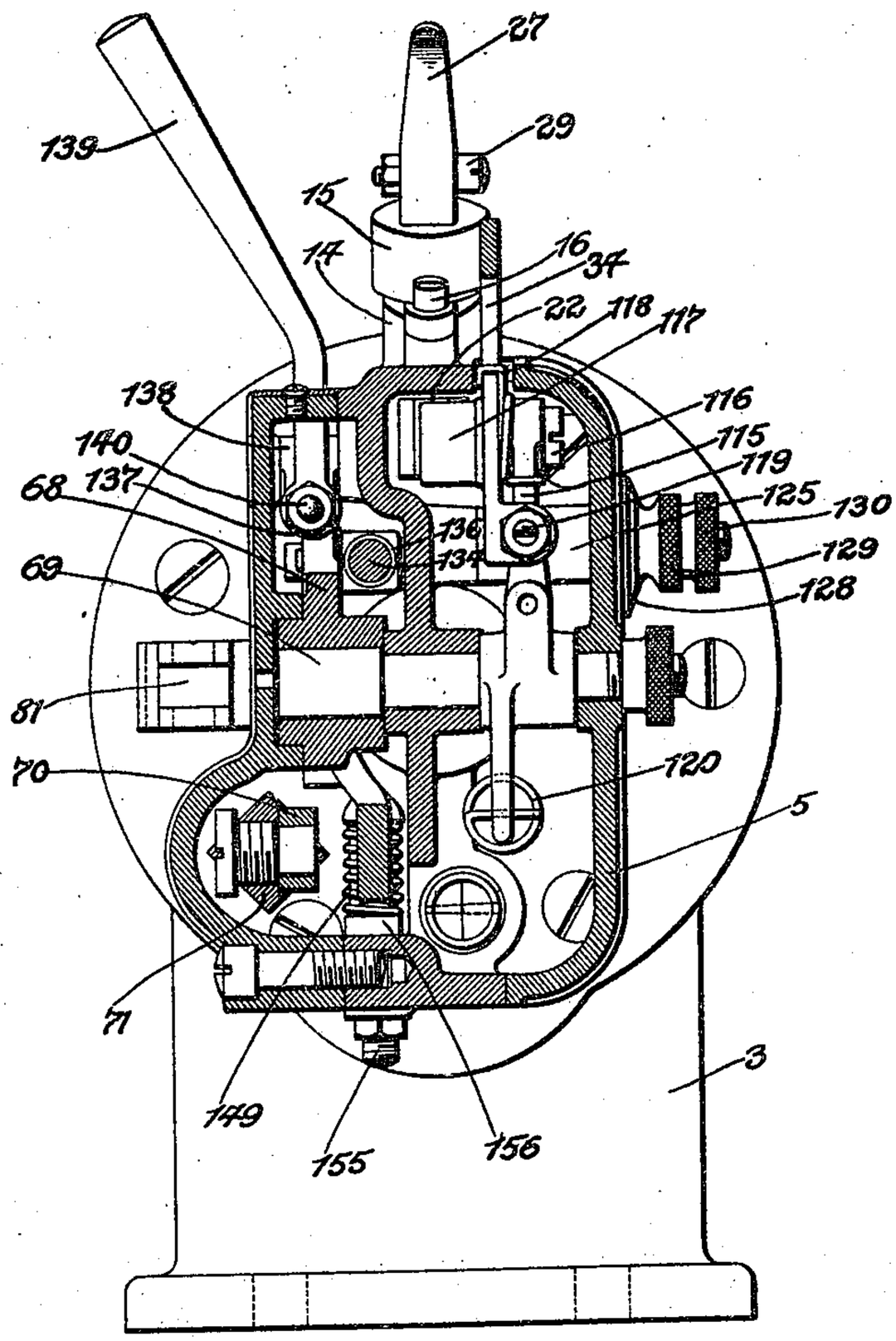
Fig. 11.



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FILED MAY 21, 1921.

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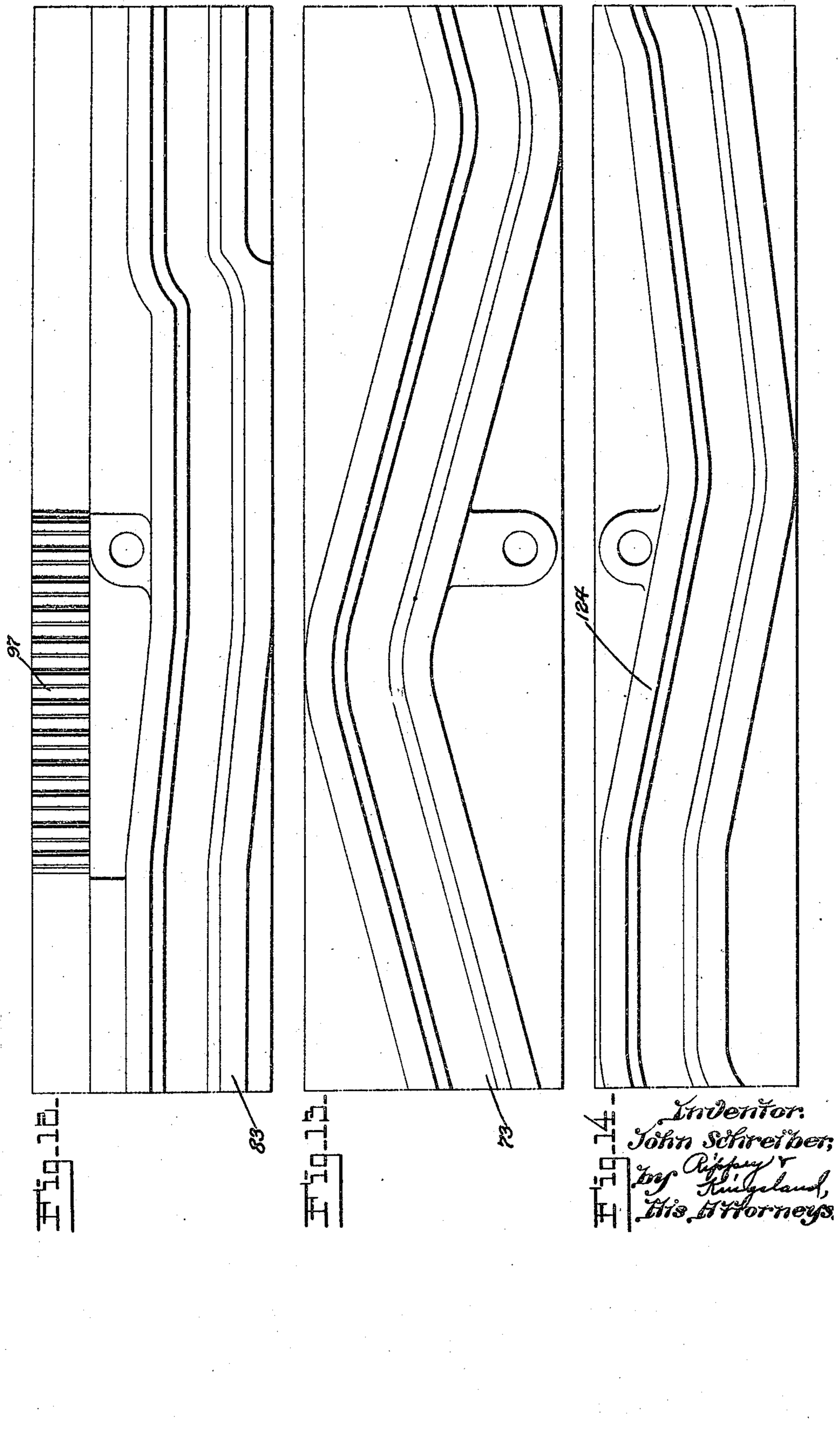

Fig. 13.

Fig. 14.

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FILED MAY 21, 1921.

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Fig. 16.

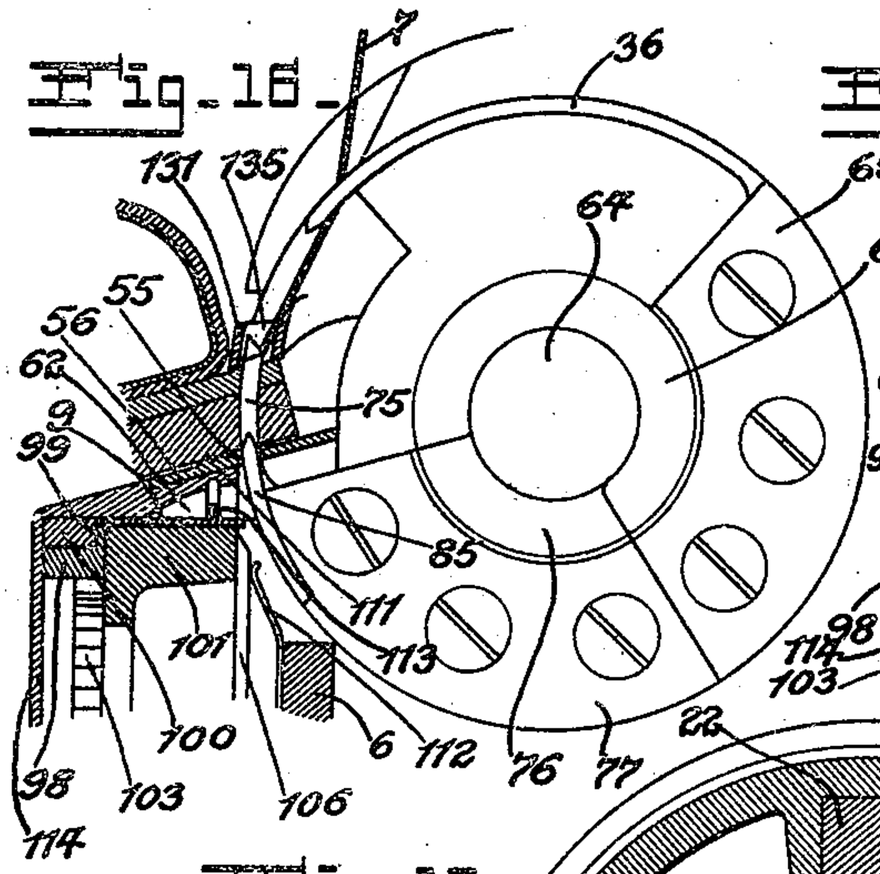


Fig. 17.

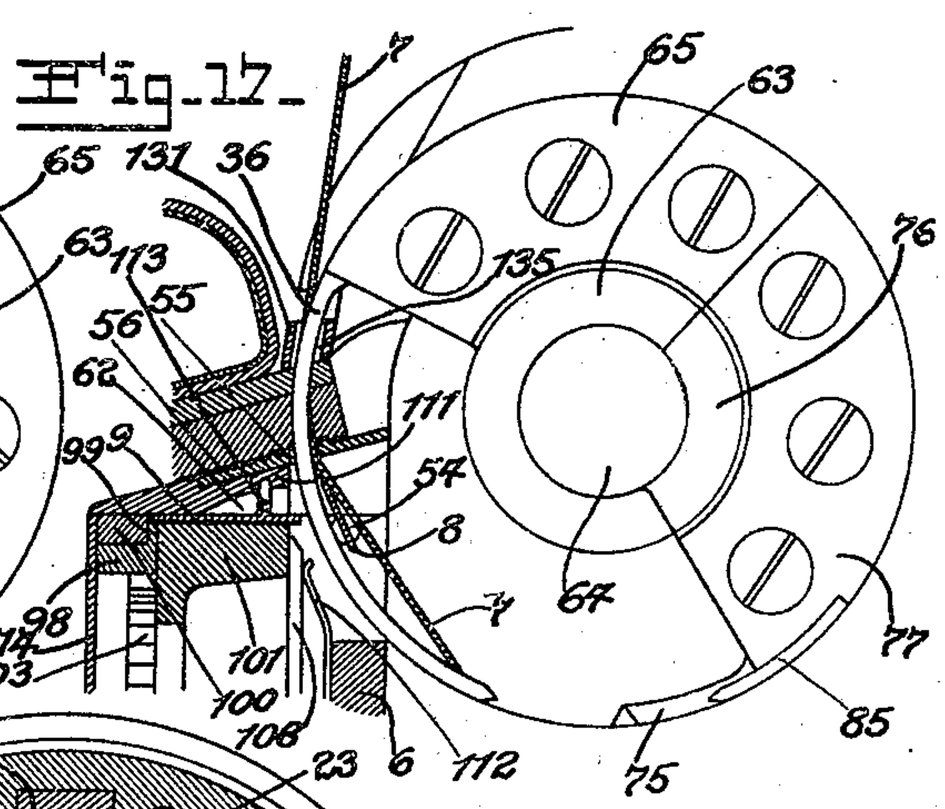


Fig. 15.

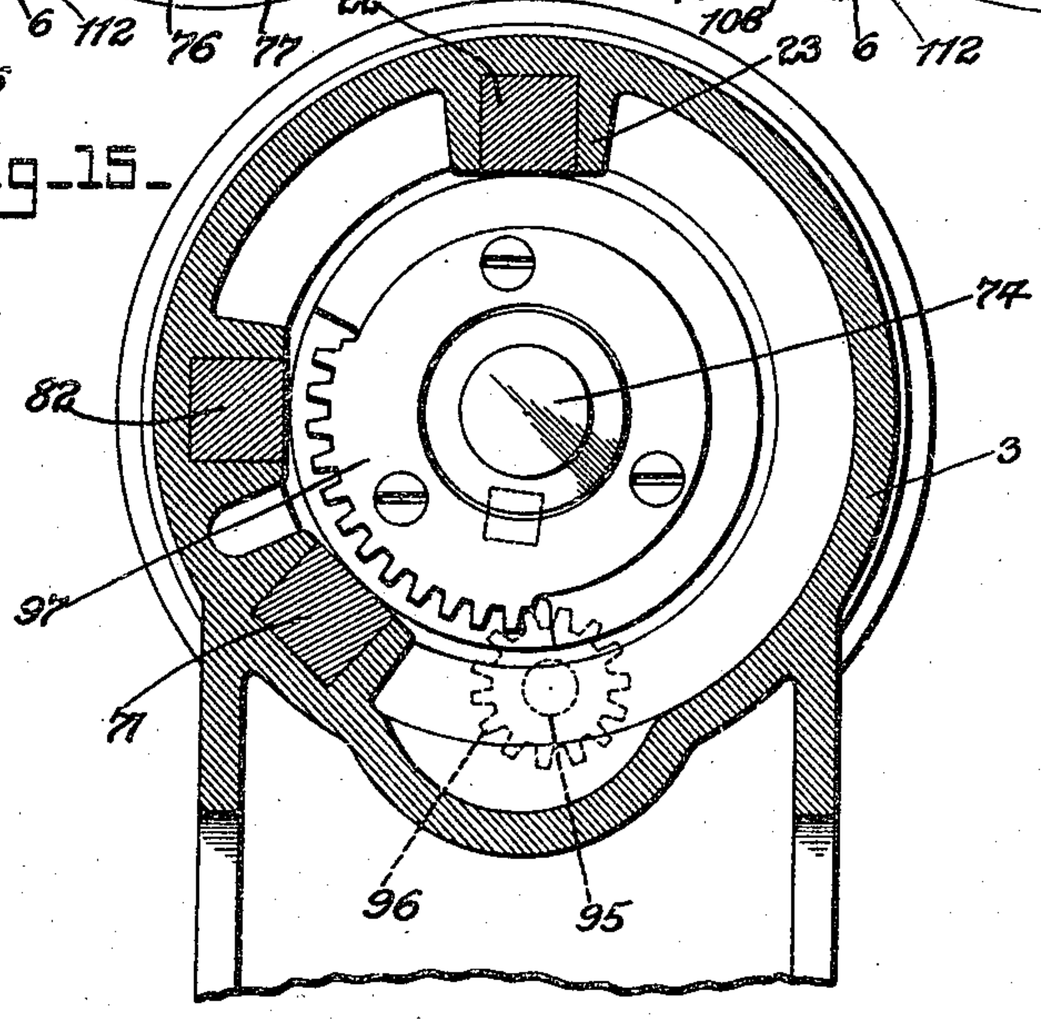


Fig. 18.

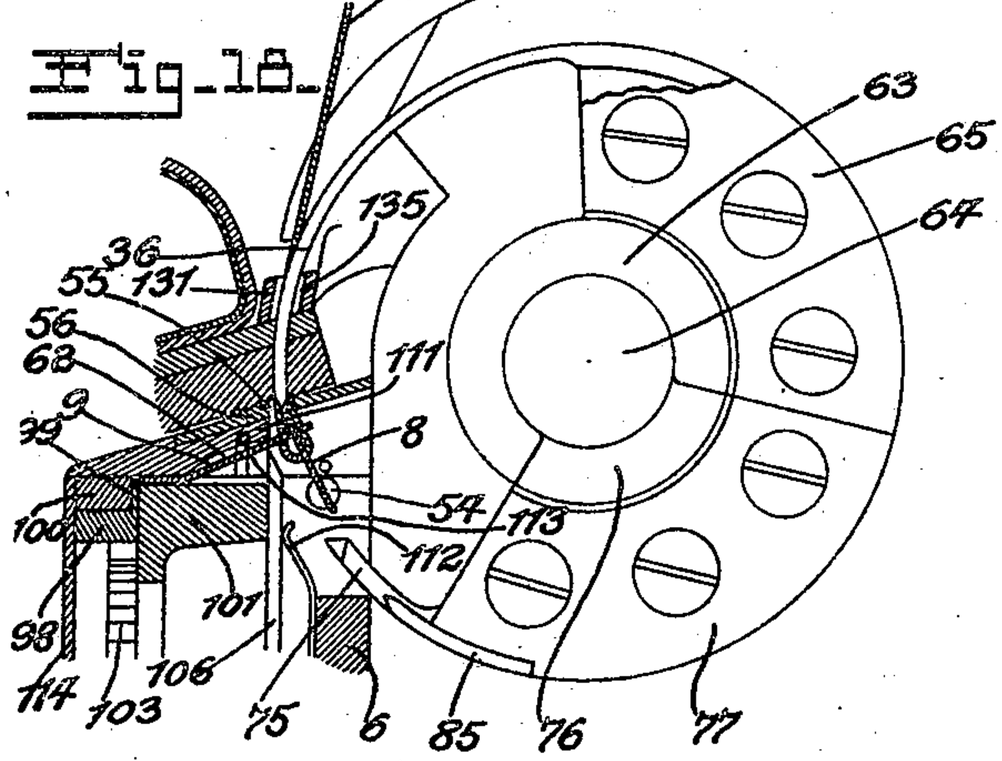
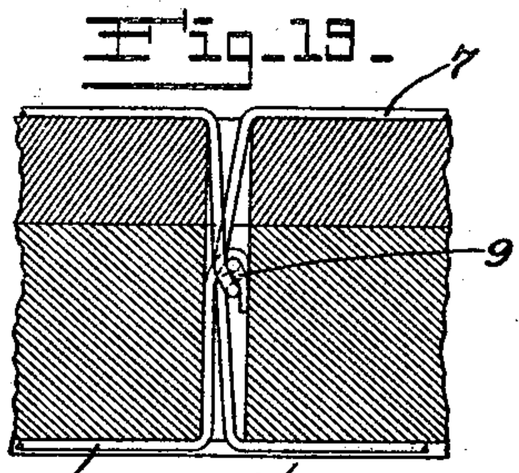


Fig. 19.



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SEWING MACHINE.
FILED MAY 21, 1921.

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Fig. 20.

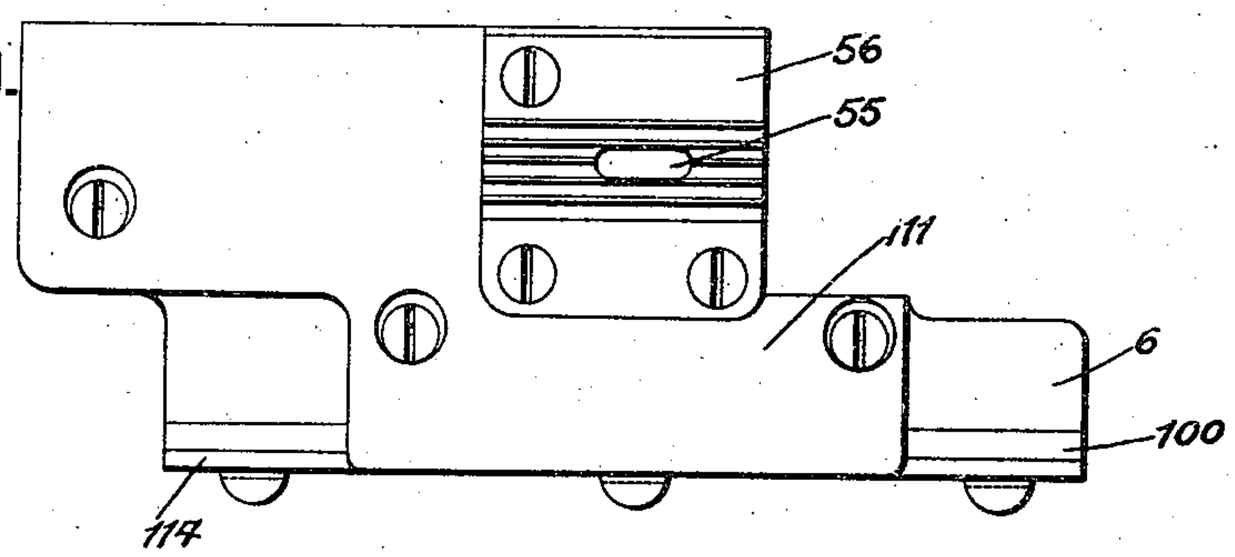
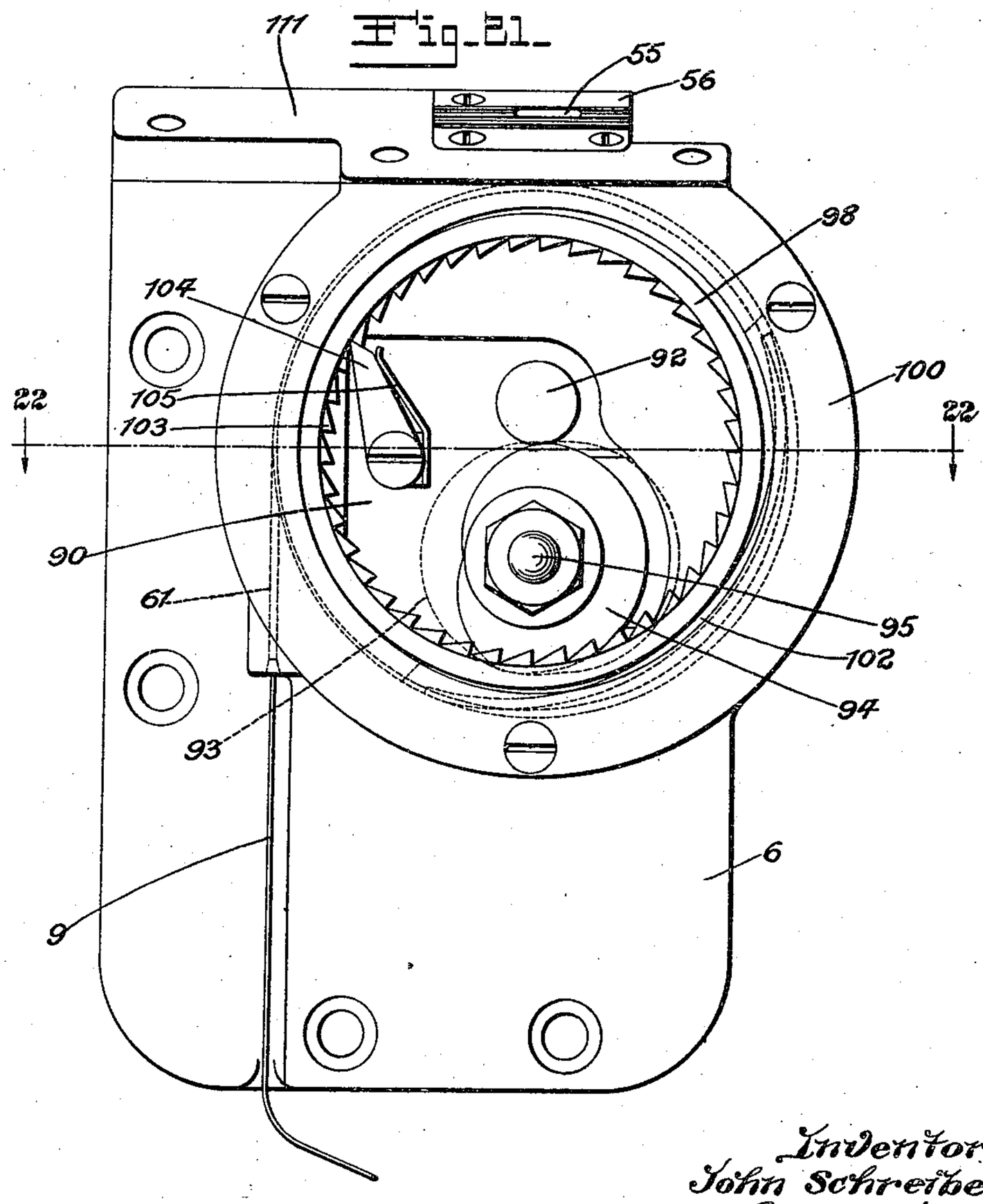


Fig. 21.



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FILED MAY 21, 1921.

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Fig. 23.

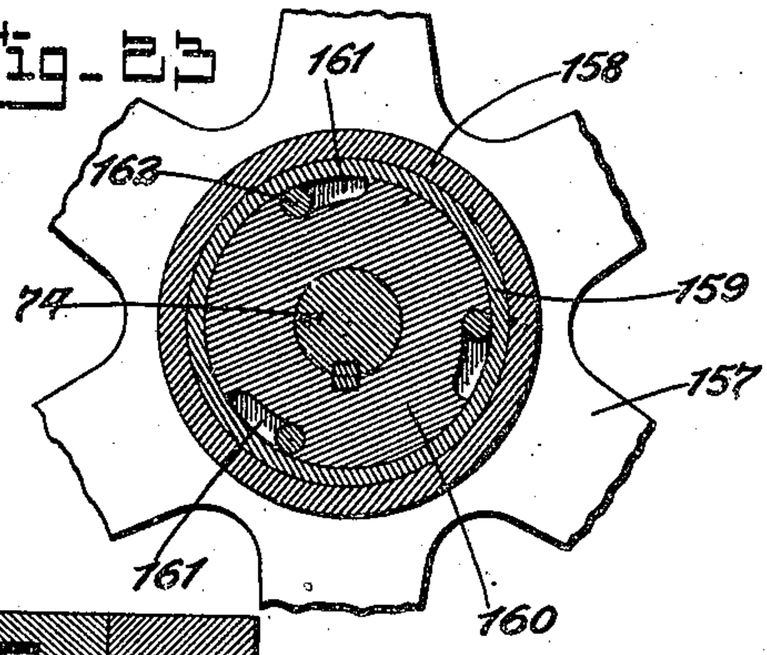


Fig. 22.

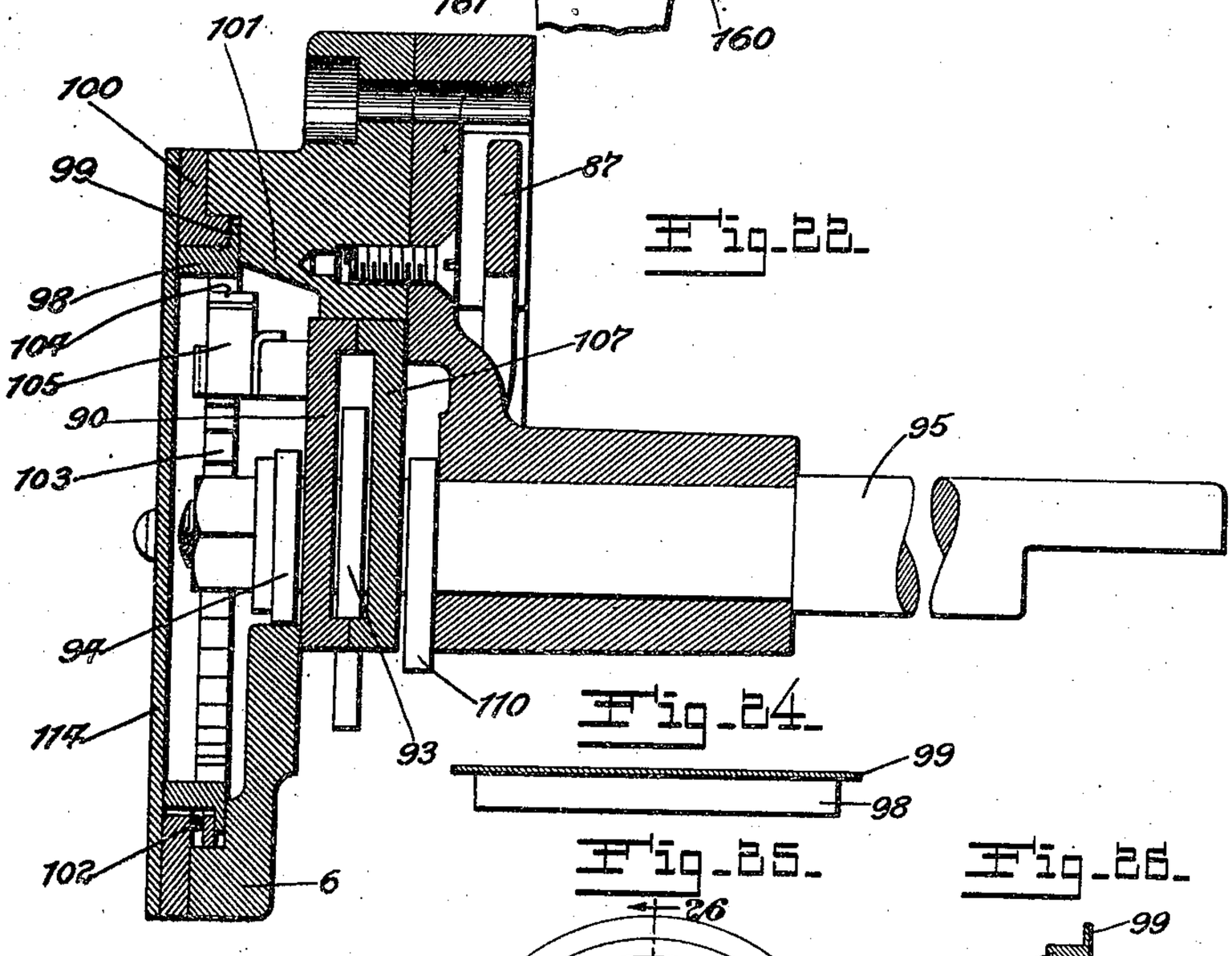


Fig. 24.

Fig. 25.

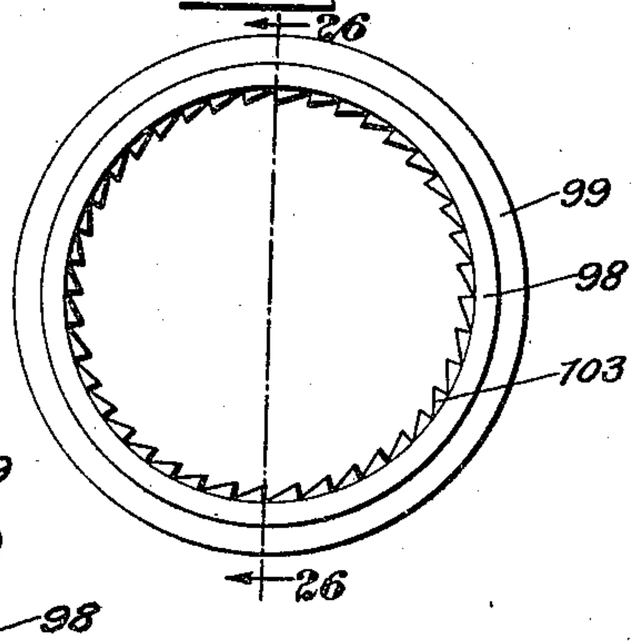


Fig. 26.

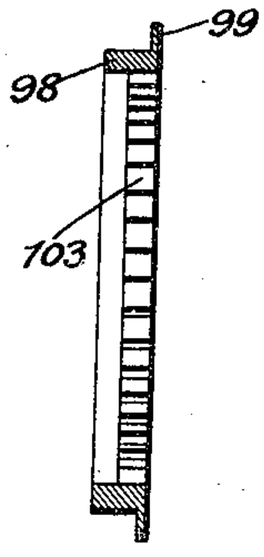
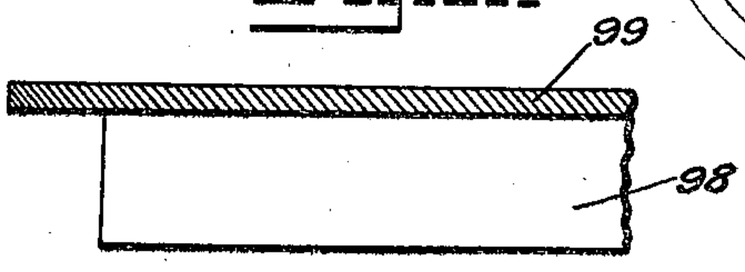


Fig. 27.



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1,440,556

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SEWING MACHINE.

FILED MAY 21, 1921.

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Fig. 28.

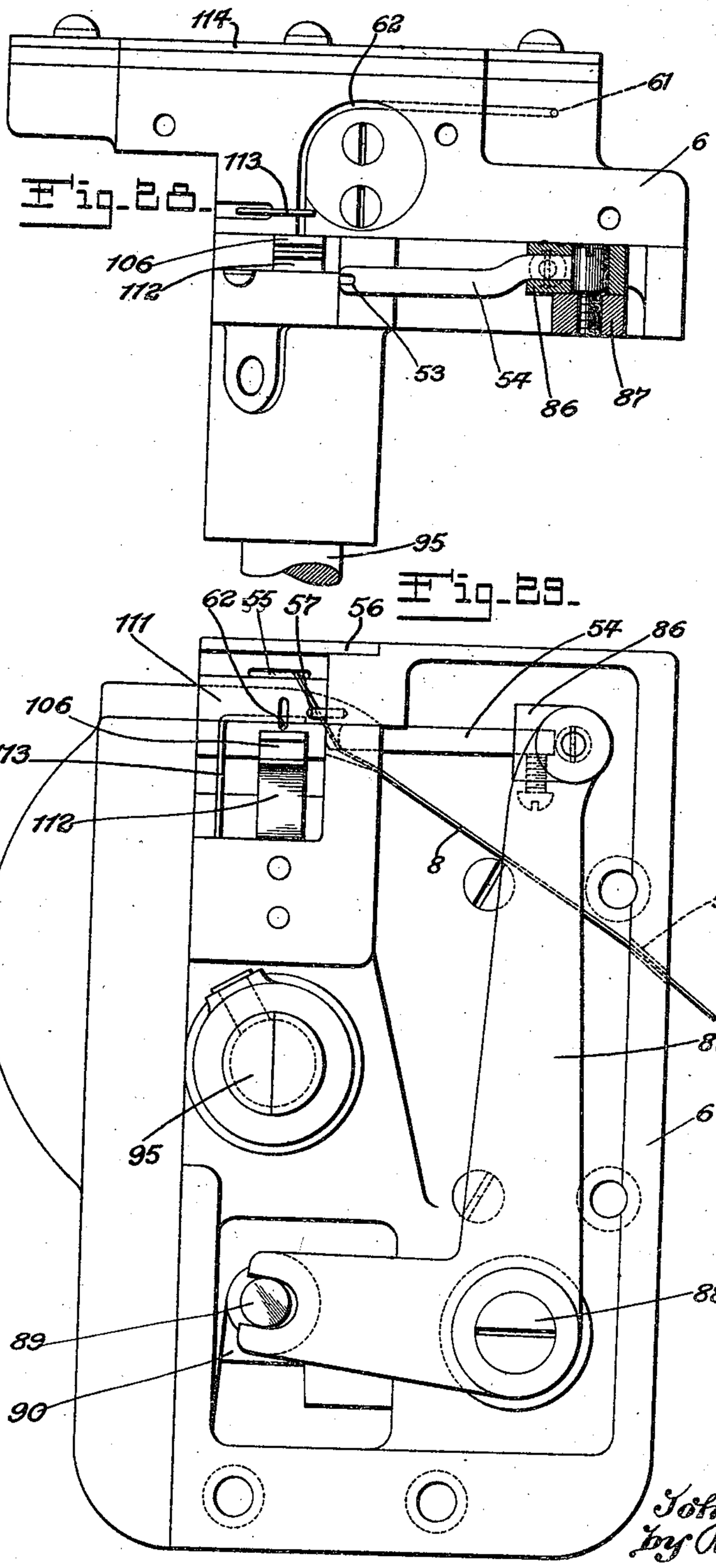

Fig. 29.

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SEWING MACHINE.
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1,440,556

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Fig. 30.

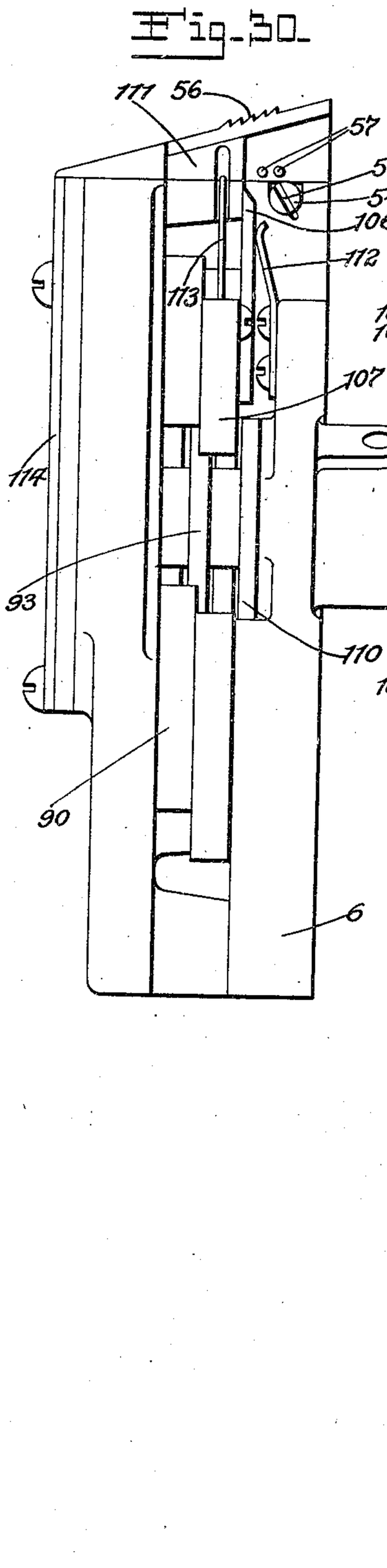
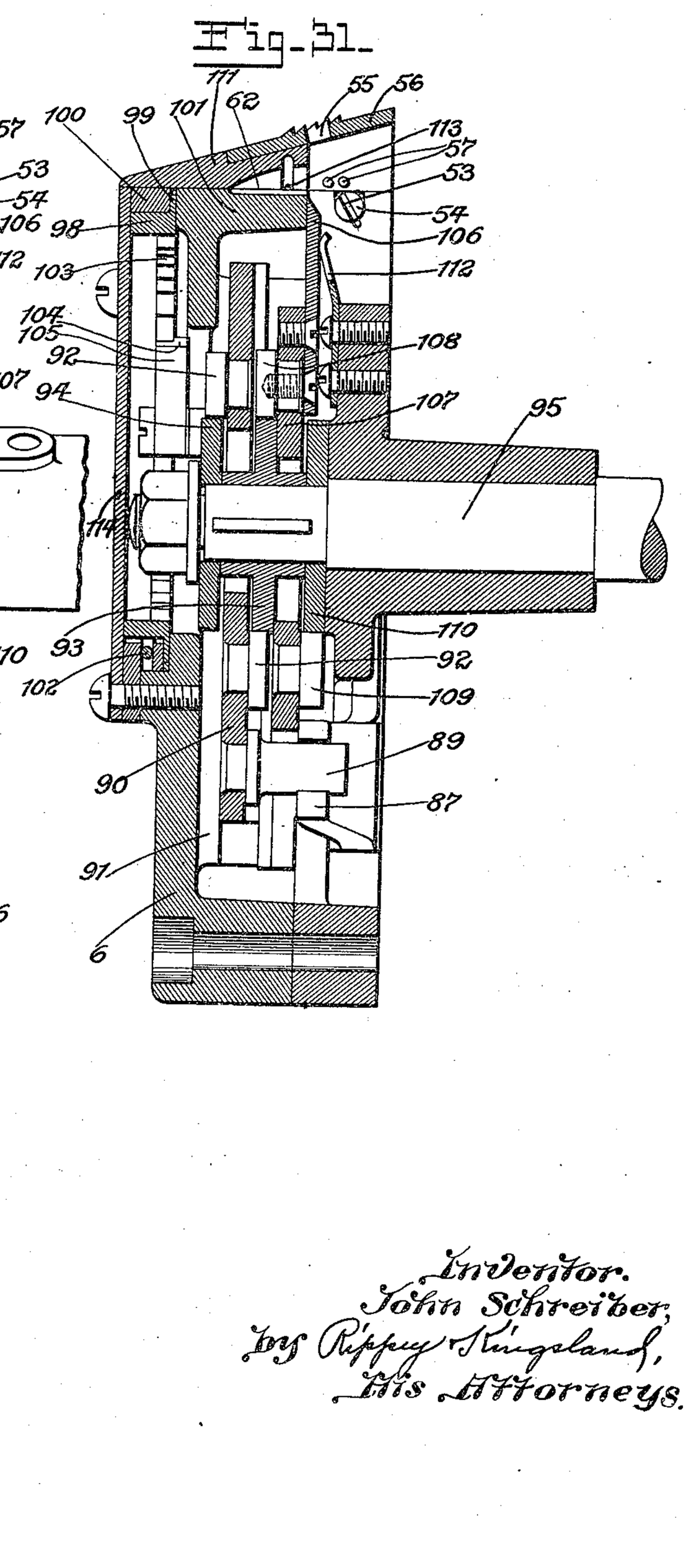


Fig. 31.



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Patented Jan. 2, 1923. 1,440,556

UNITED STATES PATENT OFFICE.

JOHN SCHREIBER, OF ST. LOUIS, MISSOURI.

SEWING MACHINE.

Application filed May 21, 1921. Serial No. 471,314.

To all whom it may concern:

Be it known that I, JOHN SCHREIBER, a citizen of the United States, residing at the city of St. Louis and State of Missouri, have invented a new and useful Sewing Machine, of which the following is a specification.

This invention relates to improvements in sewing machines and consists in the novel construction hereinafter disclosed.

An object of the invention is to provide a sewing machine equipped with novel stitch-forming mechanism principally for sewing leather parts of shoes and the like, in which the stitches are formed from a loop passed through a puncture in the layers of material to be united, a second loop inserted through said first-named loop on the side of material opposite from its point of entry, and a lock-thread inserted in the second loop, the whole stitch being drawn within the material so as to protect it from wear.

Another object of the invention is to provide a machine of the class described equipped with stitching mechanism to form a stitch of the character mentioned, and with improved means for feeding the thread to the stitching mechanism.

Another object of the invention is to provide a machine of the class described for forming a stitch of the character mentioned equipped with novel means for advancing the work so as to produce, efficiently and rapidly, an even row of stitching.

Another object of the invention is to provide in a machine of the class described improved means for regulating the stitch-forming mechanism.

Another object of the invention is to provide in a machine of the class described an improved form of mechanism for controlling and operating the stitch-forming mechanism, the work feed and thread-feeding mechanism so that the mechanisms of the machine will be accurately and properly synchronized in operation.

Many additional improved structural advantages will be apparent from the following detailed description of the invention, taken in connection with the accompanying drawings in which—

Fig. 1 is a front elevation of the machine.

Fig. 2 is a right side elevation of the machine, relative to the operator facing the front of the machine.

Fig. 3 is a top plan view of the machine.

Fig. 4 is a left side elevation of the machine, relative to the operator, showing the wax pot in section.

Fig. 5 is a left side elevation of the machine, relative to the operator, with the cover for the head removed.

Fig. 6 is a left side elevation, relative to the operator, partially in section, showing a portion of the front head and of the cam housing in section, and with certain parts of the front head mechanism removed.

Fig. 7 is a right side elevation relative to the operator, partially in section, showing the cam housing and a part of the front head and part of thread feeding mechanism in vertical section.

Fig. 8 is a horizontal section taken on an intermediate line through the front head and cam housing of the machine.

Fig. 9 is an enlarged front elevation of the machine with the thread-feeding attachment removed.

Fig. 10 is a cross section through the front head taken substantially on a line such as 10—10 of Fig. 4.

Fig. 11 is a cross section through the front head of the machine taken on a line such as 11—11 of Fig. 4.

Fig. 12 is a diagram of the front cam which is a part of the operating mechanism.

Fig. 13 is a diagram of the intermediate cam.

Fig. 14 is a diagram of the rear cam.

Fig. 15 is a cross section through the front part of the cam housing showing details of the driving mechanism for the thread-feeding attachment.

Figs. 16, 17 and 18 are views of the stitch-forming mechanism in its several operative positions, the consecutive cycles of operations being illustrated in the consecutive views.

Fig. 19 is a sectional view through the material joined by the stitch, illustrating the stitch as formed by the machine.

Fig. 20 is a plan view of the lock-thread feeding mechanism, with the front cam plate attached.

Fig. 21 is a front elevation of the same mechanism, with the front cover plate removed.

Fig. 22 is a transverse horizontal section taken on a line such as 22—22 of Fig. 21.

Fig. 23 is a sectional view of the clutch device between the cam shaft and the driv-

ing pulley, taken on the line 23—23 of Fig. 7.

Fig. 24 is a top plan view of the lock-thread feeding device.

Fig. 25 is a front elevation of the same element.

Fig. 26 is a section on the line 26—26 of Fig. 25.

Fig. 27 is an enlarged fragmentary plan view of a portion of the lock-thread feeding device.

Fig. 28 is a plan view of the lock-thread feeding mechanism with the top cover plate therefor removed.

Fig. 29 is a rear elevation of the lock-thread feeding mechanism.

Fig. 30 is a right side elevation of the lock-thread feeding mechanism.

Fig. 31 is a vertical section through the same mechanism.

The frame of the machine consists of a base 1 having a hollow pedestal or column 2, supporting a cam housing 3, which is preferably formed separate from the pedestal or column and attached thereto by bolts 4. The front head frame 5 is attached to the front end of the cam housing 3, the lock thread feeding device frame 6 being carried at the lower front end of the front head frame.

The stitching mechanism requires three separate strands of thread and for the purpose of identifying the different strands the one will be designated thread for upper loop, the other thread for lower loop, and the third thread for lock thread, said strands being numbered respectively 7, 8 and 9. The thread 7 is taken from a spool 10 that is carried by a bracket 11 bolted to the right side of the pedestal or column 2. Rising from the bracket 11 is an arm 12 having an eye formed therein near its extremity through which the thread passes.

From the arm 12 the thread 7 passes through a thread locking and tensioning device. This device includes a stem 13 (Fig. 7) mounted in a boss 14 formed on the top of the front head frame, the lower end of said stem extending through and below the top wall of the front head frame. The upper end of the stem 13 projects through the top wall of a cap 15 that is attached to the face of the boss 14 by screws 16. The stem 13 has an annular flange 17. An expansion spring 18 encircles the stem 13 above the flange 17 and is nested between the flange and the top wall of the cap 15, the tendency of the spring being to depress the stem 13. Below the flange 17 and slidably mounted on the stem 13 is a washer 19. An expansion spring 20 encircles the lower part of the stem below the washer, said spring being nested in a cavity in the boss 14.

At each side of the cap 15, adjacent to the face of the boss 14, there is formed a slot 21 (Fig. 2). The thread 7 is passed through a slot in the right side of the cap, is looped around the stem 13 between the flange 17 and the washer 19 and is passed out of the slot in the same side of the cap, the slot on the opposite side being provided merely for convenience in threading the thread through the device. The locking and tensioning device functions to release the thread, maintaining sufficient pressure thereon to prevent over-running of the thread and to preserve the necessary tension thereon when the thread is carried forward to form the loop, as hereafter described. After the loop has been formed and when the stitch is being folded into the material, the thread is locked against forward movement permitting the stitching mechanism to draw the thread tight into the material. This operation of the locking and tensioning device is accomplished by means of a cam bar 22 (Fig. 7) that is slidably mounted in a channel formed within the upper wall of the cam housing by flanges 23, depending from the top wall of said housing (Figs. 7 and 15). This cam bar extends backwardly to a point near the rear end of the cam housing and carries a roller 24 mounted on a pin 25 (Figs. 6 and 7) extending through the cam bar from the top to the bottom thereof, the roller being mounted on the lower extension of said pin and lying in a horizontal position below the lower face of the cam bar. The longitudinal movement is imparted to the cam bar 22 by means of a cam slot formed in a cam cylinder, the construction and mode of operation of which will be more fully described hereinafter.

The forward end of the cam bar 22 has an inclined cam slot 26 (Fig. 7) that extends obliquely upwardly from the end of the cam bar and upon which the lower end of the stem 13 rests, the end of the stem being flattened to enter the slot and prevent the stem from turning.

The stem 13 is provided with a manual releasing device in the form of a cam lever 27 having a cam face 28 operating on the top wall of the cap 15, the said lever being pivoted to the end of the stem 13 by a screw 29. When the lever is in a vertical position, as illustrated particularly in Fig. 7 of the drawings, the stem 13 is raised so that the stem 13 is held against downward movement by the spring 18. In this position the washer 19 is yieldingly supported by the spring 20 so that the pressure between the under face of the flange 17 and the upper face of the washer 19 is a yielding pressure, permitting the thread to be drawn forward with only sufficient tension to prevent it from over-running. This position of the device is the released position, and is only assumed when it is desired to reduce the tension and restraint on the thread 7, as when the thread is being

drawn forward by hand for threading the stitching mechanism.

When the lever 27 is depressed the stem 13 is free to move in its mounting and when it is in its lowest position the washer 19 rests on the upper wall of the boss 14. In this position the spring 18 has sufficient tension to hold the faces of the flange 17 and the washer 19 in close adjustment so as to bind the thread 7 lying therebetween and prevent it from moving forwardly. This adjustment of the device is effected at the point in the stitching operation when the stitch is being drawn into the work. As the loop is being formed in the upper thread 7 the cam bar 22 is moved forwardly, raising the stem 13 in opposition to the spring 18, so that the washer 19 will be yieldingly supported by the spring 20. In this adjustment there is sufficient play between the washer 19 and the flange 17 to permit the thread 7 to be drawn forwardly by the stitching mechanism, and yet there is sufficient tension to retard the over-running of the thread and to hold it taut between the tensioning device and the needle.

From the tensioning device the thread 7 is passed under a guide roller 30 supported on an ear 31 formed on the upper face of the front head housing. An arm 32 extends outwardly and across the roller groove to prevent the thread from slipping out of the groove in the roller. From the roller 30 the thread passes over a second roller 33 supported at the extremity of a rocker arm 34 that constitutes a means for pulling the stitch into the material after the stitch has been formed, and also serves to hold the thread taut, the operation of the arm 34 being more fully described hereinafter. The roller 33 is likewise provided with an arm 35 that extends outwardly and over the groove in the roller 33 for preventing the thread from moving out of the groove in the roller 33. From the roller 33 the thread is carried downwardly and is threaded through an eye in an arcuate needle 36, the needle 36 being formed with a groove (Fig. 17) in the top face thereof. The thread 13 is presented to the needle so that as the needle moves in an arcuate path it will lie in the slot, the needle being threaded from the top through an eye, the end of the strand of thread projecting from the bottom of the needle.

In the initial stitch forming operation the end of the thread 7 after it leaves the eye of the needle is brought over to the left side of the machine and is engaged in a spring clip device 37 (Figs. 3 and 4) on the side member of the front head 5 of the housing. This clip 37 is provided with a knife edge 38 at its lower end for cutting the thread 7.

The thread 8 for the lower loop is supported on a spool 39 carried on a bracket 40 supported on the left side of the pedestal or column 2. The bracket 40 is provided with an upwardly extending arm 41 having an eye formed near its extremity and through which the thread 8 passes. From the arm 41 the thread 8 is carried over and threaded through an eye 42 supported by the left side cover plate of the front head housing. Below the front head frame and projecting beyond the left side thereof is a wax pot 43 (Fig. 4) that is slidably mounted on a rod 44 extending downwardly from the bottom of the front head frame. A set screw 45 is provided for the adjustment of the wax pot. The wax pot is provided with a cover 46 likewise mounted on the rod 44 above the top edge of the wax pot, the cover being held in adjustment by a set screw 47.

Depending from the inner face of the cover 46 is an arm 48 that has a slotted eye at the lower extremity thereof. The wax pot cover 46 is provided with an opening in the back edge thereof, the inner wall of which is in substantially vertical alinement with the eye 42 so that the thread 8 after being passed through the eye 42 is drawn downwardly through the opening in the cover of the wax pot and under the end of the arm 48, the thread seating in the slotted eye in the extremity of the arm 48. The thread 8 is then carried outwardly through a second opening in the front edge of the wax pot cover.

Arranged just below the point of exit of the thread from the wax pot is a scraper device in the form of a flat spring 49 attached to a web 50 extending from the arm 48. The thread 8 moves between the spring 49 and the web 50 so that excess quantities of the wax carried up by the thread from the bottom of the wax pot are scraped off, it being understood that a supply of wax in semi-liquid form is maintained in the wax pot.

From the wax pot the thread 8 is carried vertically upwardly through an eye 51 supported by the left side wall of the lock thread feeding attachment, and thence transversely through an opening 52 in the side wall of the lock thread feeding attachment. The thread 8 is then carried upwardly in the lock thread feeding attachment entering a slot 53 in the end of the bottom thread needle 54, (Figs. 28, 29 and 31). Thence, the thread 8 is carried upwardly and drawn out through a slot 55 in the work plate 56 which is supported by the top cover of the lock thread feeding attachment housing.

Adjacent to and over-lying the end of the needle 54 are two pins 57 that hold the thread in position to be received in the slot 53 in the end of the needle when the needle is in operation.

The lock thread 9 is supported on a spool

58 (Figs. 1 and 2) carried by a bracket 59 supported on the front wall of the column or pedestal 2 and has an upwardly extending arm 60 near the extremity of which there is an eye through which the thread 9 passes. From the arm 60 the thread 9 passes against the front face of the lock thread feeding device housing and enters a vertical channel 61 (Figs. 21 and 28) in the front wall of the lock thread feeding device housing. From the channel 61 the thread 9 passes over the upper left quadrant of the periphery of the lock thread feeding roll, the details of construction of which will be more clearly described hereinafter.

From the lock thread feeding roll the thread 9 is delivered and advanced through a channel 62 with curves from the left of the machine to the back of the lock thread feeding device housing, said channel being formed in the top wall of the housing of this device. This delivers the lock thread 9 moving in a direction toward the rear of the machine at a point below the slot 55 (Fig. 31) in the work plate 56 for entry into the loop formed by the bottom thread 8 at the right hand side of the loop formed by the top thread 7.

Fig. 19 shows an enlargement of the stitch formed by the three threads whose movement to the stitch forming mechanism has been described, while Figs. 16, 17 and 18 show different stages in the work. As shown in Fig. 16 the work is supported upon the work plate 56 across the slot 55. After the work has been pierced by the awl to provide an opening for the reception of the stitch, the needle 36 passes through the pierced opening to a position such as shown in Fig. 17. The thread 7 is stretched and, due to the arcuate formation of the needle 36, a space is provided between the thread 7 and said needle. The needle 54 is then projected through the space between the thread 7 and the needle 36 to push a loop of the thread 8 into said space. The thread 8 is looped across the end of the needle 54 and as a consequence of this loop of the thread 8 extends through a loop of the thread 7 as the needles 36 and 54 are withdrawn. Next, the needle 54 is withdrawn, leaving a loop of the thread 7 and the needle 36. Next, the needle 36 is withdrawn, and, shortly prior to the time that said needle 36 reaches the position shown in Fig. 18, the thread 9 is advanced to place the end portion thereof within the loop of the thread 8 and across the two arms of the loop of the thread 7 to lock said loops together. As the needle 36 is wholly withdrawn from the work the roller 33 is operated at the proper time to draw the stitch into the work. As before stated, the roller 33 is supported on a pivoted arm 34 and the operations are coordinated so that said arm 34 is operated to raise the roller 33 during the time that the thread is clamped firmly between the flange 17 and the tensioning washer 19. Since the main strand of the thread 7 is thereby held from movement it is apparent that the raising of the roller 33 over which the thread 7 passes will draw the stitch into the work, as stated.

The stitch thus formed comprises a loop of the thread 8 passing through a loop of the thread 7, and a portion of the thread 9 passing through the loop of the thread 8 to prevent said last-named loop from being withdrawn from the loop of the thread 7 through which it extends. This locking part of the thread 9 is cut off at the proper time after the loops of the threads 7 and 8 have been locked together thereby, as described and as clearly shown in Fig. 18.

After each stitch has been formed and drawn into the work in the manner stated, the work is moved upon the work plate to position for the next stitch, and the lower side of the work is channeled to receive the thread 8 from the stitch that had been formed. The awl that punctures the work for the stitches also moves the work upon the work plate to receive the successive stitches. The channeling device operates with the awl to form the channel in advance of the stitches, and of sufficient depth to receive the thread 8 therein.

The needle 36 is carried and operated by a needle holder 63 mounted for rocking movements on the shaft 64 of the awl holder. The rocking movements of the needle holder are from the position shown in Fig. 16 to the position shown in Fig. 17, and return. The needle holder 63 and the awl holder take their rocking movements together, and the awl holder is operated laterally independently of the needle holder 63 in order to move the work to different positions upon the work plate 56. The needle 36 is clamped on the needle holder by a plate 65 secured in position by appropriate screws (Fig. 18) and being removable to permit removal and replacement of the needle. A collar 66 (Figs. 5 and 8) is made rigid with the needle holder 63 and is formed with an arcuate rack 67 which meshes with a segmental rack 68 carried on a supporting shaft 69. The segmental rack 68 is operated at the proper time to rock the needle holder from the position shown in Fig. 16 to the position shown in Fig. 17, and return.

A link 70 forms a pivotal connection between the segmental rack 68 and a cam bar 71 operatively mounted in a supporting guide in the housing 5. The cam bar 71 is arranged to be moved axially in opposite directions to impart the desired rocking movements to the segmental rack 68 and thereby to the needle holder. The cam bar

71 supports a roller 72 within a cam in the intermediate rotary cam 73 carried and operated by the main shaft 74 of the machine. The slot in the cam 73 winds around the cam so that each complete rotation of the cam moves the cam bar axially in opposite directions the full extent of movement thereof. In Fig. 5 the cam bar is shown in its forward position in which the needle holder is in the position shown in Fig. 17. As the cam 73 turns one-half of a revolution from the position it occupies in Fig. 5, the cam bar 71 is moved inwardly (to the left when viewed as in Fig. 5), thereby imparting a turning movement to the segmental rack 68 and to the needle holder 63, with the result that the needle 36 is moved to the position shown in Fig. 16. From this it will be seen that the axial reciprocating movements of the cam bar 71 imparted by the cam 73, imparts the necessary rocking movements to the needle holder 63 and the needle 36 carried thereby to cause said needle 36 to function in the formation of the stitches, as before described.

Referring next to the carrier for the awl and the channel cutter and first to Figs. 16, 17 and 18, it will be seen that the awl 75, that pierces the work for the reception of the stitches, is arcuate in side elevation and is on the same radius of curvature as the needle 36. The awl 75 is supported by an awl holder 76 rigid upon the shaft 64 that supports the needle holder. It will be seen by reference to Fig. 8 that the needle holder is held from lateral axial movements by contact of the hub or sides thereof with laterally immovable parts; whereas the shaft 64 is capable of axial movements, as required to effect movement of the work upon the work plate, during the operation of the machine. The shaft 64 and the awl holder carried thereby are also capable of rocking movements to and from the positions shown in Figs. 16 and 17. After the work is placed upon the machine the awl holder is first operated to the position shown in Fig. 16, to pierce the work and while the awl is within the work a lateral movement is imparted to the awl holder to move the work laterally so that when the needle 36 is operated it will pass through the opening formed in the work by the awl holder, it being understood that the awl is withdrawn from the work at the proper time. The awl is clamped between a plate 77 and an adjacent part of the awl holder, said plate 77 being removable to permit removal and replacement of the awl as desired, (Figs. 8 and 18). The awl holder 76 is rigid with the shaft 64 and comprises a segmental flange of the same size and shape as the plate 77. The segmental flange of the awl holder is within a notch or recess in the end of the hub of the needle holder 63, so that when the rocking movements are imparted to the needle holder, as described, the awl holder is rocked thereby. However, the awl holder is capable of lateral movement relative to the needle holder, as stated, the segmental flange part of the awl holder moving axially within the notch in the hub of the needle holder. From this it will be seen that the same mechanism imparts the rocking movements to the needle holder and to the awl holder, a separate device being employed to impart the lateral movements to the awl holder.

Extent of lateral movement of the awl holder may be varied in order to move the work different distances to change the distance between the stitches. As shown in Fig. 8 a bell crank lever 78 operatively mounted on a support 79 has one end engaging within a circumferential groove 80 in the shaft 64 with which the awl holder is rigid.

A link 81 has one end pivoted to an axially movable cam bar 82 operatively supported in guides in the housing 3, the opposite end of said link 81 being adapted to be connected with an arm of the lever 78 at different radial distances from the axis of the pivot of said lever in order to vary the extent of movement of said lever 78 without changing the extent of movement of the cam bar 82. If the link 81 be connected to the arm of the lever 78 near the end thereof, said lever will be moved a shorter distance than if the link 81 be connected to the arm of the lever 78 nearer the axis of the pivot of said lever, as is obvious. Thus, the extent of lateral movement of the awl holder may be varied, as desired, to vary the distance between or the length of the stitches. Axial movement is imparted to the cam bar 82 by the front cam cylinder 83 (Figs. 7 and 8) which has a circumferential winding cam slot, diagrammatically shown in Fig. 12, receiving a roller 84 carried on a pin extending from the cam bar 82.

The relationship of the parts is such that lateral movement is imparted to the awl holder during the final portion of the turning movement of the awl holder after puncturing the work and during the initial portion of the return turning movement thereof; and during the initial and greater portion of the turning movement of the awl holder in puncturing the work, the awl holder does not move laterally. After the awl holder has been shifted laterally to move the work, return turning movement of the awl holder to withdraw the awl from the work is continued. This return turning movement is affected by operation of the described connections, said connections being operated from the cam 83.

The awl holder plate 77 supports the chan-

nel cutter 85. The channel cutter is in the form of an arcuate blade supported at the side of the awl 75 and arranged to cut a channel in the work of sufficient depth to receive the lower thread 8 therein.

Referring next to the mechanism for operating the needle 54 that controls the bottom thread 8 and first to Figs. 28 and 29, it will be seen that the needle 54 is secured to a part 86 pivotally supported on one arm of an angular lever 87. The lever 87 is pivotally supported at 88 and the other arm of said lever has a notch or recess receiving a pin 89 extending from a vertically movable slide 90 located within the lock thread feed housing and mounted between two appropriate guides 91, (Fig. 31). The slide 90 supports pins 92 one of which engages a cam 93 and the other of which engages a cam 94. The cams 93 and 94 are attached to the end portion of a detachably jointed shaft 95, the forward end of which extends into the lock thread feed housing and the rear end of which extends into the cam housing 3. The two portions of the shaft are coupled by a sleeve 95[a], which permits quick removal of the lock thread feed housing.

The inner or rear end of the shaft 95 supports a pinion 96 adapted to be intermittently engaged and operated by a segmental rack or gear 97 on the shaft 74 (Fig. 7). When the machine is in operation the shaft 74 is in continuous rotation, but the shaft 95 is only intermittently rotated and this during about one-third of each rotation of the shaft 74. The cams 93 and 94 (Fig. 31) are constructed and arranged to impart vertical and reciprocating movements to the slide 90, with the result that the lever 87 is oscillated. The bottom thread 8 which extends through the notch 53 in the end of the needle 54 is thereby moved to loop the thread 8 through the loop of the thread 7 made by the movement of the needle 36 to the position shown in Fig. 17. This movement is imparted to the needle 54 by the downward movement of the slide 90 and the lever 87 is operated to withdraw the needle 54 from the loop in the thread 7 by the upward movement of the slide 90, leaving the loop of the thread 8 extending through the loop of the thread 7. The cams 93 and 94 are rotated intermittently by the shaft 95 which is intermittently rotated by the segmental rack or gear 97 on the shaft 74 (Fig. 15). The mechanism is arranged to operate so that the needle 54 is advanced to loop the thread 8 within the loop of the thread 7 during the final portion of the downward movement of the needle 36; and the withdrawal movement of the needle 54 occurs during the initial portion of the return movement of the needle 36, leaving the loop of the thread 8 within the loop of the thread 7 to receive the end portion of the thread 9 to lock said loops together.

Having described the mechanism for passing the loop of the thread 8 within the loop of the thread 7 and for piercing and moving the work laterally, I now proceed to describe the lock thread feeding mechanism. As before stated the lock thread 9 passes from the channel 61 to a feeding roll. The feeding roll is shown detached from the operative mechanism therefor in Figs. 24 to 27, and is shown in association with the operating mechanism therefor in Figs. 21, 22 and 31.

In the construction shown the feeding roll comprises a ring 98 provided with a circumferential flange 99 having its periphery provided with ribs arranged obliquely to the side edges to effect better engagement with the thread 9 and to pass said thread along through the channel 62. The feeding roll thus formed is supported so that the flange 99 engages the thread 9 passing from the channel 61 and as the feeding roll is turned in its support the thread 9 is passed therefrom through the channel 62 (Figs. 28 and 29) and from the channel 62 the thread 9 is passed through the loop of the thread 8, as shown (Fig. 18). The ring 98 of the lock thread feeding roll is within a support 100 having an opening of somewhat greater diameter than the diameter of the ring 98. The flange 99 of the lock thread feeding roll is between the support 100 and a plate 101 forming a part of the housing of the lock thread feeding mechanism. A spring 102 (Figs. 21 and 31) supported by the support for the lock thread feeding roll 98 yieldingly supports said feeding device and presses the same to the position shown in Fig. 21, so as to engage and feed the thread 9 properly when the feeding device is rotated. From the channel 61 the lock thread 9 passes upwardly between the periphery of the flange 99 and the adjacent wall of the support for the feeding device. As a result of this the spring 102 causes the spotted or knurled peripheral surface of the flange 99 to move the thread 9 around about one fourth of the circumference of the feeding device, and thence into the curved channel 62. A short rotary movement is imparted to the feeding roll for the thread 9 from each rotary movement of the shaft 95, and the devices for effecting this movement of the feeding roll 98—99 will now be described.

The lock thread feeding roll 98—99 is provided with an internal circumferential series of ratchet teeth 103. A pawl 104 is pivotally supported by the vertically movable slide 90 and is pressed into engagement with the ratchet teeth 103 by a spring 105. During downward movement of the slide 90 the pawl 104 escapes over the teeth 103, leaving

the lock thread feeding roll 98—99 stationary. Upward movement of the slide 90, which is effected by the cams 93 and 94, as described, imparts a short rotary movement to the feeding roll 98—99 sufficient to pass the desired length of the thread 9 through the loop of the thread 8 (Fig. 18) to lock the threads 7 and 8 together. As the stitch thus formed is being drawn upwardly the end portion of the thread 9 is raised thereby into a vertically widened portion of the channel 62 and, at the proper time, the lock thread 9 is cut to leave the end portion thereof in and as a part of the stitch. Then the entire stitch, comprising the interlocked loops of the threads 7 and 8 and the locking part of the thread 9, is drawn into the material being sewed.

The knife 106 for cutting off the end portions of the thread 9 at each stitching operation is supported by a slide 107 arranged for vertical sliding movements similar to the slide 90. Both of said slides are within the housing for the lock thread feeding attachment, and the vertical sliding movements of both slides are effected by cams on the shaft 95. The upper portion of the slide 107 has a pin or projection 108 against which the cam 93 operates. The said slide 107 has another pin 109 against which a cam 110 on the shaft 95 operates. As before stated, upward movement of the slide 90 operates the lock thread feeding device to pass the end of the lock thread 9 through the loop of the thread 8. After the lock thread 9 has been advanced and extended through the loop of the thread 8 the slide 107 is raised operating the knife 106 against the inner surface of the upper portion of the plate 101 and against the inner edge of the cover 111 of the housing for the lock thread feeding device. The vertically widened portion of the channel 62, before mentioned, is within the cover plate 111. As the interlocked loops of the threads 7 and 8 are drawn toward the work the thread 9 is raised into the vertically widened portion of the channel 62 (Fig. 18). During this operation the knife 106 moves upwardly against the inner surfaces of the plates 101 and 111 and the extent of such upward movement of of said knife is sufficient to cut the thread 9, leaving a portion thereof to lock the loops of the threads 7 and 8 together. The slide 107 is then moved downwardly to carry the knife 106 below the lower wall of the channel 62 leaving the thread 9 free to be moved at the next stitch forming operation. A spring 112 (Fig. 31) may be utilized to press the knife 106 against the plates 101 and 111.

After the thread 9 has been cut, as described, the portion of said thread that had been raised into the widened portion of the channel 62, is returned to the lower part of said channel by a finger 113 carried by the slide 107 and extending across the channel 62 above the thread 9 therein. As the slide 107 is raised as described the finger 113 is also raised to permit the thread 9 to be raised into the widened portion of the channel 62. At the same time the knife 106 is moving upwardly and said knife continues its upward movement after the thread 9 contacts with the upper wall of the widened portion of the channel 62. As a result of the continued upward movement of the knife 106 the thread 9 is cut or sheared to leave the end portion thereof of the proper length, locking the loops of the threads 7 and 8 together. The interlocked loops of said threads are then drawn into the material and the operation of the machine is continued. The front part of the housing for the lock stitch feeding mechanism includes a removable plate 114 which may be removed to afford access to said mechanism for inspection or other purposes.

Referring next to the mechanism for drawing the stitch into the work this mechanism may be best understood by reference to Figs. 7 and 11. As before stated, the thread 7, after leaving the tensioning and clamping device, comprising the flange 17 and the washer 19 on the stem 13, passes under a roller 30 on a stationary support and thence over the roller 33 carried on the lever 34. The lever 34 is pivoted to the upper end of an additional lever 115 operatively mounted on the shaft 69.

The connection between the levers 34 and 115 comprises a pivot 116 which is connected with a cam bar 22 by a link 117. A spring 118 held around the hubs of the levers 34 and 115 engages the lever 34 and tends to raise the forward end of said lever in opposition to the pressure imparted thereto by the thread 7 which passes over the roller 33. An adjustable abutment 119 in the form of a screw passing through a projection on the depending end of the lever 34, is adapted to contact with the lever 115 to limit downward movement of the lever 34 relative to said lever 115. A spring 120 connects an extension of the lever 115 below the shaft 69 with a stationary part of the machine, and serves to actuate the upper end of the lever 115 in a forward direction. Forward movement of the upper end of the lever 115 is limited by an abutment 121. A screw 122 is adjustably supported by the lever 115 and contacts with the abutment 121 to limit forward movement of said lever. Extent of forward movement of the lever 115 may be varied by changing the adjustment of the screw 122 therein, as desired.

The link 117 is connected with the cam bar 22 by a pin-in-slot connection 123 permitting slight movement of the cam bar relative to said link and the connected parts.

The roller 24 supported by the cam bar

22 has already been mentioned as lying within the winding curve of a cam cylinder. The cam cylinder mentioned is the rear cam 124 shown in section in Figs. 7 and 8, and diagrammatically in Fig. 14. As the shaft 74 rotates the cam bar 22 is moved axially in forward and rearward directions. The construction and arrangement is such that when the needle 36 is extended downwardly to the position shown in Figs. 7 and 17, the cam bar 22 is in its extreme forward position, as shown in Fig. 7. In these positions of the parts the thread 7 is held by the tensioning device 17—19. As the cam bar 22 moves to its rearward position the lever 34 is raised to draw the stitch that had been formed into the work, the thread in the meantime being held from movement by the device 17—19 which moves to locking adjustment. The relationship of the parts is such that the stitch will be drawn into the work to the proper depth as determined by the regulating device provided for that purpose. As the cam bar 22 is moved to its rearward position the upper end of the lever 115 is swung rearwardly (to the right when viewed as in Fig. 7) carrying the lever 34 with it.

A sleeve 125 (Figs. 7 and 10) is supported eccentrically upon a rod or bolt 126 in position to be engaged by the tail 127 of the lever 34 during rearward movement of said lever. Extent of movement of the lever 34, before contact of the tail 127 of said lever with the eccentrically supported sleeve 125, may be varied by turning said sleeve 125 to different selected adjustments as is obvious by reference to Fig. 7. When the tail 127 of the lever 34 contracts with the eccentric sleeve 125 further rearward movement of the lower end of said lever 34 is stopped; with the result that, as the rearward movement of the upper end of the lever 115 continues, the forward and upper end of the lever 34 with the roller 33 thereon is given a rapid upward and rearward movement, drawing the stitch into the work to the extent desired. The extent to which the stitch will be drawn into the work depends upon the adjustment of the eccentric sleeve 125; for, if the eccentric sleeve 125 be adjusted to impart only a slight movement to the lever 34 as described, the stitch will be drawn into the work only a short distance; whereas, by varying the position of the eccentric sleeve 125 to impart additional movement to the upper end of the lever 34, the stitch will be drawn further into the work, and the extent to which the stitch will be drawn into the work may be varied within relatively wide limits.

As shown, the eccentric sleeve 125 extends through an opening in the right side cover of the front head 5 and is provided with a circumferential flange 128 having a graduated scale represented thereon (Fig. 2) to afford visual indication of the positions of the eccentric sleeve. The end of the sleeve is provided with a knurled or spotted knob 129 for manual engagement to turn the sleeve to its different adjustments. The end of the rod or bolt 126 supports a clamp nut 130 for holding the sleeve 125 in any position in which it may be adjusted. To change the adjustment of the sleeve 125 it is only necessary to loosen the nut 130 and turn the sleeve to the position desired, and then tighten the nut 130 to hold the sleeve from movement.

The presser foot 131 extends from a rocking supporting member which comprises a ring 132 supported for rocking movements on a boss 133 (Fig. 8) extending from an inner wall of the front head frame 5. A rod 134 (Fig. 6) has its forward end pivoted to the presser foot support 132 so that forward movement of said rod will lower the presser foot 131 to press the work on the work plate 56 (Figs. 16, 17 and 18). The presser foot 131 extends downwardly and laterally from the support 132 (Fig. 9) and has a slot 135 therein to receive the awl 75 (Fig. 16) when the awl is operated to pierce the work to receive the needle 36 (Fig. 17) when the needle is operated.

The rod 134 has its rear end supported within a sleeve 136 (Figs. 6 and 10) carried by a pivoted support 137. The support 137 is swingingly supported by a pin 138 and is connected with an operating lever 139. The lever 139 embraces the support 137 between the arms of a fork at the lower end of said lever and the connection between the lever 139 and the support 137 is pivotal. The axis of the pivot 140 connecting the lever 139 with the support 137 is at right angles to the axis of the pivot 138. The lever 139 extends through an opening in the upper wall of the head frame 5. A plate 141 is secured to the upper wall of the front head frame at the side of the lever 139, leaving room for the movements of said lever. As shown in Figs. 3, 5 and 6 the lever 139 is in its forward position and the presser foot 131 is raised. In this position the lever 139 is latched in front of a projection 142 on the plate 141. When the lever 139 is moved rearwardly the spring 143 which encircles the rod 134 is placed under compression. The forward end of the spring 143 bears against a circumferential shoulder or washer 144 on the rod 134 and the rear end of said spring bears against the sleeve 136. By this construction the presser foot 131 will be lowered and pressed upon the work between the presser foot and the work plate 56. At the proper time the spring 143 yields to permit the work to be moved laterally by the awl 75 which lateral movement has already been mentioned in connection

with the description of the operation of the awl. In this rear position the lever is latched behind the projection 142 thereby holding the spring 143 under compression to hold the presser foot 131 on the work.

While the awl is piercing the work and before the time arrives for the work to be moved laterally, the presser foot 131 is held rigid by a brake device or clutch provided for that purpose. This brake device or clutch comprises a brake shoe or clutch member 145 located within a groove or channel in the rear peripheral portion of the presser foot support 132. The brake shoe or clutch device is pivoted on a support 146 (Fig. 6). An elongated slot in the brake device receives the support 146, forward movement of the brake device on the support being limited by an adjustable abutment 147. The abutment 147 is in the form of a screw carried by the brake device and has its forward end serving as an abutment to contact with the support 146. A brake shoe operating lever is under control of the lever 139 so that when the lever 139 is moved to its rear position behind the projection 142, the brake shoe operating lever will set the brake to hold the presser foot positively during the piercing operation of the awl. As shown, the brake shoe operating lever comprises an arm 148 having its forward end pivoted on a support 148[a] and having its rear end supported upon a spring 149. A cam 150 on the forward end of the brake shoe operating lever contacts with the brake shoe and presses the brake shoe into rigid engagement with the presser foot support 132 when the rear end of the operating lever is raised by the spring 149. The brake shoe operating lever has an arm 151 extending upwardly from the spring 149 and provided with an arcuate part 152 on the end thereof, constituting a contact or abutment member for the lower end of the pivoted support 137 that is controlled by the lever 139.

The support 137 and the arm 151 of the brake shoe operating lever, with the part 152 thereon, constitute a species of toggle whereby movement of the lever 139 will control the brakesetting lever 148. When the lever 139 is in its rear position behind the projection 142, the support 137 is beyond the forward end of the part 152 permitting the spring 149 to raise the rear end of the lever 149 and cause the cam 150 to press the brake shoe 145 in rigid engagement with the presser foot support 132. The parts occupy the positions last described when the machine is in use so that, during the piercing operation the presser foot will hold the work rigidly upon the work plate 56. At the proper time, however, the brake is released to permit lateral movement of the work by the awl holder. This is accomplished by a roller 153 carried by the cam bar 82 passing over a pin or projection 154 on the brake shoe operating lever 148 during the forward movement of said cam bar which forward movement of the bar also operates the lever 78 to shift the work laterally. As the roller 153 passes over the pin or projection 154 the spring 149 is compressed thereby releasing the cam 150 from pressure against the brake shoe and causing the brake shoe to release the presser foot support. This permits the work to be moved laterally, the presser foot yielding to adjust itself to any irregularities in the thickness of the work, while the serrated work plate 56 prevents the work from slipping forwardly.

The spring 149 constitutes an elastic actuator, for the brake shoe operating device. The tension of the spring may be varied by adjustment of the support 155 upon which the spring seat 156 is mounted. The spring 149 yields to the different mechanisms which operate to control the application and release of the brake shoe to and from the presser foot support. It will be understood that during the operation of the machine the brake shoe is held in set position against the presser foot support, except during the intermittent intervals in which the work is being shifted laterally. At the proper time in the forward movement of the cam bar 82 the brake shoe is released by the operation of the roller 153 against the part 154. When the brake shoe is released the awl moves the work laterally, the spring 143 yielding to accommodate the presser foot to any irregularities in the work.

Rearward movement of the cam bar 82 then occurs, permitting the spring 149 to reset the brake to hold the presser foot positively upon the work. It will be understood that these operations are rapidly performed as an incident to the operation of the machine and that the timing of the operations is properly maintained, due to the construction and mode of operation described.

From the foregoing it will be seen that the entire mechanism is driven from the main shaft 74. Any appropriate driving connections for operating the main shaft may be employed and I have shown a preferred form of a part of such connections designed and constructed to prevent operation of the machine in a reverse direction.

As shown (Figs. 6, 7 and 23) a belt wheel or pulley 157 is loosely supported upon the shaft 74. Within an extended portion 158 of the hub of the pulley a bushing 159 is located. A cylindrical member 160 is connected to the shaft 74 within the hub part 158 and the bushing 159, and in its periphery is provided with a number of reentrant notches 161 containing the cylindrical pins 162. The construction and arrangement are such that when the pins 162 are

located in the deep portions of the notches 161 the pulley is free to turn in a reverse direction without turning the shaft 74; but, if the pulley be turned in a forward direction, that is in the direction for operating the machine, the pins 162 roll on the inclined bottom walls of the notches 161 toward the shallow ends of the notches and clutch the pulley to the member 160 thereby rotating the shaft 74 to operate the machine. The pulley 157 may be operated by a belt 163 driven by a power device 164 (Figs. 1 and 2). Starting and stopping of the power device may be controlled by connections of any known construction and arrangement (not shown) within the pedestal or column 2, and said connection may be controlled by a foot treadle 165, or otherwise.

From the foregoing it will be seen that my invention accomplishes all of its intended objects and purposes in a highly efficient manner. The entire machine is compact and strongly constructed and contains a minimum number of parts. The operation of the different mechanisms is accurately coordinated and timed so that there is no interference whatever by one with another. By reducing the number of parts of the machine to a minimum danger and likelihood of disarrangement and breaking of the parts is diminished.

It is apparent that the construction, arrangement and formation of various parts of the machine may be varied within a wide range of limits without departure from the nature and principle of the invention. I do not restrict myself to specific or unessential features of construction or arrangement, except where such features are of the essence of the invention.

What I claim and desire to secure by Letters Patent is:—

1. In a machine of the character described, the combination of a work support, a needle for passing an upper thread loop through work on the support, a needle for passing a lower thread loop through the loop of the upper thread below the work on the support, mechanism for passing a lock thread through the lower thread loop to lock the threads together to form stitches, means for cutting a channel in the work to receive the lower thread between the stitches, a rotary shaft, supports for said needles respectively, cams on said shaft, connections operated by said cams for operating the needle supports and the channel cutting means, and devices operated by said shaft for operating the mechanism that moves the lock thread.

2. In a machine of the character described, the combination of a work support, a needle for passing an upper thread loop through work on the support, a needle for passing a lower thread loop through the upper thread loop below the work, a device for passing a lock thread through the lower thread loop to lock the loops together to form stitches, a driving shaft, connections operated by said shaft for operating said needles and said device to form a stitch composed of the interlocked loops as aforesaid and to draw the stitch so formed into the work, and a device operated by said shaft for piercing the work and moving the work laterally and for cutting a channel in the work between the stitches to receive the lower thread.

3. In a machine of the character described, the combination of a work support, a needle for passing an upper thread loop through work on the support, a pivoted element supporting said needle for rocking movements in an arc, a needle for passing a lower thread loop through the upper thread loop below the work, a device for passing a lock thread through the lower thread loop to lock the loops together, a driving shaft journaled for rotation at right angles to the axis of the needle supporting element, connections operated by said shaft for operating said needles and said device to form a stitch composed of the interlocked loops as aforesaid and to draw the stitch so formed into the work, means for varying the depth to which the stitch will be drawn into the work, and an awl operated by said shaft for piercing the work and moving the work laterally.

4. In a machine of the character described, the combination of mechanism for passing an upper thread loop through work and for drawing the formed stitch into the work, mechanism for passing a lower thread loop through the upper thread loop below the work, mechanism for passing a lock thread through the lower thread loop to form a lock stitch, mechanism for raising the lock stitch thread toward the work as the stitch is drawn into the work, means for cutting off the locking portion of the lock thread, a device for cutting a channel in the work to receive the lower thread between the stitches, means for operating the first-named mechanism to draw the stitch into the work after the stitch has been formed as aforesaid and to draw the lower thread into said channel between the stitches, and means for varying the depth to which the stitch will be drawn into the work.

5. In a machine of the character described, the combination of a work support, an awl for piercing and moving the work laterally on the support, a needle for passing an upper thread loop through work on the support, a pivot on which said needle is supported, a needle for passing a lower thread loop through the loop of the upper thread, a rotary device for passing a lock thread through the lower thread loop to lock the threads together, a rotary shaft at an angle relative to said pivot and parallel with the

axis of said rotary device, a pair of cams on said shaft, connections operated by said cams for operating said needles respectively, an additional cam on the shaft, connections operated by said additional cam for operating said awl, and devices operated by said shaft for imparting intermittent movements to the lock thread mechanism.

6. In a machine of the character described, the combination of a work support, an awl for piercing and moving the work laterally on the support, a needle for passing an upper thread loop through work on the support, a pivot on which said needle is supported, a needle for passing a lower thread loop through the loop of the upper thread, a rotary device for passing a lock thread through the lower thread loop to lock the threads together, a rotary shaft at an angle relative to said pivot and parallel with the axis of said rotary device, a pair of cams on said shaft, connections operated by said cams for operating said needles respectively, an additional cam on the shaft, connections operated by said additional cam for operating said awl, devices operated by said shaft for imparting intermittent movements to the lock thread mechanism, and means operated by said connections for severing the lock thread.

7. In a machine of the character described, the combination of a work support, mechanisms for passing an upper thread loop through work on the support and for passing a lower thread loop through the upper thread loop below the work, a drive shaft, cams on said shaft for operating said mechanisms, a rotary lock thread feed device for passing a lock thread through the lower thread loop to lock the threads together, a knife for severing the lock thread, and devices operated by said drive shaft for imparting intermittent rotary movements in only one direction to the lock thread feed device.

8. In a machine of the character described, the combination of a work support, mechanisms for passing an upper thread loop through work on the support and for passing a lower thread loop through the upper thread loop below the work, a drive shaft, cams on said shaft for operating said mechanisms, a rotary lock thread feed device for passing a lock thread through the lower thread loop to lock the threads together, a knife for severing the lock thread, devices operated by said drive shaft for imparting intermittent rotary movements in only one direction to the lock thread feed device, and an awl for piercing and moving the work laterally operated from said drive shaft.

9. In a machine of the character described, the combination of a work support, an awl for piercing and moving the work laterally on the support, a needle above the support for passing an upper thread loop through the work, a pivoted element supporting said needle, a needle below the support for passing a lower thread loop through the loop of the upper thread, a device for passing a lock thread through the lower thread loop after the lower thread loop has been passed through the upper thread loop, a locking and tensioning device for the upper thread, a drive shaft supported at right angles to the axis of said element and to the line of movement of the second needle for operating said needle, means operated by the drive shaft for controlling said locking and tensioning device, and mechanism operated by the drive shaft for imparting intermittent movements to the lock thread feed device.

10. In a machine of the character described, the combination of a work support, mechanism for passing an upper thread loop through work on the support and for interlocking another thread therewith to form a stitch, a device for tensioning the upper thread, a rotary shaft for operating said mechanism, a reciprocating bar operated by said shaft for controlling said tensioning device, and means operated by said bar to draw the stitch into the work.

11. In a machine of the character described, the combination of a work support, mechanism for passing an upper thread loop through work on the support and for interlocking another thread therewith to form a stitch, a device for tensioning the upper thread, a rotary shaft for operating said mechanism, a reciprocating bar operated by said shaft for controlling said tensioning device, to lock the upper thread and to release the upper thread for movement under tension intermittently, and a lever device operated by said bar to draw the stitch into the work.

12. In a machine of the character described, the combination of a work support, a needle for passing an upper thread through work on the support, a rotary shaft, means for operating said needle from said shaft, a tensioning device for the upper thread, a bar operated by said shaft for controlling said tensioning device, and a lever operated by said bar between said tensioning device and said needle cooperating with said tensioning device to hold the thread under tension.

13. In a machine of the character described, the combination of a work support, a needle for passing an upper thread through work on the support, a rotary shaft, means for operating said needle from said shaft, a tensioning device for the upper thread, a bar operated by said shaft for controlling said tensioning device, a lever between said tensioning device and said needle cooperating with said tensioning device to hold the thread under tension, and means operated

by said bar for operating said lever to cooperate with said needle to draw the stitch into the work.

14. In a machine of the character described, the combination of a work support, a needle for passing an upper thread through the work on the support, a rotary shaft, means for operating said needle from said shaft, a tensioning device for the upper thread, an element operated by said shaft for controlling said tensioning device, a lever between said tensioning device and said needle cooperating with said tensioning device to hold the thread under tension, means operated by said element for operating said lever to cooperate with said needle to draw the stitch into the work, and a device settable to vary extent of movement of said lever to vary the depth to which the stitch will be drawn into the work.

15. In a machine of the character described, the combination of a work support, a needle for passing an upper thread loop through work on the support, mechanism for connecting other threads with the loop formed by said needle to form a stitch, a rotary shaft, a cam on said shaft, connections operated by said cam for operating said needle, a tensioning device for holding under tension the thread passing to said needle, a lever cooperating with said needle to draw the thread into the work, and an element operated by said shaft to effect cooperation between said tensioning device and said lever.

16. In a machine of the character described, the combination of a work support, a needle for passing an upper thread loop through work on the support, mechanism for connecting other threads with the loop formed by said needle to form a stitch, a rotary shaft, a cam on said shaft, connections operated by said cam for operating said needle, a tensioning device for holding under tension the thread passing to said needle, a swinging support, a lever pivoted on said support cooperating with said needle to draw the thread into the work, and connections operated by said shaft for moving said support and said lever in one direction during the movement of said needle through the work and for moving said support and said lever in the opposite direction during the movement of the needle from the work to draw the stitch into the work.

17. In a machine of the character described, the combination of a work support, a needle for passing an upper thread loop through work on the support, mechanism for connecting other threads with the loop formed by said needle to form a stitch, a rotary shaft, a cam on said shaft, connections operated by said cam for operating said needle, a tensioning device, for holding under tension the thread passing to said needle, a lever cooperating with said needle to draw the thread into the work, a reciprocating bar pivotally connected with said lever and operated by said shaft for moving said lever in one direction during the movement of said needle through the work and for moving said lever in the opposite direction during the movement of the needle from the work to draw the stitch into the work, and a device supported independently of said lever and settable to vary extent of movement of said lever to vary the depth to which the stitch will be drawn into the work.

18. In a machine of the character described, the combination of a work support, a needle for passing an upper thread loop through work on the support, mechanism for connecting other threads with the loop formed by said needle to form a stitch, a rotary shaft, a cam on said shaft, connections operated by said cam for operating said needle, a tensioning device for holding under tension the thread passing to said needle, a lever cooperating with said needle to draw the thread into the work, a reciprocating bar pivotally connected with said lever and operated by said shaft for moving said lever in one direction during the movement of said needle through the work and for moving said lever in the opposite direction during the movement of the needle from the work to draw the stitch into the work, a device settable to vary extent of movement of said lever to vary the depth to which the stitch will be drawn into the work, and an indicator for indicating the positions of said settable device.

19. In a machine of the character described, the combination of a needle for passing a thread through work, a tensioning device adapted to engage the thread passing to the needle, a rotary shaft, connections operated by said shaft for operating said needle, a device for intermittently locking the thread passing to the needle and releasing the thread for movement under tension, a reciprocating bar for operating both of said devices, and means operated by said shaft for reciprocating said bar.

20. In a machine of the character described, the combination of a needle for passing a thread through the work, a rotary shaft, a device for intermittently locking the thread passing to the needle and releasing the thread for movement under tension, a reciprocating bar for operating said device to release the thread for movement under tension, a pivoted support, a lever pivotally carried by said support for cooperation with said needle to draw the thread into the work, and a connection between said reciprocating bar and said lever and said support for oper-

ating said lever and said support to cause said lever to cooperate with the needle to draw the thread into the work.

21. In a machine of the character described, the combination of a needle for passing a thread through work, a rotary shaft, connections operated by said shaft for operating said needle to pass the thread into the work and to draw the stitch into the work, a combined tensioning and locking device controlling the movement of the thread to the needle, means operated by said shaft for controlling said device to lock the thread against movement and to hold the thread for movement under tension alternately, and means located between the tensioning device and the needle cooperating with the needle to draw the stitch into the work.

22. In a machine of the character described, the combination of a needle for passing a thread through work, a rotary shaft, connections operated by said shaft for operating said needle to pass the thread into the work and to draw the stitch into the work, a combined tensioning and locking device controlling the movement of the thread to the needle, means operated by said shaft for controlling said device to lock the thread against movement and to hold the thread for movement under tension alternately, means located between the tensioning device and the needle cooperating with the needle to draw the stitch into the work, and an element supported independently of said last-named means and settable to vary the depth to which the stitch will be drawn into the work by said needle and said means.

23. In a machine of the character described, the combination of a needle for passing a thread through work, a rotary shaft, connections operated by said shaft for operating said needle to pass the thread into the work and to draw the stitch into the work, a tensioning and locking device controlling the movement of the thread to the needle, means operated by said shaft for controlling said tensioning device to lock the thread against movement and to hold the thread for movement under tension alternately, means located between the tensioning device and the needle cooperating with the needle to draw the stitch into the work, an element settable to vary the depth to which the stitch will be drawn into the work by said needle and said means, and a work puncturing and moving device for puncturing and moving the work properly.

24. In a machine of the character described, the combination of a needle for passing a thread through work, a rotary shaft, connections operated by said shaft for operating said needle to pass the thread into the work and to draw the stitch into the work, a combined tensioning and locking device controlling the movement of the thread to the needle, means operated by said shaft for controlling said tensioning device to lock the thread against movement and to release the thread for movement under tension alternately, means located between the tensioning device and the needle cooperating with the needle to draw the stitch into the work, an element settable to vary the depth to which the stitch will be drawn into the work by said needle and said means, a work puncturing and moving device for puncturing and moving the work properly, and an element operating with said last-named device for cutting a channel in the work between the stitches.

25. In a machine of the character described, the combination of a needle for passing a thread through the work, a device for intermittently locking the thread passing to the needle and releasing the thread for movement under tension, a movable support, a lever pivotally carried by said support for cooperation with said needle to draw the thread into the work, a rotary shaft, mechanism for operating said needle from said shaft, and a reciprocating bar operated by said shaft for operating said device to release the thread for movement under tension and for operating said support and said lever to cause said lever to cooperate with the needle to draw the thread into the work.

26. In a machine of the character described, the combination of a needle for passing a thread through the work, a device for intermittently locking the thread passing to the needle and releasing the thread for movement under tension, a movable support, a lever pivotally carried by said support for cooperation with said needle to draw the thread into the work, a rotary shaft, mechanism for operating said needle from said shaft, a reciprocating bar operated by said shaft for operating said device to release the thread for movement under tension and for operating said support and said lever to cause said lever to cooperate with the needle to draw the thread into the work, and mechanism operated from said shaft for puncturing and moving the work relative to the needle.

27. In a machine of the character described, the combination of a needle for passing a thread through the work, a device for intermittently locking the thread passing to the needle and releasing the thread for movement under tension, a movable support, a lever pivotally carried by said support for cooperation with said needle to draw the thread into the work, a rotary shaft, mechanism for operating said needle from said shaft, a reciprocating bar operated by said shaft for operating said device to release the thread for movement under tension and for operating said sup-

port and said lever to cause said lever to cooperate with the needle to draw the thread into the work, mechanism operated from said shaft for puncturing and moving the work relative to the needle, and a device associated with said last-named mechanism for cutting a channel in the work to receive the thread between the stitches.

28. In a machine of the character described, the combination of stitchforming mechanism, an awl supported for pivotal movement to pierce the work and for lateral movement to move the work laterally, a device for cutting a channel in the work a drive shaft, connections operated by the drive shaft for imparting pivotal movement to the awl and said device, and other connections operated by the drive shaft for imparting lateral movements to the awl to move the work laterally.

29. In a machine of the character described, the combination of stitch forming mechanism, an awl supported for pivotal movement to pierce the work and for lateral movement to move the work laterally, a drive shaft, connections operated by the drive shaft for imparting pivotal movement to the awl, other connections operated by the drive shaft for imparting lateral movements to the awl to move the work laterally, and a device operating with the awl to cut a channel in the work for the thread.

30. In a machine of the character described, the combination of a support for the work, a needle carrier supported for rocking movements, mechanism for rocking the needle carrier, a needle mounted on said carrier for passing thread through the work, an awl carrier supported for rocking movements with the needle carrier and for lateral movements relative to the needle carrier, an awl carried by the awl carrier, a device carried by the awl carrier for cutting a channel in the work for the thread between the stitches, means carried by the needle carrier for imparting rocking movements to the awl carrier and for guiding the awl carrier in its lateral movements, and mechanism for moving the awl carrier laterally to cause the awl to move the work during the time that the awl is in the work.

31. In a machine of the character described, the combination of a needle carrier supported for rocking movements, a needle in connection with the needle carrier, an awl carrier, mechanism for imparting rocking movements to said needle carrier and to said awl carrier simultaneously, a device for cutting a channel in the work to receive a thread, and mechanism for imparting lateral movements to the awl carrier during the time that the awl is in the work to move the work laterally.

32. In a machine of the character described, the combination of a plate for supporting the work, a needle for passing a loop of thread downwardly through the work to the lower side of said plate, a needle below said plate for passing a loop of thread through the first-named loop below the plate, a rotary ring for passing a lock thread into the second-named loop of thread to lock said loops together to form a stitch outside of the work and below said plate, a ratchet device for rotating said ring, and mechanism for drawing the stitch so formed through the work plate into the work.

33. In a machine of the character described, the combination of a plate for supporting the work, a needle for passing a loop of thread downwardly through the work to the lower side of said plate, a needle below said plate for passing a loop of thread through the first-named loop below the plate, a rotary ring for passing a lock thread into the second-named loop of thread to lock said loops together to form a stitch outside of the work and below said plate, a ratchet device for rotating said ring, mechanism for drawing the stitch so formed through the work plate into the work, and means for varying the depth to which the stitch will be drawn into the work.

34. In a machine of the character described, the combination of a plate for supporting the work, a needle for passing a loop of thread downwardly through the work to the lower side of said plate, a needle below said plate for passing a loop of thread through the first-named loop below the plate, a rotary ring for passing a lock thread into the second-named loop of thread to lock said loops together to form a stitch outside of the work and below said plate, a ratchet device for rotating said rings, mechanism for drawing the stitch so formed through the work plate into the work, means for severing the locking portion of the last-named thread, and means for drawing the stitch so formed into the work after said thread has been severed.

35. In a machine of the character described, the combination of a plate for supporting the work, a needle for passing a loop of thread downwardly through the work to the lower side of said plate, a needle below said plate for passing a loop of thread through the first-named loop below the plate, a rotary ring for passing a lock thread into the second-named loop of thread to lock said loops together to form a stitch outside of the work and below said plate, a rotary device for rotating said ring mechanism for drawing the stitch so formed through the work plate into the work, means for severing the locking portion of the last-named thread, means for drawing the stitch so formed into the work after said thread has been severed,

and means for varying the depth to which the thread will be drawn into the work.

36. In a machine of the character described, the combination of a work supporting plate, mechanism for holding the work on the supporting plate and moving the work laterally on said plate, a device for cutting a channel in the work, mechanism for passing a thread loop downwardly through the work to the lower side of said plate and forming a lock stitch below the plate outside of the work, and mechanism for drawing the stitch through the plate into the work and the thread into the channel.

37. In a machine of the character described, the combination of a work supporting plate, mechanism for holding the work on the supporting plate and moving the work laterally on said plate, a device for cutting a channel in the work, mechanism for passing a thread loop downwardly through the work to the lower side of said plate and forming a lock stitch below the plate outside of the work, mechanism for drawing the stitch through the plate into the work and the thread into the channel, and means for varying the depth to which the stitch will be drawn into the work.

38. In a machine of the character described, the combination of a work supporting plate, mechanism for holding the work on the plate, mechanism for piercing the work and moving the work laterally on the plate, a device for cutting a channel in the work, mechanism for passing a thread loop downwardly through the work to the under side of the plate and forming a stitch below the plate outside of the work, mechanism for drawing the stitch into the work and the thread into the channel after the stitch has been formed below said plate, and means for varying the depth to which the stitch will be drawn into the work.

39. In a machine of the character described, the combination of a work supporting plate, a device for cutting a channel in the work, mechanism for passing a thread loop downwardly through the work to the lower side of the plate and for passing another thread loop through the first one below the plate, mechanism for passing a lock thread through the second thread loop below the plate to form a lock stitch, mechanism for drawing the loop stitch into the work and the thread into the channel, and means for severing the lock thread after it has been passed through said loop as aforesaid.

40. In a machine of the character described, the combination of a work supporting plate, a device for cutting a channel in the work, mechanism for passing a thread loop downwardly through the work to the lower side of the plate and for passing another thread loop through the first one below the plate, mechanism for passing a lock thread through the second thread loop below the plate to form a lock stitch, mechanism for drawing the loop stitch into the work and the thread into the channel, a knife for severing the lock thread, and means operating said knife to sever the lock thread during the time that the stitch is being drawn toward the work.

41. In a machine of the character described, the combination of a work supporting plate, mechanism for passing a loop of thread downwardly through the work on the plate to the under side of the plate and for looping another thread through said loop, mechanism for passing a lock thread through one of said loops to lock the loops together, a device for guiding the lock thread, mechanism for drawing the stitch so formed upwardly into the work and for moving said device to permit the lock thread to be raised toward said plate, a knife for severing the lock thread, and means for operating said device to return the lock thread to position for another operation.

42. In a machine of the character described, the combination of mechanisms for passing one loop of thread through another loop of thread, mechanism for passing a lock thread through one of said loops to lock the loops together, mechanism for drawing the interlocking loops and the lock thread toward the work, a knife for cutting the lock thread, and a device for returning the lock thread to position for another operation.

43. In a machine of the character described, the combination of mechanisms for passing one loop of thread through the work and passing another loop of thread through the one that has been passed through the work, mechanism for passing a lock thread through the second-named loop before the same has been materially closed by the first-named loop, to lock the two loops together; mechanism for drawing the interlocked loops and the lock thread toward the work, a device for cutting the lock thread, and a driving device for operating said mechanisms and said cutting device in a co-ordinated relationship to cut the lock thread during the movement of the interlocked loops and the lock thread toward the work.

44. In a machine of the character described, the combination of mechanisms for looping two threads together, a guide for guiding a lock thread to the loops, and a rotary actuator arranged for rotary movements in only one direction, and means for rotating said actuator successively in only one direction to move the lock thread in said guide.

45. In a machine of the character described, the combination of mechanisms for looping two threads together, a guide for guiding a lock thread to the loops, a rotary actuator arranged for rotary movements in

only one direction, and means for rotating said actuator successively in only one direction to move the lock thread in said guide, and mechanism for imparting intermittent movements to said actuator after said threads have been interlooped.

46. In a machine of the character described, the combination of mechanisms for passing one loop of thread through another loop of thread, a guide for a lock thread, a rotary actuator arranged for rotary movements in only one direction, and means for rotating said actuator successively in only one direction to move a lock thread through said guide and through one of said loops to lock the loops together, mechanism for imparting intermittent rotary motions to said actuator, and a knife operating to cut the lock thread after the lock thread has been passed through one of said loops.

47. In a machine of the character described, the combination of a work supporting plate, mechanism for passing a thread loop downwardly through the work to the lower side of the plate and for passing another thread loop through the first one below the plate, a lock thread guide, a rotary feed roll for passing a lock thread through said guide and through one of said loops to lock the loops together, mechanism for imparting intermittent rotary movements to said feed roll to pass the locking thread through one of said loops as aforesaid, and means for cutting the lock thread after it has been passed through one of said loops.

48. In a machine of the character described, the combination of a work supporting plate, mechanism for passing a thread loop downwardly through the work to the lower side of the plate and for passing another thread loop through the first one below the plate, a lock thread guide, a rotary feed roll for passing a lock thread through said guide and through one of said loops to lock the loops together, mechanism for imparting intermittent rotary movements to said feed roll to pass the locking thread through one of said loops as aforesaid, means for cutting the lock thread after it has been passed through one of said loops, and mechanism for drawing the stitch so formed into the work.

49. In a machine of the character described, the combination of a work supporting plate, mechanism for passing a thread loop downwardly through the work to the lower side of the plate and for passing another thread loop through the first one below the plate, a lock thread guide, a rotary feed roll for passing a lock thread through said guide and through one of said loops to lock the loops together, resilient means for supporting the feed roll in proper position, mechanism for imparting intermittent rotary movements to said feed roll to pass the locking thread through one of said loops as aforesaid, means for cutting the lock thread after it has been passed through one of said loops, mechanism for drawing the stitch so formed into the work, and means for varying the depth through which the stitch will be drawn into the work.

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