950,616.

A. EPPLER.

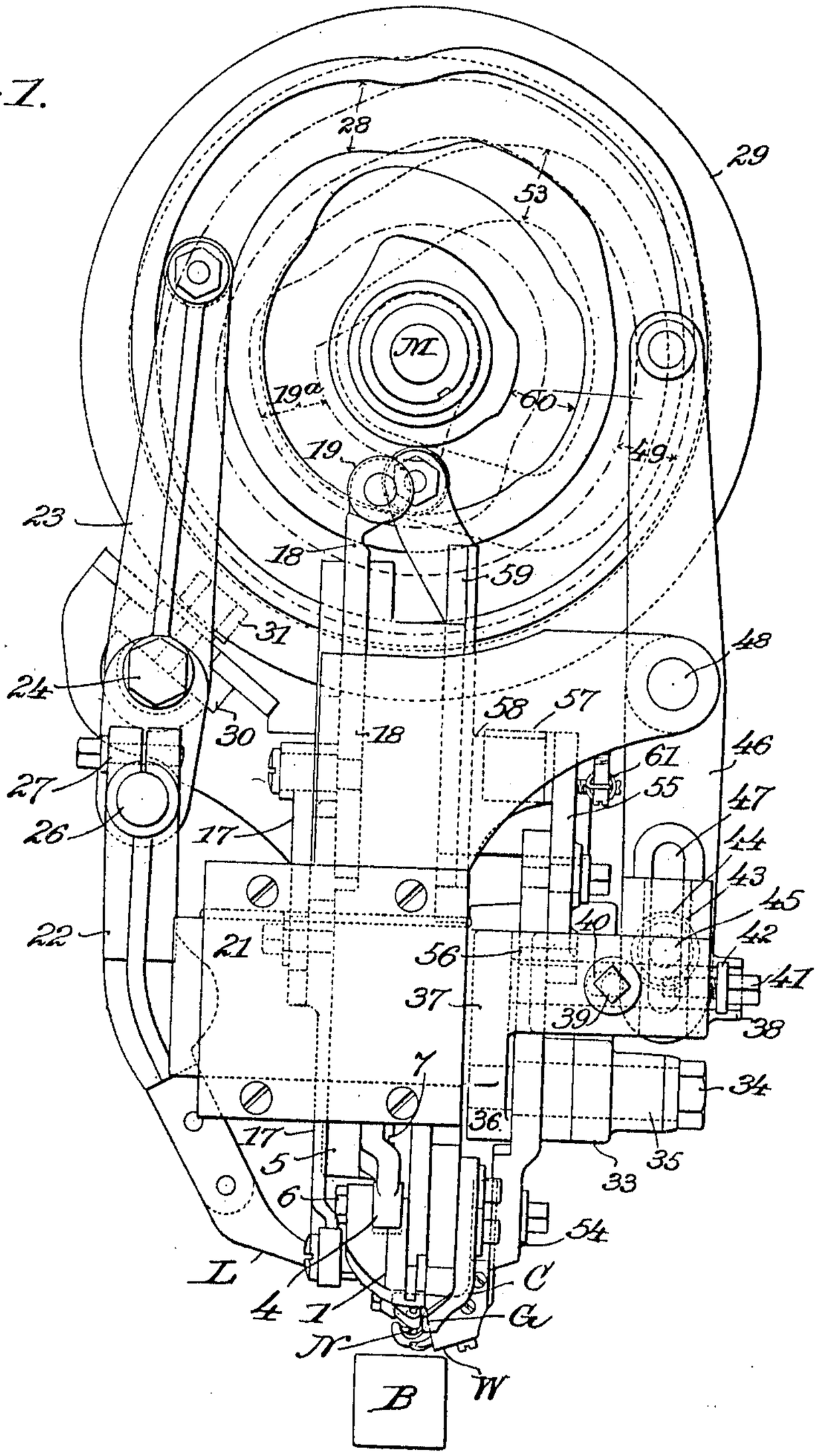
SHOE SEWING MACHINE.

APPLICATION FILED MAR. 16, 1903.

Patented Mar. 1, 1910.

7 SHEETS—SHEET 1.

Fig. 1.



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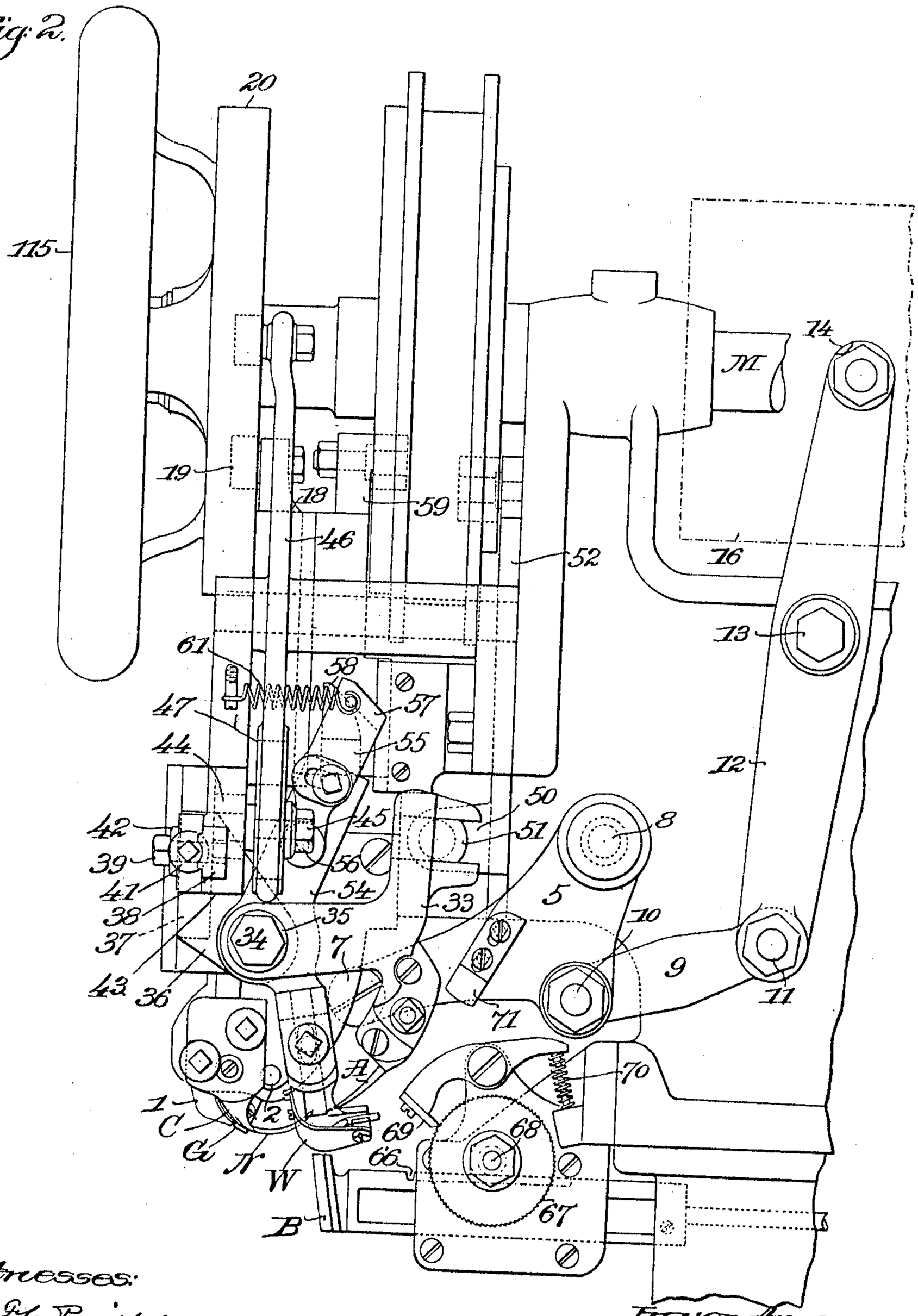
7 SHEETS—SHEET 2.

Fig. 2.



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7 SHEETS—SHEET 3.

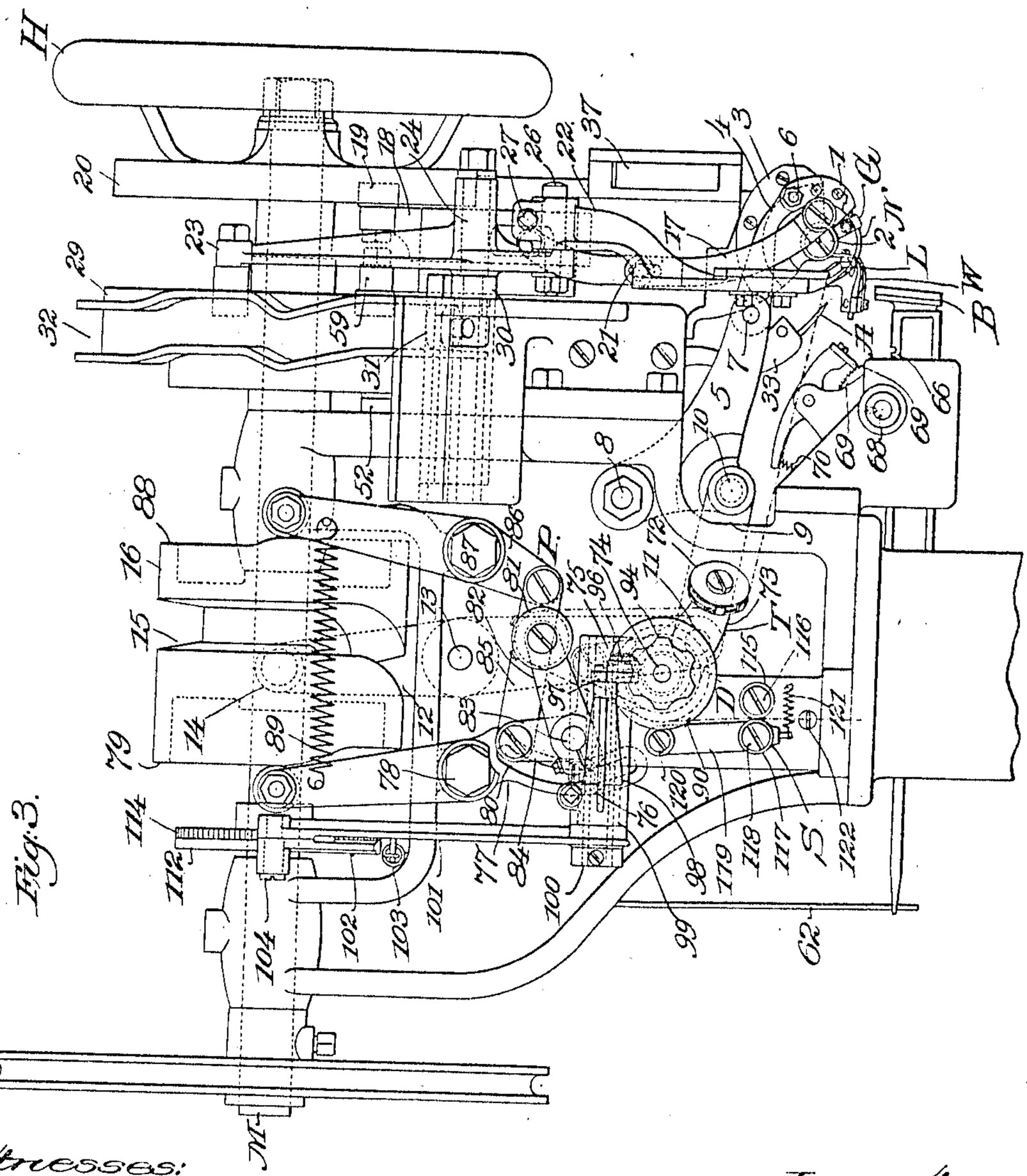

Fig. 3.

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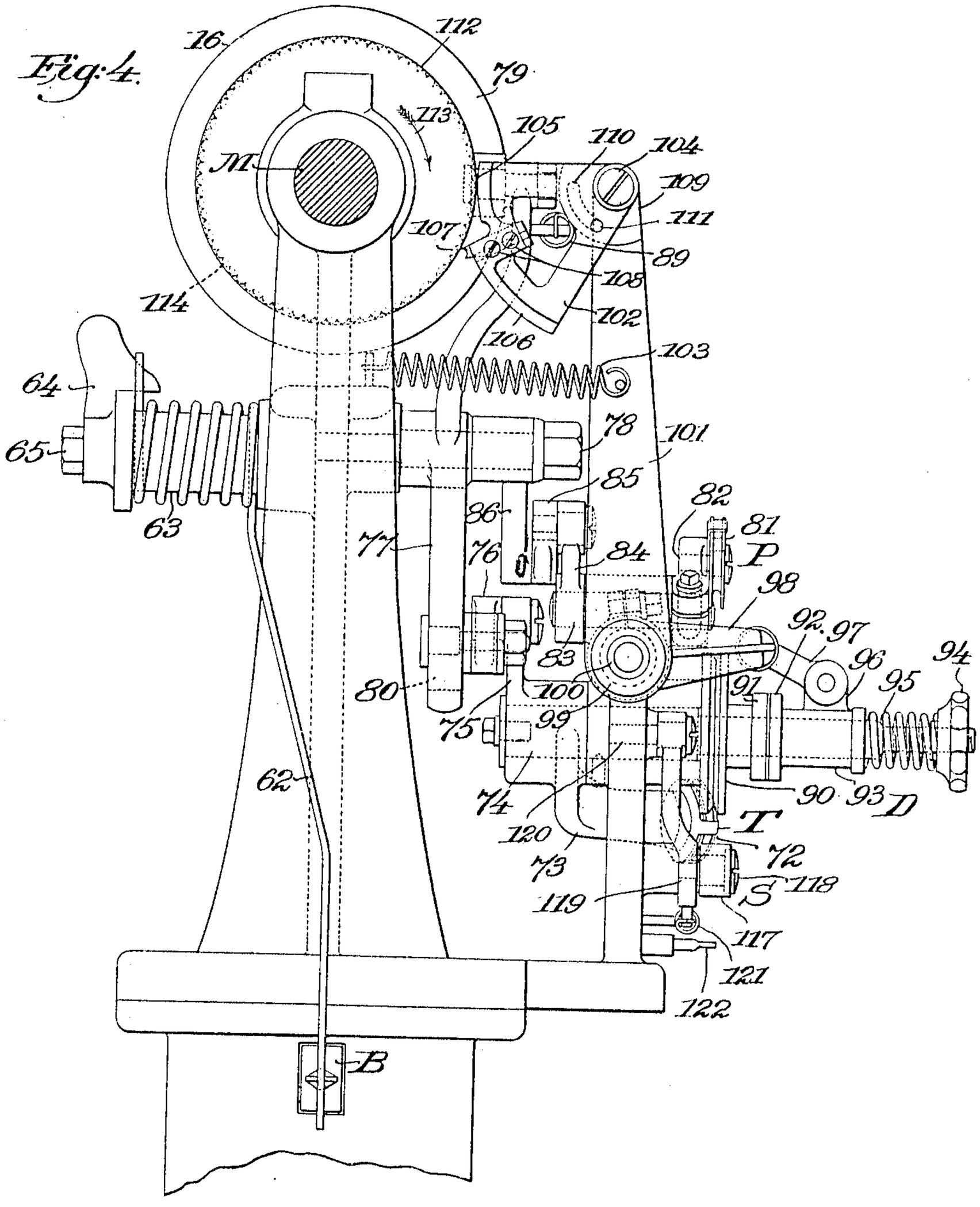
7 SHEETS—SHEET 4.

Fig. 4.



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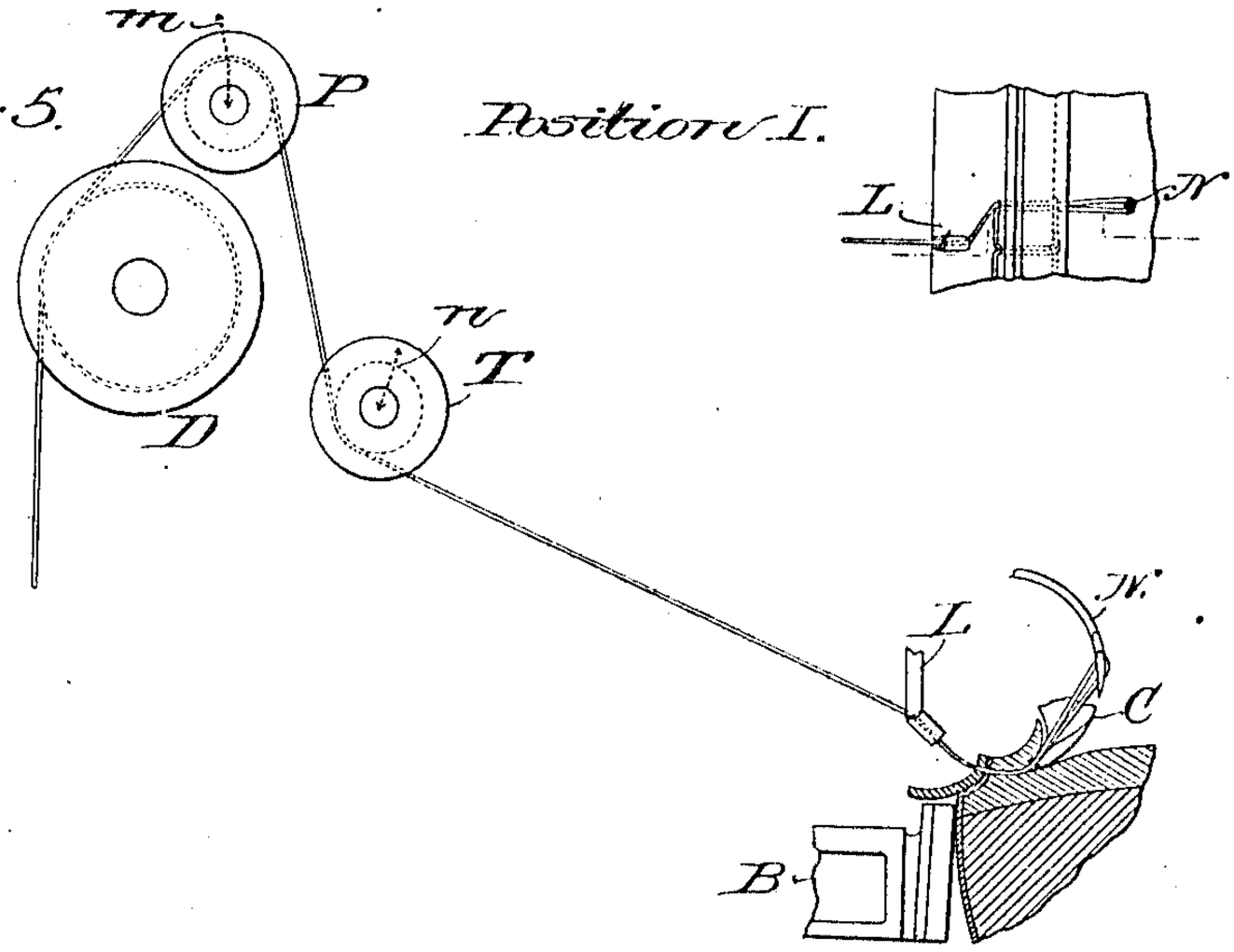
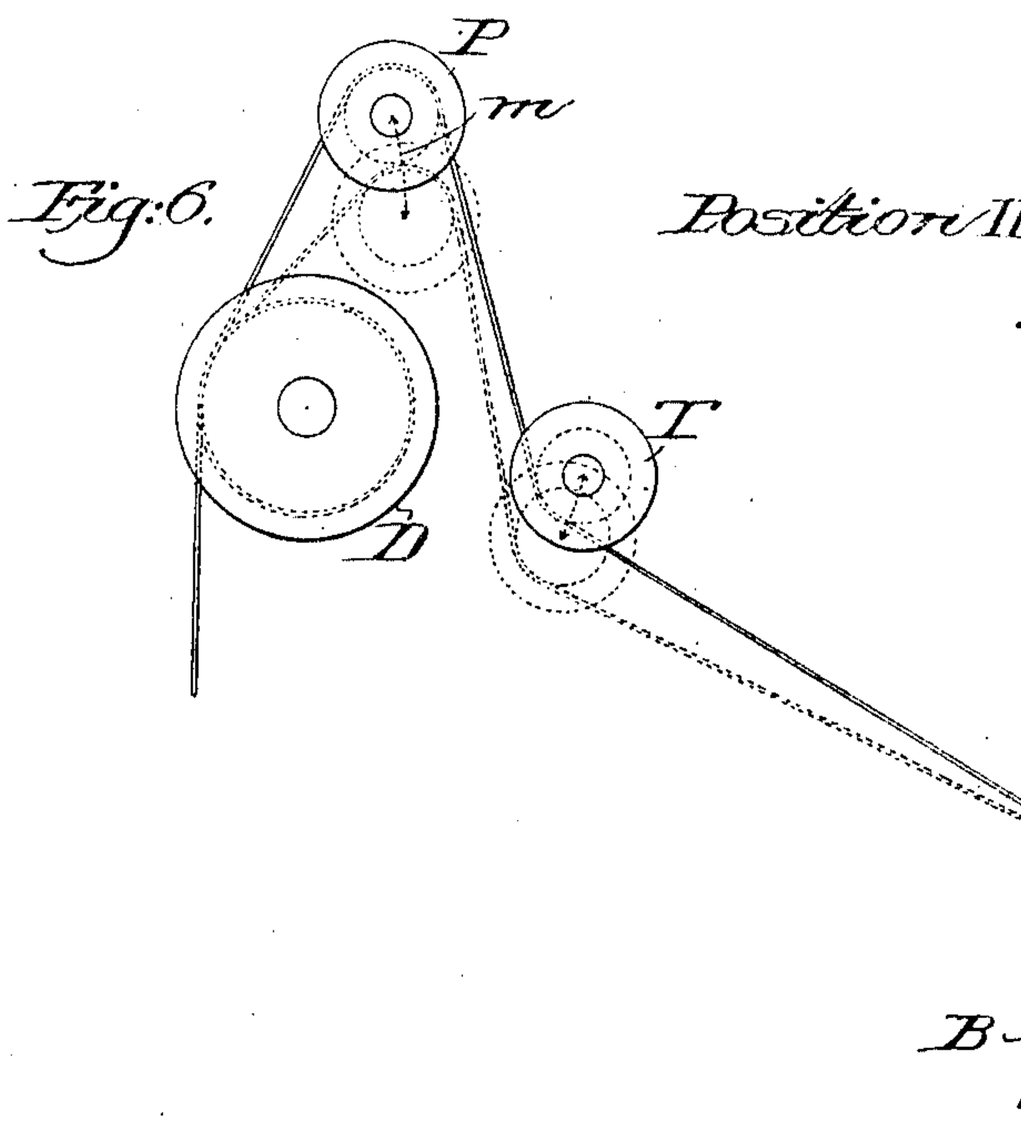
7 SHEETS—SHEET 5.

Fig: 5.

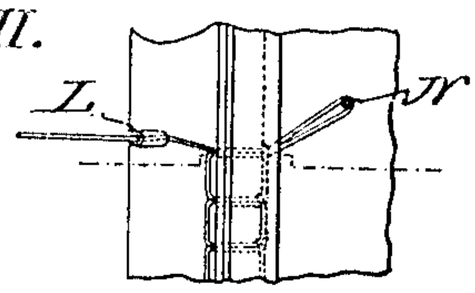


Position I.

Fig: 6.



Position II.



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7 SHEETS—SHEET 6.

Fig: 7.

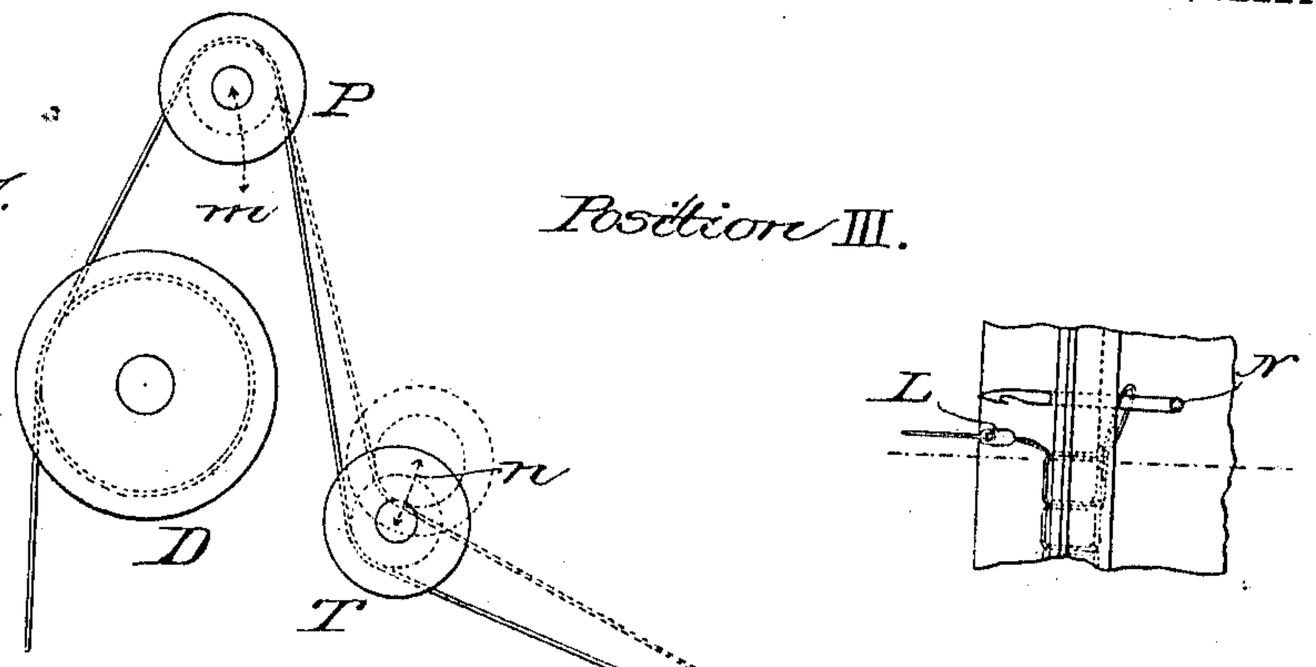
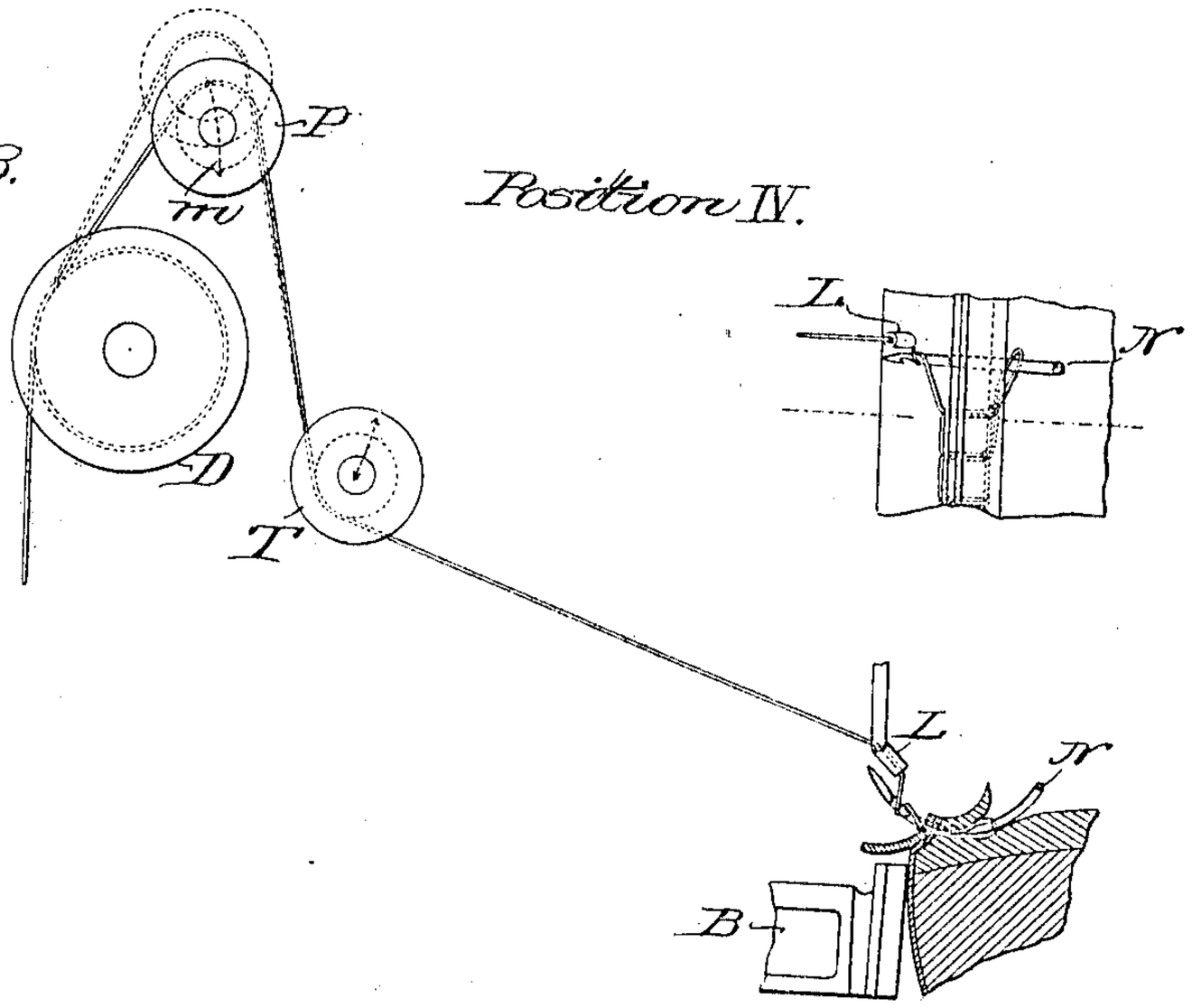


Fig: 8.



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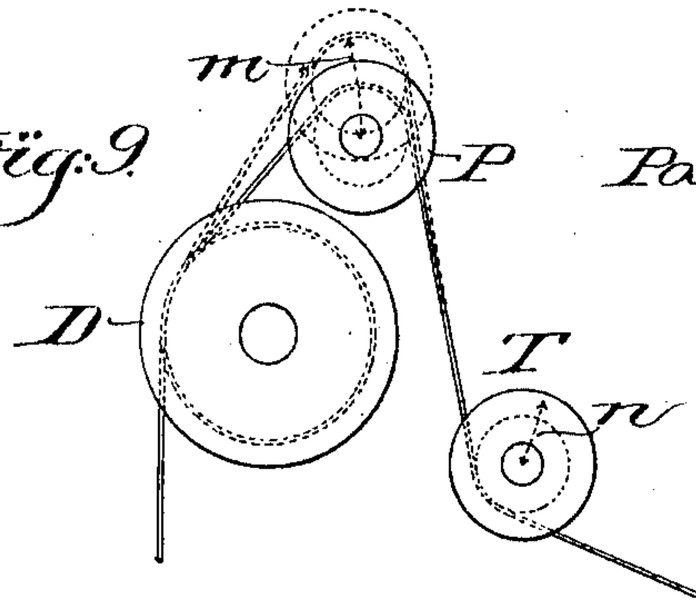
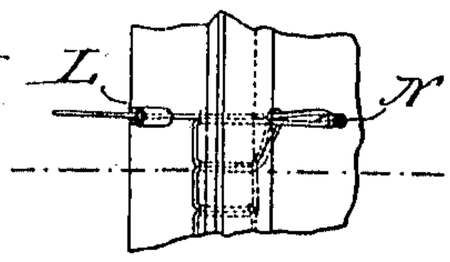
7 SHEETS—SHEET 7.

Fig. 9.



Position V.



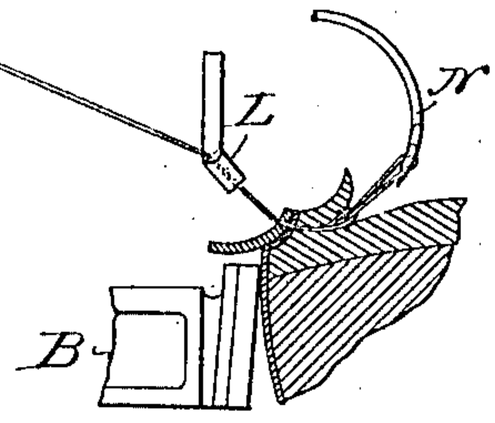
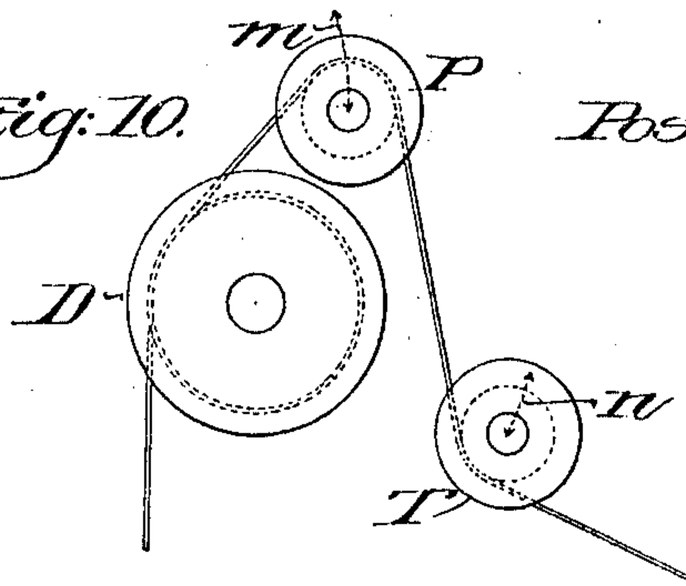
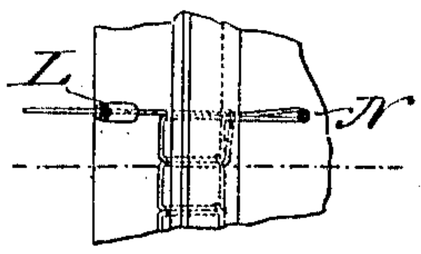
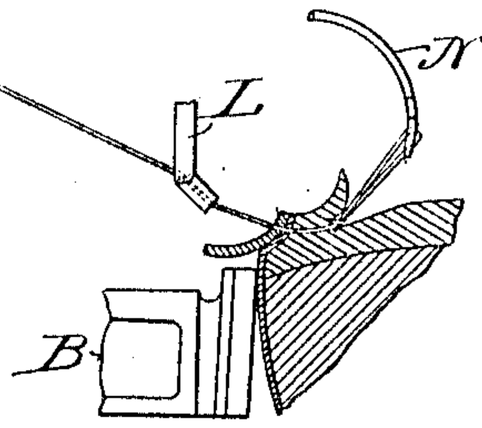


Fig. 10.



Position VI.





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UNITED STATES PATENT OFFICE.

ANDREW EPPLER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO UNITED SHOE MACHINERY COMPANY, OF PATERSON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

SHOE-SEWING MACHINE.

950,616. Specification of Letters Patent. Patented Mar. 1, 1910.

Application filed March 16, 1903. Serial No. 147,879.

To all whom it may concern:

Be it known that I, ANDREW EPPLER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Shoe-Sewing Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to an improvement in shoe sewing machines and more particularly to curved hook needle wax thread chain stitch sewing machines of which the commercial welt and turn machines are examples.

The object of the present invention is to reorganize and improve the sewing machines of the above class.

To the above end the present invention consists in the devices and combination of devices hereinafter described and particularly defined in the claims.

In the accompanying drawings illustrating the preferred form of this invention, Figure 1 is a front elevation with parts removed for the sake of clearness; Fig. 2 is a side elevation of the front portion of the machine looking from the right of the machine as seen in Fig. 1; Fig. 3 is a side elevation looking at the machine from the left as seen in Fig. 1; Fig. 4 is a rear elevation of the machine, parts being omitted for the sake of clearness; and Figs. 5, 6, 7, 8, 9 and 10 are diagrammatic illustrations of positions which the parts assume during the formation of each stitch more particularly referred to hereinafter in connection with the description of the operation of the machine.

The present invention is an improvement on the sewing machine illustrated in the patent granted to the father of the applicant March 10, 1891, No. 447,872, as improved in the manner illustrated in the patent granted to the said patentee November 29, 1891, No. 487,214, and more particularly as further improved and modified by the present applicant as illustrated in the patent granted November 2, 1892, No. 593,156. In the machine of said Patent No. 447,872, the stitch was tightened and set solely by the needle which entered the work from the channel side and emerged on the welt side of the inseam, laying the chain in the channel, and in the machine of the said Patent No. 487,214, the needle was assisted in the tightening and setting of the stitch by a take-up which operated during the forward movement of the needle to shorten the loop last drawn through the material. In the machine of the patent granted to the present applicant No. 593,156, the needle was caused to enter the work on the welt side and to emerge in the channel thereby laying the chain on the welt or upper side instead of in the channel, but otherwise the machine in its general construction and organization is similar to the machine of the said Patent No. 487,214. This machine of Patent No. 593,156 is also provided with a take-up operating, during the forward movement of the needle, to shorten the loop of thread drawn back by the needle.

In the present machine the needle, like the needle in said Patents Nos. 447,872 and 487,214, enters the material from the channel side and emerges through the upper or welt laying the chain in the channel, but in addition to the stitch forming instrumentalities of said patents there has been provided a pull-off as a separate instrumentality from the take-up which operates to pull off thread from the supply, thereby relieving the take-up of this duty and materially improving the work done by the machine.

In machine of Patent No. 593,156, as in the machine of said Patent No. 487,214, the take-up operated to shorten the loop of thread drawn back by the needle during the advancing movement of the needle and provision was made for adjusting the throw of the take-up to cause the latter to take up and give up more or less thread in order to vary the amount of thread taken up and given up according to the thickness of material being sewed. It has been found, however in actual practice with such machines that while increasing the throw of the take-up causes it to handle more thread, its operation as a pull-off only will be increased, as a consequence of which it is impossible to shorten the loop of thread drawn back by the needle any more with one adjustment of the take-up than with another. In other words, whenever the take-up action was increased the pull-off action was correspondingly increased and the amount of thread handled increased to the same extent so that the effect upon the loop of thread drawn

back by the needle was the same in both cases.

One of the objects of the present invention has been to provide a machine of this character with a pull-off which, while separate and distinct from the take-up, so that the adjustment of the amount of take-up will be inoperative to vary the stroke of the pull-off, will operate to vary the thread pulling capacity of the pull-off.

Another object has been to produce a machine in which the take-up, pull-off and needle operate in a new way upon the thread to form the stitch, whereby the loops of thread drawn back by the needle are shortened to the desired amount necessary to reduce the reeving of the thread in the hook of the needle to a smaller amount than has hitherto been found possible.

Other features of the invention will be pointed out in connection with the description of the machine illustrated in the accompanying drawings.

The needle N is mounted in the needle segment 1 pivoted on the stud 2 and sliding in the needle guide G. A link 4 connects the needle segment to the needle lever 5 being pivoted at one end to the needle segment at 6 and at the other end to the needle lever at 7. The needle lever 5 is pivoted to the frame of the machine at 8. The link 9 pivoted at 10 to the needle lever 5 intermediate its ends is pivoted at its opposite end at 11 to the needle cam lever 12 pivoted at 13 to the frame of the machine, carrying upon its upper end a stud bearing the cam roll 14 which engages the cam path 15 in the cam disk 16 mounted upon and secured to the main shaft M of the machine. The needle is arranged so that on its forward movement it enters the channel of the insole of a welted shoe or the sole of a turned shoe and emerges through the welt or upper as the case may be in the manner similar to that in which it operates in the said Patents Nos. 447,872 and 487,214, laying the chain in the channel.

The needle guide G is pivotally mounted upon the stud 2 provided with an aperture to receive, guide and support the needle. The needle guide is actuated by means of a link 17 which is pivotally connected to the guide and extends upwardly therefrom and is pivotally connected at its upper end to the needle guide slide 18 which carries upon its upper end a stud bearing the cam roll 19 which engages a cam path 19ª in the cam disk 20, said cam path being indicated in dash and dot lines in Fig. 1, said cam 20 not being shown in Fig. 1 for sake of clearness of illustration. The link 17 consists of two parts which are adjustably secured together by means of a bolt 21 which passes through a slot in the lower part of said link and screws into the upper part so that the length of the link may be varied and whereby the position of the needle guide is adjusted with relation to the needle segment. The needle guide is oscillated in timed co-relation to the needle so that during the first part of the forward movement of the needle it is advanced and affords a support for the needle, which advancing movement terminates after the needle guide has been brought in proximity to the work when the needle guide stands still during the remainder of the forward movement of the needle.

The looper L is secured to the lower end of the looper lever, being secured thereto by means of cap bolts. The looper lever consists of two parts, a lower part 22 and an upper part 23. The looper lever is pivotally mounted upon the stud 24 to oscillate in a plane normal to the plane of motion of the needle, the stud 24 entering a hole in a boss in the upper part 23 of the looper lever, and the lever being secured in place by means of the stud 24 which is screwed into the end of the slide 30 hereinafter referred to. The upper part 23 of the looper lever carries a pin 26 upon its lower end upon which the lower part 22 of the looper lever is secured by means of a clamp screw 27, the upper end of the lower part 22 of the looper lever being slotted so that by screwing up the bolt 27 the lower part 22 of the looper lever may be secured in the desired position upon the stud 26. The stud 26 is made longer than the boss of the lower part 22 of the looper lever which embraces it so that the said lower part may be adjusted forward and back in a line parallel to the plane of movement of the needle as well as across such plane, whereby the position of the path of movement of the looper may be varied. The upper end of the upper part 23 of the looper lever is provided with a stud carrying a cam roll which engages a cam path 28 in the cam disk 29 mounted upon the main shaft M of the machine. By this means oscillations across the plane of motion of the needle are imparted to the looper L. The stud 24 above referred to is screwed into the looper slide 30 mounted in guides so that it may move forward and back in a direction parallel to the plane of movement of the needle. The looper slide is provided with a stud carrying a cam roll 31 which engages a cam path 32 in the cam disk 29 above referred to. By this means motions are imparted to the looper in a direction parallel to the plane of movement of the needle. The above described arrangement is such that the looper is caused to move over the needle after the same has been thrust through the materials rearwardly around, and over the needle again to lay a loop of thread in the hook of the needle. It will be observed that the looping movements are the resultant of the motions imparted to it by the cam paths 28 and 32. The shape of

the path of motion of the looper is accurately determined by these cams but the position of the path movement of the looper may be changed by adjusting the lower part 22 of the looper lever upon the stud 26, thus by swinging the part 22 to the left, as seen in Fig. 1, the path of motion of the looper will be moved to the left and by swinging it to the right the path of motion of the looper will be correspondingly moved to the right. By moving the lower part 22 toward the front of the machine the path of motion of the looper will be moved forward, and vice-versa by moving it back the position of the path of motion of the looper will be moved backward.

The channel guide C is fixedly and adjustably secured by gib and groove connection and cap bolts passing through elongated holes in the shank of the channel guide, to a stationary part of the frame of the machine with its work engaging end located alongside of the path of motion of the needle.

The awl or feed point A is adapted to penetrate the work from the side opposite the needle, that is to say, to enter the work in the machine operating in the manner in which this machine does on the upper or welt side and to make a puncturing movement through the materials, which hole subsequently guides the needle through the material. The awl A is mounted in the lower end of the awl lever 33 pivoted at 34 upon a stud 35 mounted in the ear 36 projected rearwardly and downwardly from the feed slide 37. The feed slide is mounted in bearings on the front part of the frame of the machine so that the said slide may move transversely to the plane of motion of the needle. The feed slide carries upon its rear side a block 38 which is adapted to be secured to the slide by a cap screw 39 which passes through the slotted hole 40 in the feed slide and screws into said block 38. An adjusting screw 41 provided with a collar 42 which engages a groove cut in the block 38 is provided for adjusting the block 38 to the right or left as may be desired, said screw 41 screwing into a threaded aperture in the end of the feed slide. By loosening the cap bolt 39 the block 38 may be adjusted to the desired position and then fixed there by means of the cap screw 39. The block 38 is provided with a grooved portion 43 upon its rear side, the groove being vertical and adapted to receive a block 44 carried by the stud 45, which stud is adjustably secured to the lever 46 passing through a slot 47 in said lever. The lever 46 is pivoted at 48 upon the frame of the machine and is provided upon its upper end with a stud which carries a cam roll which engages a cam path 49 in the rear face of the cam disk 20 mounted upon the main shaft of the machine in front of the cam disk 29, the said cam path being shown in dash and dot lines in Fig. 1. By adjusting the stud 45 in the slide 47 the length of the feed may be varied. By this means the feed motions of the awl to feed the work and to return the awl to its original position are accomplished. The awl lever 33 is bifurcated at its rear end being provided with a slot 50 which receives a block 51 mounted upon the lower end of the slide 52 carried in guideways in the frame of the machine. The upper end of the slide 52 is provided with a stud which carries a cam roll which engages a cam path 53 in the rear face of the cam disk 29, said cam path being shown in dotted lines in Fig. 1. The cam path 53 reciprocates the slide 52 vertically and imparts oscillating movements to the awl by means of the awl lever 33.

The above described arrangement is such that after the needle has retreated drawing a loop of thread through the materials the awl advances and engages the material opposite the right-hand edge of the channel guide as viewed in Fig. 1, puncturing the materials slightly beyond the edge of the channel guide, thereafter the awl retreats slightly, before it moves laterally to feed the materials so as to clear the channel guide and to release the material, then the awl moves laterally feeding the materials to the left as viewed in Fig. 1 until the awl comes opposite the needle when it again advances in order to hold the materials firmly against the channel guide and in position for the needle to make its advancing stroke. The awl thereby presents the materials very accurately to the needle and retreats slightly in advance of the forward motion of the needle so that as the awl retreats through the materials the needle follows it therethrough.

The welt guide W is adjustably secured to the lower end of the welt guide lever 54, being provided with a gib and groove connection between the welt guide and the lower end of the welt guide lever 54, a cap bolt and elongated hole being provided for securing the welt guide in adjusted position. The welt guide lever 54 is pivotally mounted at 34 upon the hub of the awl lever 33 and its upper end is provided with an adjustable portion 55 which is pivoted at 56 to the said lever and slotted to receive a cap bolt which screws into the extreme upper end of said welt guide lever 54. The part 55 is provided upon its upper end with a lug or projection 57 which is adapted to be engaged by a cam lug 58 upon the vertical slide 59 mounted in suitable guideways in the frame of the machine and carrying upon its upper end a stud bearing a cam roll which engages a cam path 60 in the cam disk 29. A spring 61 is provided which is secured at one end to

the part 55 of the welt guide lever above referred to, and at the other end to a pin on the frame of the machine, said spring normally acting to move the welt guide to its rear position, that is to say, the spring normally tends to pull the welt guide away from the shoe while the cam in timed coöperation with the other parts acts to force the welt guide positively against the shoe to present the welt thereto. The movements of the welt guide are so timed that it moves forward, presents the welt to the upper, retreats slightly during the feed and again advances to hold the work against the channel guide during the time the needle is penetrating the materials; the adjustable connection between the part 55 and the welt guide lever 54 affording means for adjusting the welt guide to adapt it to varying thicknesses of materials being sewed.

The back rest B is mounted in horizontal guideways in a bracket at the front part of the frame of the machine and is projected forward to engage the shoe by means of the spring 62 which encircles the stud 63 mounted on the rear part of the machine and which normally presses upon the back rest with the tendency to force it forward. A spring abutment 64 is secured to the end of the stud 63 by means of a bolt 65 and by turning the abutment 64 and fixing it in the desired position the force exerted by the spring may be varied to the desired amount. The back rest B is provided upon its upper edge with a rack 66 which is engaged by a pinion (not shown) secured to the ratchet wheel 67; said pinion and ratchet wheel being loosely mounted upon the stud 68. A pawl 69 is pivotally mounted upon said bracket of the machine so that its operative end may engage the teeth of the ratchet wheel 67, a spring 70 being employed normally to press the pawl into engagement with the teeth of the ratchet wheel. A pawl tripper 71 mounted upon the right-hand side of the needle lever 5 is provided, which when the needle is retracted engages the tail of the pawl 69 and releases it from engagement with the ratchet wheel 67 so that at this time, that is, during the feed of the materials, the back rest is released. The pawl tripper 71 is provided with two slots and screws passing through these slots hold the pawl tripper in adjusted position. This adjustment provides for the engagement of the pawl tripper with the tail of the pawl early or later, as may be desired.

The take-up, indicated in a general way by the reference character T, is mounted on the left side of the machine and coöperates in timed relation with the needle to take up some of the loop of thread pulled back by the needle through the materials. The take-up truck 72 is rotatably mounted on the take-up lever 73 pivotally mounted upon the stud 74, being provided with an upwardly extended arm 75 to which is pivotally connected the link 76, the opposite end of which link is secured to the take-up cam lever 77 pivoted at 78 on the frame of the machine and carrying upon its upper end a stud bearing the cam roll which engages the cam surface 79 on the cam disk 16. The lower end of the lever 77 is slotted at 80 and the link 76 is adjustably secured to the lever 77 by means of a bolt which passes through the said slot. By moving this bolt upward in the slot the amplitude of oscillation of the take-up truck 72 is varied and as a consequence the take-up action is increased or diminished as desired, the oscillation being decreased by moving the bolt upward in the slot 80 and increasing by moving it downward in the said slot.

The pull-off, indicated in a general way by the reference character P, consists of a pull-off truck 81 rotatably mounted upon the extremity of the pull-off arm 82 which is secured to one end of the short shaft 83 mounted in bearings in the frame of the machine and carrying upon its opposite end the arm 84 which is connected by means of a link 85 with the lower end of the pull-off cam lever 86 pivoted at 87 to the frame of the machine and carrying upon its upper end a stud bearing the cam roll which engages the cam surface 88 on the cam disk 16. The take up cam lever 77 and the pull-off cam lever 86 are held against their cam surfaces by means of the spring 89 which connects these two levers and tends to hold them in engagement with the cam surfaces which actuate them.

The tension device indicated in a general way by the reference character D is described as follows:—The stud 74 above referred to in connection with the make-up is extended in both directions through a plate which forms a part of the frame of the machine and upon one end carries the take-up lever while upon its opposite end it carries the thread truck 90 rotatably mounted upon the said stud 74, being provided upon its rear side with a friction pad which bears against a fixed stationary surface and being provided on its front part with a collar 91 which is engaged by a collar 92 upon a sliding sleeve 93 also mounted on said stud 74. A friction washer is preferably interposed between the two surfaces 91 and 92. The end of the stud 74 is reduced in size and is screw-threaded to receive the adjusting nut 94 which is screwed thereon. Between the adjusting nut 94 and the sliding sleeve 93 is interposed a spring 95 and by adjusting the pressure of the nut 94 upon the spring the tension may be varied.

The tension releasing device consists of the following mechanism:—The sleeve 93 above referred to is provided with an ear 96 to which is pivotally attached the link 97 in

turn pivotally connected at its opposite end to the arm 98 which is secured to the hub 99 mounted upon the hollow stud 100 secured to the frame of the machine. The hub 99 carries the upwardly extended arm 101 which is secured to said hub and which carries upon its upper end a segment 102 which is loosely pivoted to said arm 101. By moving the arm 101 to the right as viewed in Fig. 4, the arm 98 is turned downwardly and the sleeve 93 is caused to be moved to the right, thereby compressing the spring 95 and relieving the thread truck 90 of its pressure thereby removing the tension. A spring 103 fastened at one end to the said arm 101 and at the other end to a pin on the frame of the machine tends to hold the arm 101 in the position illustrated in Fig. 4. The segment 102 is provided with two cylindrical surfaces, the centers of curvature of which are the center of the axis of the stud 104 by which the segment 102 is attached to the arm 101. The cylindrical surface 105 is of shorter radius of curvature than that of the cylindrical surface 106 and these two surfaces are separated from each other a short distance, a tooth 107 being interposed therebetween but located in a plane along side of the plane of the surfaces 105 and 106, said tooth being adjustably secured to the segment 102 by the screws 109 and the gib and groove connection. The arm 101 is provided with a segmental plate 108 having the circular slot 110 therein which is engaged by the pin 111 secured to the segment 102. With the parts in the position shown in Fig. 4 the short radius cylindrical surface 105 engages the surface of disk 112 mounted upon and secured to the main shaft M of the machine, which main shaft during the operation of the machine rotates in the direction of the arrow 113. The surface of the disk 112 therefore normally tends, during the operation of the machine, to hold the segment 102 in the position shown. Alongside of the disk 112 there is mounted a toothed disk 114 which is provided with teeth which are adapted to be engaged by the tooth 107 above referred to.

After the completion of the sewing of a shoe the operator grasps the hand wheel H and turns it in the opposite direction to its normal direction of rotation so that the main shaft M is rotated backward. The slight friction between the surface 105 and the surface of the disk 112 causes the segment 102 to be rotated so as to bring the tooth 107 into engagement with one of the teeth of the toothed disk 114. The engagement of the tooth with the disk during the continued backward rotation of the main shaft causes the segment 102 to be still further rotated upwardly as viewed in Fig. 4 and this motion continues until said tooth 107 passes out of engagement with the teeth of the toothed disk 114 when the surface 106 rolls into contact with the surface of the disk 112 and continued backward rotation of the main shaft retains the parts in the position which they have assumed. By this means after the completion of the sewing of a shoe and the rotation of the main shaft backward the tension is relieved from the thread and the shoe may be taken out without compelling the operator to pull upon a shoe with sufficient force to draw the thread from the supply against the full tension strain. This tension releasing device affords means acting at any position in which the main shaft may come to rest to throw off the tension immediately upon the backward rotation of the main shaft. The pin 111 by engagement with the upper end of the slot 110 limits the upward motion of the segment 102 so that thereafter further backward rotation of the main shaft is inoperative to produce any further operation of the parts, the surface of the disk 112 sliding under the surface 106 of the segment 102. Upon the beginning of forward rotation the operations thus described are reversed the friction between the surface 106 and the surface of the disk 112 rotating the segment 102 downwardly brings the tooth 107 into engagement with one of the teeth of the toothed disk 114, which then turns the segment 102 still farther down until the surface 105 comes in contact with the surface of the disk 112, thereby restoring tension to the thread.

A wax stripper S is provided which consists of a roll 115 loosely mounted on the stud 116 on the frame of the machine adjacent to the tension device which coöperates with a roll 117 loosely mounted on the stud 118 secured to the lower end of link 119 pivoted at its upper end to stud 120, said link 119 having a spring 121 acting thereon, which being connected at one end to the lower end of said link 119 and at the other end to the stationary part of the machine operates to press the rolls 115 and 117 toward each other. A thread eye 122 guides the thread to the rolls, the thread passing through the thread eye 122 thence between the rolls 115 and 117 which press the thread as the thread is drawn between them and squeeze out surplus wax from the thread which wax passes to the ends of the rolls and drops back into the wax pot below. The stripper S is quite satisfactory in use as it removes such surplus wax as would be more than the necessities of use demanded and at the same time does not deprive the thread of the wax to an undesirable extent.

The lead of the thread is indicated in dot and dash lines in Fig. 3, the thread extending up through the thread eye 122, thence between the rolls 115 and 117 of the stripper S, thence over the thread truck 90 of the tension device D completely around the same,

thence up over the pull-off truck 81 of the pull-off P, thence down underneath the take-up truck 72 of the take-up T, thence to the eye of the looper L.

The needle, needle guide, looper, welt guide, awl, back rest, tension device, and tension releasing device, together with their construction, organization, and mode of operation, have been described in order that the complete machine in which the invention is preferably embodied may be described and illustrated, but the construction, organization, and mode of operation of these parts is not essential to the carrying out of the present invention except as hereinafter pointed out. The tension releasing device, however, forms the subject matter of another application filed by the present applicant of even date herewith, Serial No. 147,880.

Before proceeding to a description of the operation of the machine by reference to Figs. 5, 6, 7, 8, 9 and 10, it is convenient to point out that the dotted line *m* indicates in these figures the path of motion of the center of the pull-off truck. This path of motion shows the relative position of the pull-off truck with relation to the extremities of its path of motion in the several positions in which the parts are shown. Similarly the dotted line *n* indicates in these figures the path of motion of the center of the take-up truck. Figs. 5, 6, 7, 8, 9 and 10 illustrate the parts referred to in the different positions which they assume during the formation of each stitch and are for convenience marked respectively, positions I, II, III, IV, V and VI, each figure including a plan of the work showing the position of the needle and looper with relation thereto.

Beginning with the parts in the position indicated in position I, with the needle at the extremity of its retracting stroke holding the loop of thread which it has just drawn through the materials in the barb thereof, with the pull-off truck and take-up truck in their lowermost positions, the feed movement takes place, and then the take-up truck and pull-off truck both rise moving from the positions illustrated in dotted lines in position II to the position shown in full lines in position II. The rising of the take-up truck at this time shortens the lead of the thread but it does not shorten the lead of the thread as much as the rising of the pull-off truck lengthens it, as a consequence of which the pull-off truck pulls off thread from the tension while the needle is standing still in its retracted position holding the loop in its barb or hook which it has just drawn through the materials under tension. The needle now advances through the materials and moves to the position illustrated in position III, the take-up truck falling from a position illustrated in dotted lines in position III to the position illustrated in full lines in said figure, thereby shortening the loop of thread extending around the shank of the needle as the needle advances and drawing it up, but not tightly, around the shank of the needle. This is the take-up action of the take-up truck. The pull-off truck at this time stands still. The looper now travels around the needle and lays the thread in the barb or hook thereof, the pull-off moving downward during this looping action of the looper and giving up thread freely to the looper so that the motion of the looper does not tend to further shorten the loop of thread standing around the shank of the needle. The needle barb at this time stands somewhat above the materials so that the length of the thread extending from the last needle hole to the needle hook is greater than the distance from needle hole to needle hole. This is for the purpose of assisting the needle during its retracting stroke by avoidance of pulling up too tightly the loop of thread standing around the shank of the needle. During the time the looper is performing its looping movement the pull-off truck, as has been stated, falls and by reference to position IV it will be observed that it has fallen through only about one-half of its total path of motion, the position of the pull-off truck being located at the completion of the looping movement at about the middle of the path. The needle now begins its retracting movement and during the first part thereof the pull-off falls from the position illustrated in dotted lines in position V to the bottom of its path of motion. The needle does not therefore during the first part of its retracting motion exert any substantial strain upon the thread, the thread being supplied to the needle freely the thread does not slide down the needle as it retracts but buckles. During the time the needle hook is passing through the materials the pull-off is giving thread to it upon one side and it is taking thread on the other side from the thread extending from the needle to the preceding needle hole or from the loop standing around the shank of the needle, or from both, so that after the needle has emerged from the materials and moved rearwardly to the position substantially that illustrated in position V there is no reeving of the thread in the hook of the needle. During the time the needle is moving from the position indicated in position V to the position indicated in position VI the needle completely shortens the loop standing around the thread drawn through by the needle, if not already completely shortened, and the stitch of which said loop forms a part is set, that is, drawn into the position which it occupies in the finished seam.

In order to compensate for the slight variations in the thickness of the stock being sewed, the amount of thread pulled off by the pull-off must be made slightly less than the amount consumed in the formation of each stitch, and therefore just before the retracting stroke of the needle is completed the needle must pull off a slight compensatory amount of thread from the thread supply under the full tension strain. This pull-off function of the needle is slight and by the present construction reduced to as small amount as is possible consistent with the variations in the thickness of the materials which are met with in practice.

It is to be noted that the channel guide being stationary and the needle always retracting to the same distance from the channel guide the loop of thread drawn back by the needle measured from the edge of the channel guide is always the same, but that with an increase of thickness of materials the amount of loop taken by the take-up must be decreased and that because the amount of thread consumed in each stitch is increased with the thickness of the stock, the amount of thread supplied for each stitch must be increased. Now the stroke of the pull-off truck is constant but its capacity to pull off thread is determined by the stroke of the take-up, when the stroke of the take-up is increased the pull-off capacity of the pull-off is decreased. This is precisely what is required. When the stock is thicker the amount of take-up must be less because the loop extending to the needle as measured from the channel guide must be shortened to a less extent in order properly to extend to the next needle hole than when the stock is thinner, and that the amount of thread consumed in the formation of a stitch around thicker stock is greater consequently the amount of thread pulled off must be increased. The construction produced by the applicant and embodied in the present invention provides for adjustment of the stroke of the take-up which acts directly to increase or diminish the amount of thread taken up by it and acts indirectly to decrease or increase the amount of thread pulled off by the pull-off although the latter is not adjusted at all. The invention therefore contemplates a pull off operating to make its pulling off stroke while the needle holds a loop of thread in its hook and a take-up operating to take-up thread from the loop of thread just previously drawn back by the needle while the needle is advancing, and also a coöperating pull-off and take-up mechanism having provision for increasing or diminishing the stroke of the take-up operating thereby to decrease and increase the effective thread pulling capacity of the pull off.

The present invention is not limited to the embodiment thereof illustrated in the accompanying drawings and described herein but may be embodied in other forms of chain stitch sewing machines without departure therefrom and while for reasons apparent to those skilled in the art it is considered that the invention is of greater utility in a machine not provided with a thread finger still the invention is not limited to such a machine as it may be embodied in a machine provided with a thread finger. Nor is the invention limited to the embodiment in a machine in which the stitch is tightened and set by the needle or an instrumentality operating on the thread on the needle side of the work as it is considered that it may be embodied in a machine in which the stitch is set by a take-up operating on the thread on the opposite side of the work from the needle.

Having thus described the invention what is claimed is:

1. A chain-stitch sewing machine, having, in combination, a needle, a looper, a constant throw pull-off, an adjustable throw take-up, the adjustment of the throw of the take-up operating to vary the amount of pull-off inversely with the variation of the amount of take-up, and mechanism for actuating the parts, substantially as described.

2. A chain-stitch sewing machine, having, in combination, a needle, a looper, a pull-off, a take-up, means for actuating the pull-off to draw thread from the supply while the needle holds a loop of thread in its hook, and means for actuating the take-up to shorten the loop of thread pulled back by the needle, substantially as described.

3. A chain-stitch sewing machine, having, in combination, a needle, a looper, a pull-off, a take-up of less throw than the pull-off, means for actuating the pull-off to make its thread-pulling stroke while the needle is retracted holding a loop of thread in its hook, and means for actuating the take-up to shorten the lead of the thread during the pulling off movement of the pull-off, substantially as described.

4. A chain-stitch sewing machine, having, in combination, a needle, a looper, a pull-off, a take-up, means for actuating the pull-off to draw thread from the supply while the needle holds a loop of thread in its hook, and means for actuating the take-up to shorten the lead of the thread during the pull-off movement of the pull-off and to shorten the loop of thread pulled back by the needle, substantially as described.

5. A chain-stitch sewing machine, having, in combination, a needle, a looper, a pull-off, a take-up of less throw than the pull-off, and means for actuating the take-up and pull-off to move simultaneously to pull off

thread from the supply, the amount pulled off being the difference between the thread pulling capacity of the pull-off and the thread taking capacity of the take-up, substantially as described.

6. A chain-stitch sewing machine, having, in combination, a needle, a looper, a constant throw pull-off, a take-up having provision for adjustment of its throw, and actuating mechanism for the pull-off and take-up to cause the pull-off and take-up to coöperate to pull off thread from the supply while the needle is retracted and to take up thread from the loop drawn back by the needle while the needle is advancing, the adjustment of the throw of the take-up operating to vary the amount of the pull off inversely with variation of the amount of the take up, substantially as described.

7. A chain-stitch sewing machine, having, in combination, a needle, a looper, a pull-off, and a take-up, the pull-off and take-up being constructed and arranged so that an adjustment of the thread taking capacity of the one will operate inversely upon the thread taking capacity of the other, substantially as described.

8. A chain stitch sewing machine having, in combination, a hook needle, a looper, a tension, a pull-off, a take-up having provision for adjustment of its throw, and means for actuating the parts, said pull-off and take-up acting on the thread extending freely between them and being located in such relative position adjacent to each other between the needle and the tension that the adjustment of the throw of the take-up controls the amount of thread pulled off by the pull-off, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

ANDREW EPPLER.

Witnesses:
HORACE VAN EVEREN,
FARNUM F. DORSEY.