No. 773,780. PATENTED NOV. 1, 1904.

S. BORTON.

THREAD CONTROLLING MECHANISM FOR SEWING MACHINES.

APPLICATION FILED MAY 28, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

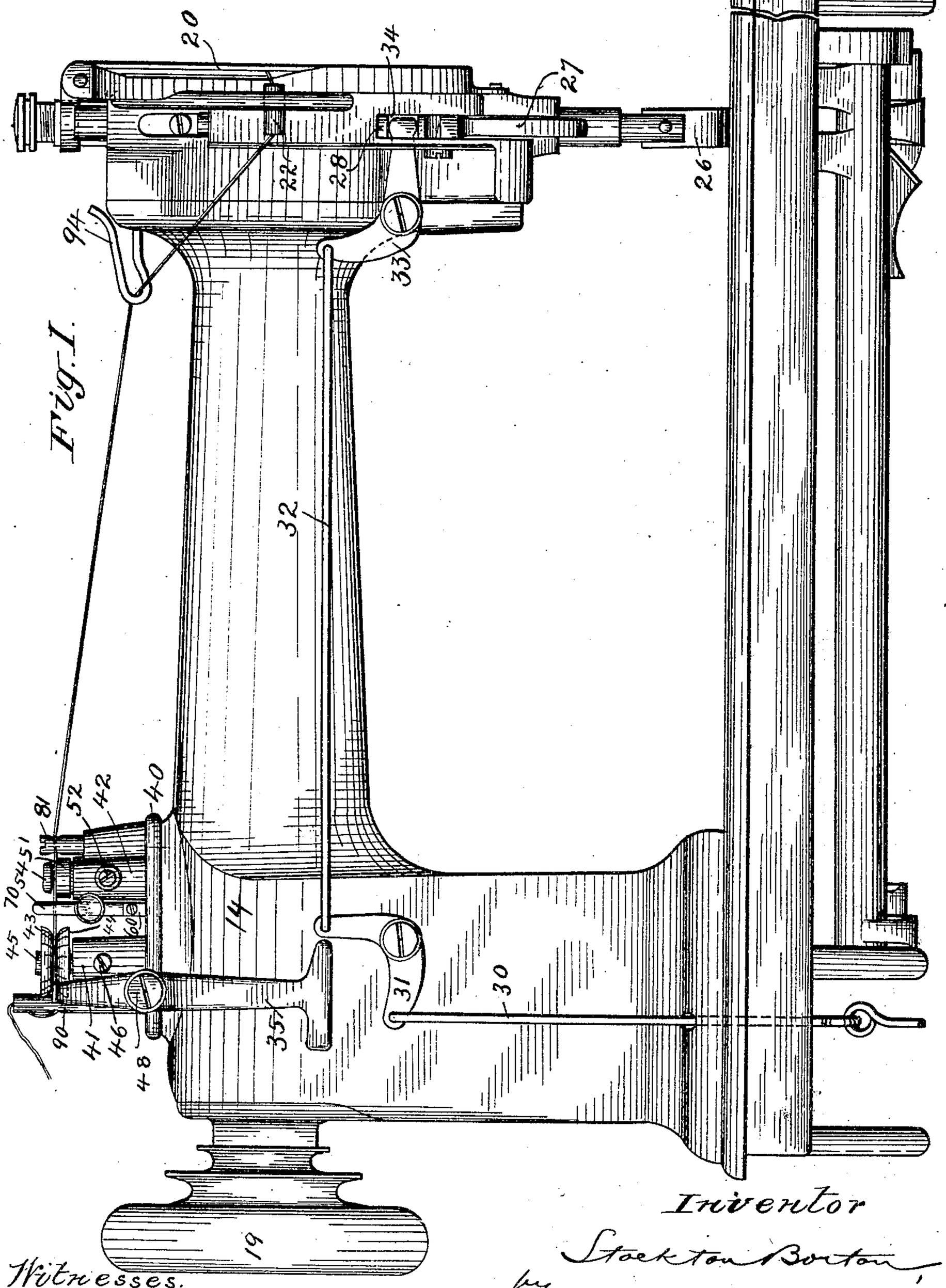

Fig. 1.

Witnesses.
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NO MODEL. 3 SHEETS—SHEET 2.

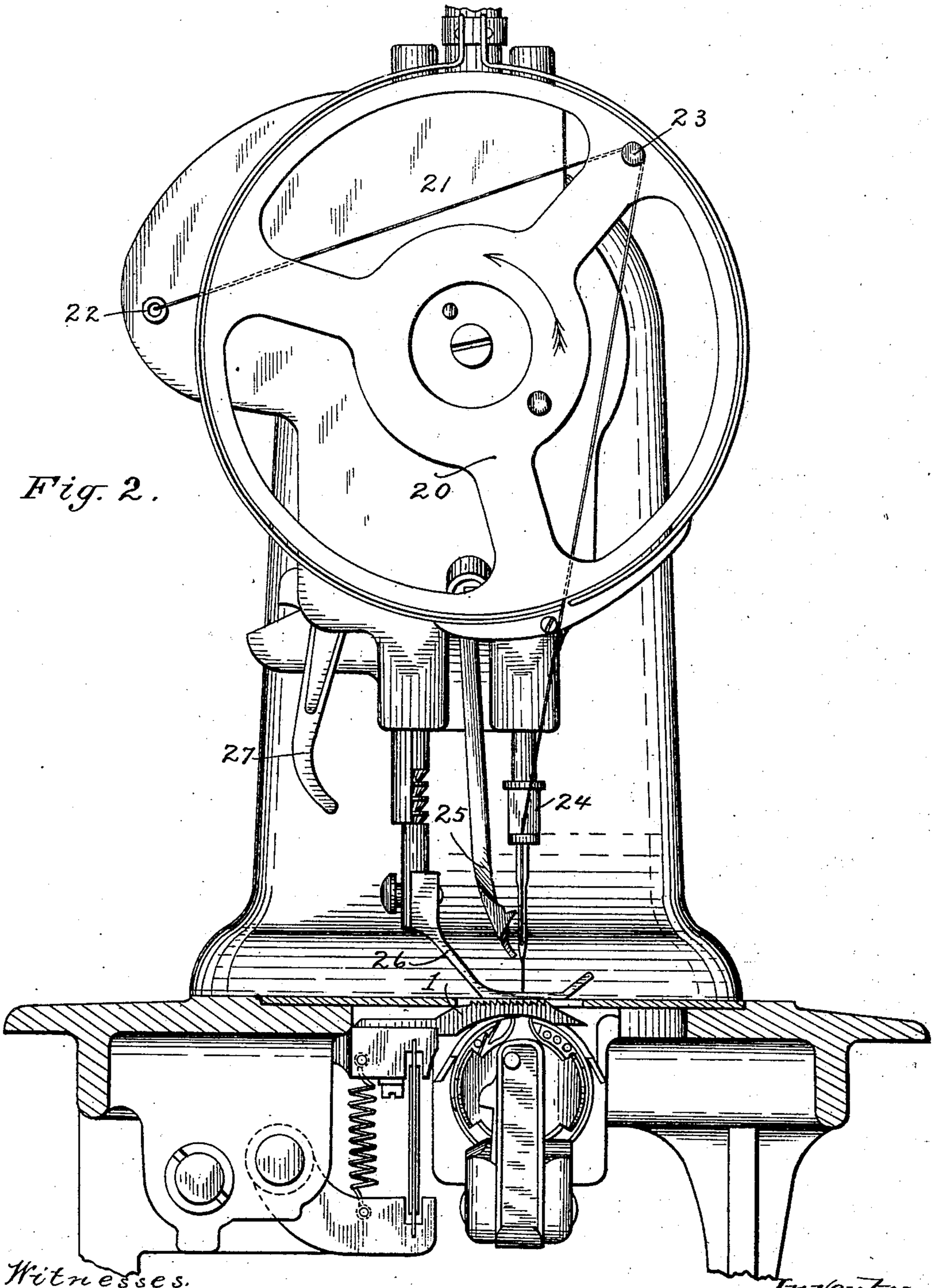

Fig. 2.

Witnesses.
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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

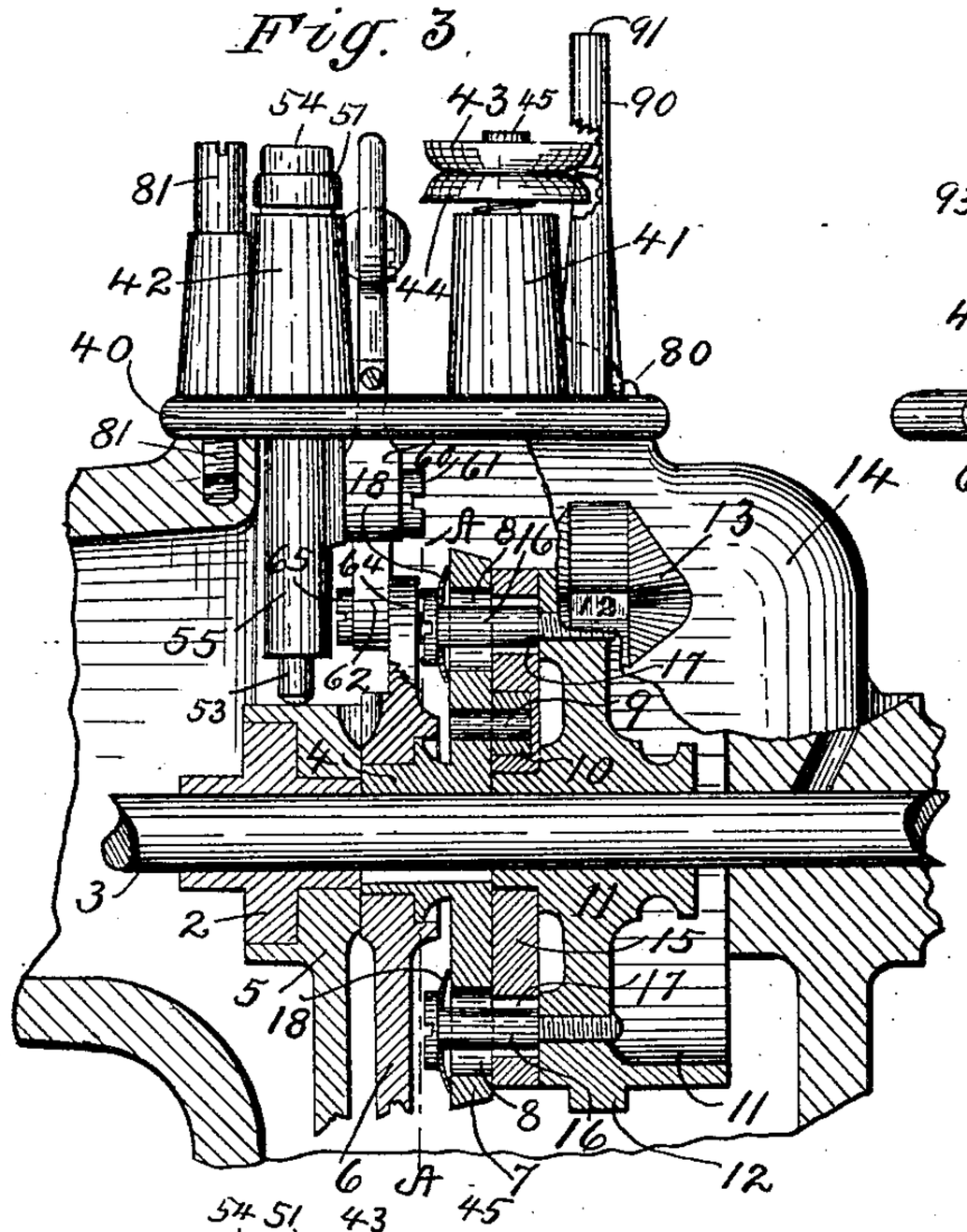
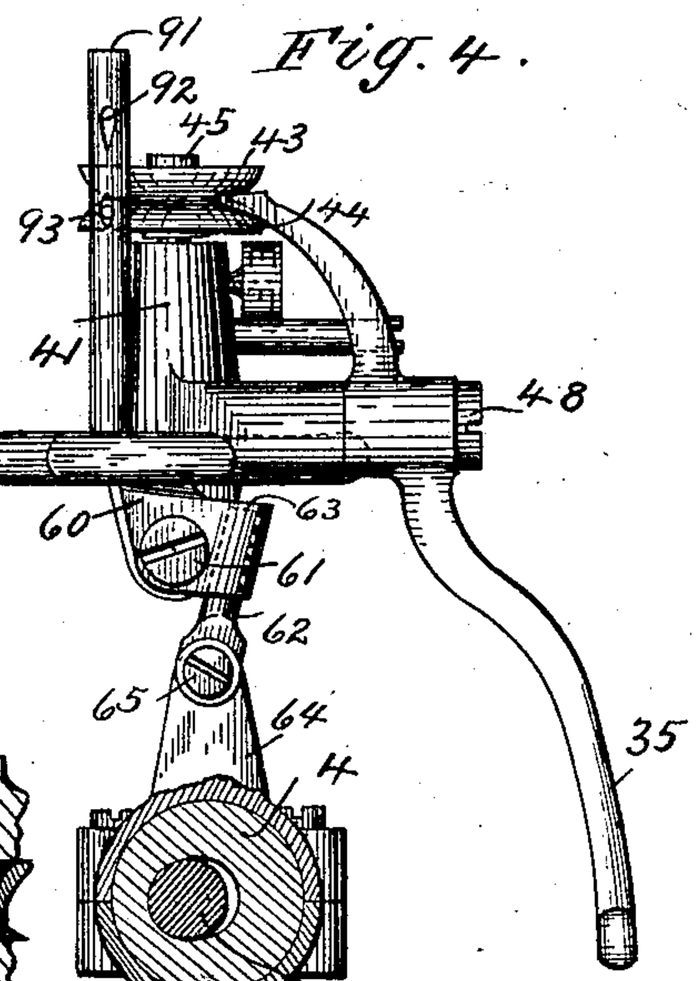


Fig. 4.



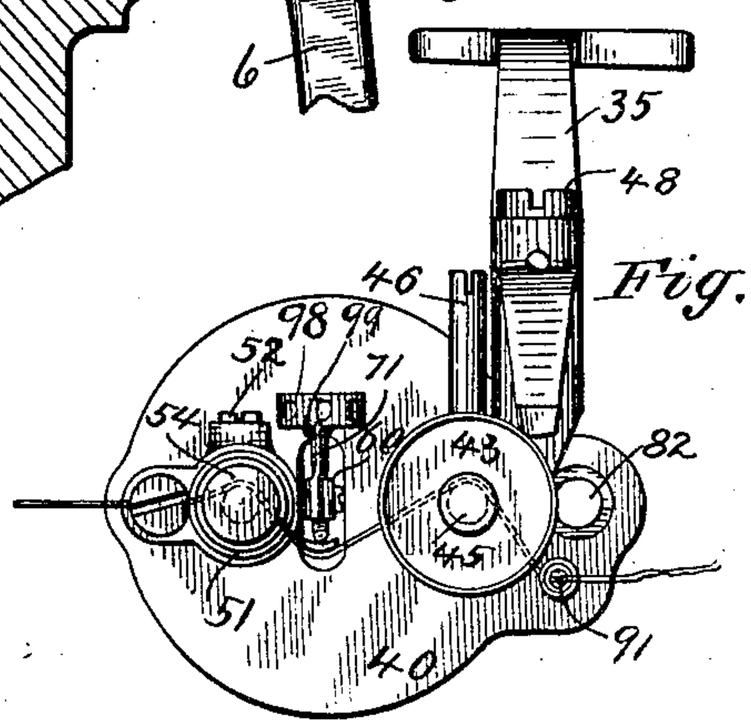


Fig. 6.

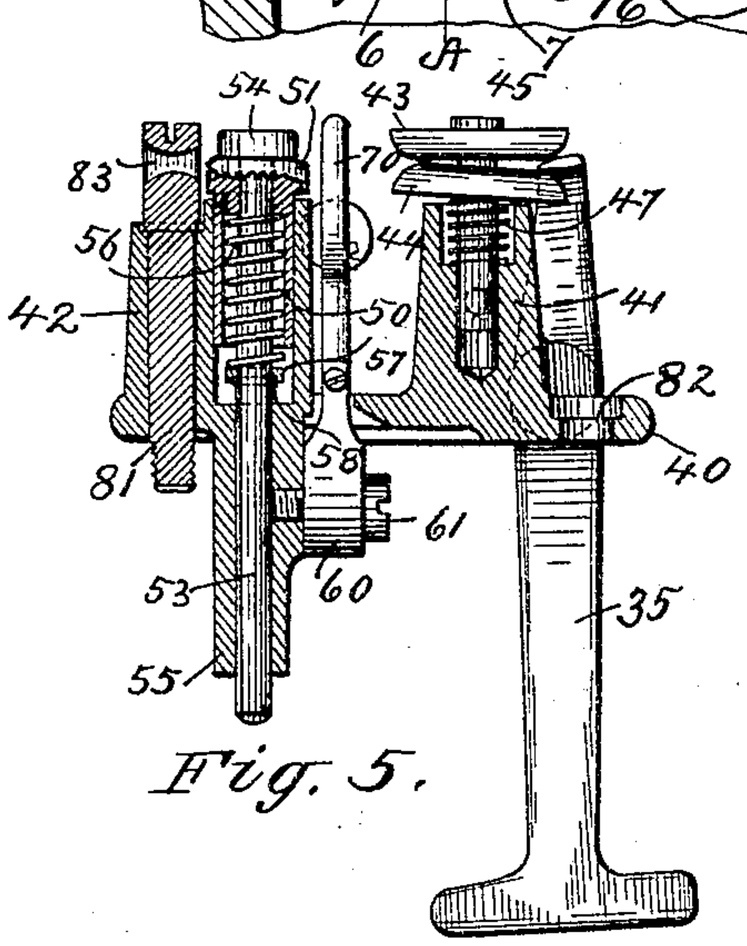


Fig. 5.

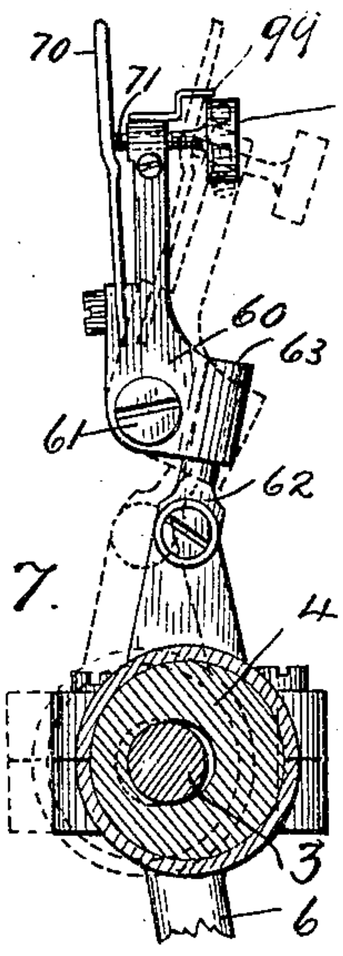


Fig. 7.

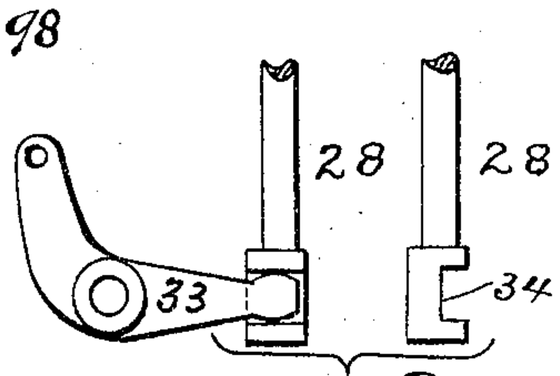


Fig. 8.

Witnesses.
W. Rees Edelen.
Wm. B. Kerkam.

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by
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attys.

No. 773,780. Patented November 1, 1904.

UNITED STATES PATENT OFFICE.

STOCKTON BORTON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO WILLCOX & GIBBS SEWING MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

THREAD-CONTROLLING MECHANISM FOR SEWING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 773,780, dated November 1, 1904.

Application filed May 28, 1903. Serial No. 159,175. (No model.)

To all whom it may concern:

Be it known that I, STOCKTON BORTON, a resident of Providence, Rhode Island, have invented a new and useful Improvement in Thread-Controlling Mechanism for Sewing-Machines, which invention is fully set forth in the following specification.

In the operation of high-speed lock-stitch machines it has been found that the friction of the tension and other parts through which the thread passes increases with increase of speed. Consequently in stitches made when the machine is running at high speed the upper or needle thread will be drawn tighter than in stitches made when running at a low speed. In certain classes of work this involves serious difficulties and objections. For example, in running a line of stitching along the edge of a collar or cuff the operator will start with the needle at one corner and run the machine at a rate of three or four thousand stitches a minute until nearly to the opposite corner—say within half a dozen stitches—when for fear of going too far or running off she stops the machine. It then becomes necessary to finish the remaining half-dozen or so stitches by operating the machine by hand, necessarily, of course, at a very slow speed. The result is that in these stitches the upper thread will be much looser than in the stitches formed at high speed, thereby materially marring the appearance of the finished article.

The principal object of my present invention is to overcome this difficulty; also, to provide a machine capable of making uniform and even stitching, notwithstanding imperfections in the thread, such as roughness, unevenness, or irregularities in size. In the ordinary arrangement of tensions for the upper and lower thread simperfections in the thread produce corresponding unevenness in stitching, for reasons to be presently pointed out. This object I accomplish by the combination and arrangement of mechanism hereinafter described, wherein the take-up is not required to pull the needle-thread through the tension, but merely to act within and tighten the thread previously pulled through the tension by the action of a pull-off. As the pull-off draws the same quantity of thread through the tension for each stitch irrespective of imperfections in the thread or the speed of the machine, it follows that differences in speed will not result in differences in the stitches.

With the ordinary arrangement of friction tensions in two-thread or what are generally known as "lock-stitch" machines the tensions on the two threads (upper and lower) are regulated with the object of causing the threads to interlock as nearly as possible at a point at the center of the thickness of the material. To effect this, the upper and lower tensions are adjusted so as to counterbalance each other, or, in other words, the two tensions are pitted against each other; but disturbances of this balance, caused by an increase in the tension upon either thread due to imperfections therein or changes in the speed of the machine, have not heretofore been provided for, and it has been practically impossible to obtain a perfectly even tension in the ordinary manner. For these reasons uneven stitching has been frequently produced. In the machine embodying my present invention this difficulty is overcome. I am enabled to apply a much stronger tension to the upper thread than to the lower thread, about three to one, this difference in tension being possible, for the reason that, as already stated, the take-up is not required to pull thread through the tension, but simply acts within and tightens the thread previously drawn through the tension by the pull-off. It follows that when the take-up draws the thread tight the upper stronger tension is in control of the lower weaker tension, and no matter what the variation in the friction of the two threads by reason of variation in size or roughness thereof or change in the speed of the machine the stitches will have a uniform appearance on the upper or right side of the goods.

It has been customary in lock-stitch machines to place the friction tension just behind the take-up or in some other position to act on

the needle-thread between the take-up and the spool, the take-up acting to pull the thread through the tension. In machines embodying such arrangement and running at high speed the action of the take-up is so rapid that the pulling of the thread through the tension and off the spool amounts to a severe blow on the thread, sufficient to break comparatively strong threads. In the machine of my present invention, however, this blow is eliminated, as the take-up is not required to pull the thread through the tension or off the spool, this being effected by the pull-off, which is given much more time in which to do the work, and consequently has an easier action on the thread. Much weaker thread can therefore be used. In fact, it has been found that a thread that could not be used in ordinary high-speed lock-stitch machines running at three or four thousand stitches a minute may be used at that speed in my present machine without difficulty.

In accordance with the improvements constituting my present invention a thread-clamp is interposed between the tension and the take-up, and a pull-off is interposed between the tension and clamp. The clamp is operated to grip and hold the needle-thread after the take-up has drawn up and completed the stitch and while the pull-off is operating to draw thread through the tension for the next stitch, so that the thread will not be drawn back from the needle instead of being pulled through the tension. The machine is provided with the usual adjustment to make different lengths of stitch, the pull-off being simultaneously adjusted to proportionately vary the length of thread pulled through the tension for each stitch. In addition to the automatic adjustment in accordance with the length of the stitch to be formed the pull-off is provided with a second independent adjustment, whereby it may be set to compensate for inaccuracies in the machine and in special cases to regulate the length of thread pulled off to varying thicknesses of goods.

Other features of improvement will be referred to in the detail description.

To clearly illustrate my invention, I have shown in the accompanying drawings the preferred embodiment thereof as applied to the well-known Willcox & Gibbs lock-stitch machine.

Figure 1 is a rear elevation. Fig. 2 is an end elevation from the right of Fig. 1. Fig. 3 is a vertical sectional view, with parts in elevation, through a portion of the hollow arm of the machine and mechanism inclosed thereby. Fig. 4 is an elevation (from the right of Fig. 3) of the plate which carries the tension, pull-off, thread-clamp, and associated parts, the feed-eccentric, which also operates the pull-off, being shown in section on the line A A of Fig. 3. Fig. 5 is a vertical sectional view through said plate and the mechanism carried thereby, and Fig. 6 is a top view of the same. Fig. 7 is a detail view showing in full and dotted lines the two extreme positions, respectively, of the pull-off and its actuating-eccentric; and Fig. 8 is a detail view of parts involved in the operation of the presser-foot.

1, Fig. 2, is a feed-dog having the usual back-and-forth movement imparted thereto by eccentric 4, Fig. 3, on main shaft 3 and the usual rising-and-falling movement imparted thereto by eccentric 2 on said shaft. The connections from the eccentrics to the feed-bars may be of the well-known form shown in United States Letters Patent No. 572,039, dated November 24, 1896, and comprising a pitman 5 for eccentric 2 and a pitman 6 for eccentric 4. In order to vary the throw of feed-eccentric 4 to correspondingly vary the length of stitch, I provide means for adjusting the position of said eccentric relatively to the axis of shaft 3. As said adjusting means are fully set forth in Patent No. 572,041, of November 24, 1896, it will suffice to briefly describe the same herein.

7 is a disk integral with eccentric 4 and having radial slots 8 8 and a pin 9, carrying an antifriction-roller 10. A driving-pulley 11, fixed on shaft 3, has a peripheral rib 12, on which a series of numbers are inscribed. These numbers, indicating the number of stitches to be made in a given distance, (one inch, for example,) are visible one at a time through a countersunk opening 13, Fig. 3, in the wall of the hollow arm or gooseneck 14 of the machine. In Fig. 3 the number "12" is visible through said opening, which in the operation of adjusting the eccentric would indicate that the parts were in position to form twelve stitches to the inch.

15 is a cam-disk, termed the "adjusting-cam," supported loosely on the hub of pulley 11. Eccentric 4 is attached to pulley 11, and hence to the shaft 3, by screws 16 16 passing through curved concentric slots 17 17 in cam 15 and the radial slots 8 8 in disk 7. This arrangement permits the disk and its eccentric to move a limited distance radially of the shaft and the cam to turn relatively to the shaft. Spring friction-washers 18 18 prevent these adjustable parts from slipping. The antifriction-roller 10 on pin 9 engages a cam-groove in the face of disk 7, so that when the cam is held against rotation and the disk rotated the roller in following the cam-groove will upon rotation of the shaft 3 by means of the hand-wheel 19, Fig. 1, move said disk and its eccentric 4 radially with reference to the axis of the shaft, thereby effecting the desired adjustment of the eccentric. The cam is held against rotation during this operation by means of a stop-pin (not shown) adapted to be pressed into engagement therewith by the operator.

20 is a rotary take-up embodying the im-

provements set forth in Patent No. 675,438, of June 4, 1901. The upper thread 21 of the machine passes from the eye or thread-tube 22, over take-up pin 23, through an eye on needle-bar 24, to the needle.

25 is a needle-guard the function and operation of which are well known.

A presser-foot 26 may be raised by hand, by a cam-lever 27 acting against the lower end of vertically-movable lifter-rod 28 in a well-known manner, or it may be raised by a treadle (not shown) operating through rod 30, bell-crank lever 31, rod 32, and bell-crank lever 33, Fig. 1, the latter engaging in a notch 34, Fig. 8, in the lower end of the lifter-rod 28, so that whether the presser-foot be released by the lever 27 or the treadle the bell-cranks 33 and 31 will both be operated. It follows that a tension-release lever 35 (more fully described hereinafter) in the path of movement of bell-crank lever 31 will be operated every time the presser-foot is raised either by hand or foot.

40 is a plate constituting a cover for an opening through the upper wall of the hollow arm or gooseneck 14 above the feed-operating eccentrics and mechanism for adjusting the length of stitch. Two upwardly-projecting hollow posts 41 and 42 are preferably cast integral with plate 40. On post 41 is mounted a tension of well-known form, consisting of two disks 43 and 44, secured in place by a headed pin 45, the stem of which is rigidly secured in a socket in post 41 by a set-screw 46. A spiral spring 47, Fig. 5, around the stem is housed in the upper end of the post and presses the two disks together to give the desired tension upon the thread. The spring bears at its lower end upon a shoulder on the post and at the upper end against the under side of disk 44. It is held under compression to give the desired tension by bringing pin 45 to the proper position and clamping it securely in that position by set-screw 46. The tension may of course be set to different strengths by varying the compression of the spring and correspondingly varying the position in which pin 45 is clamped. The disks engage loosely on the stem, so as to enable them to be pushed apart in the manner indicated in Fig. 5 by the wedge-like upper end of tension-release lever 35, when said lever is actuated (through the connections already described) upon raising of the presser-foot. This pressing apart of the disks releases the thread upon raising of the presser-foot, leaving the thread entirely free to be pulled off the spool, provided, however, the machine is stopped in such position as to bring the thread-clamp hereinafter referred to to its release position. The release-lever 35 is fulcrumed to plate 40 by a pivot-screw 48.

The thread-clamp comprises a hollow plug 50, having a head 51 with rounded edge constituting a seat against which the thread is clamped. Said plug is fixed in the desired position in post 42 by a set-screw 51, Figs. 1 and 6, passing through the wall of the post and bearing against the outer surface of the plug. A clamp-actuating stem or rod 53 has at its upper end a head 54, constituting a movable jaw for clamping the thread against the seat or fixed jaw. The stem passes downwardly through the plug and through a hollow depending post 55 on the under side of plate 40, from which it projects and bears against the top surface or cap of pitman 5, Fig. 3, which in its upward movement operates to raise the stem against the tension of a spring 56, Fig. 5, thereby opening the clamp to release the thread. Upon downward movement of the pitman the spring acts to close the clamp. It happens that the movements imparted to the pitman 5 by the feed-eccentric 2 are such as to open and permit the clamp to be closed at the proper times. Other and independent means may, however, be employed to operate the clamp. Spring 56, which surrounds stem 53 within the plug 50, bears at its upper end against a shoulder in the plug and at its lower end against a washer 57, encircling the stem and resting against a pin 58 passing therethrough. The parts constituting the clamp may be removed from the machine by loosening set-screw 52. The clamp may be secured in proper operative position by turning the main shaft 3 until pitman 5 is on its upstroke. The clamp having been inserted in the hollow post, pressure is applied upon the head of stem 53 to push the clamp down in the post until the lower end of the stem bears against the head of the pitman. The plug 50 is then secured against movement by set-screw 52, so that continued upward movement of the pitman opens the clamp against the pressure of the spring. As soon as the pitman commences its downward movement the spring comes into action to close the clamp. If the pitman has completed a portion of its upstroke when the parts of the clamp are set, as above described, the clamp will be opened and held open for a correspondingly shorter time. The duration of release of the clamp should be so adjusted as to close before the pull-off (described hereinafter) operates, but after the take-up has tightened the stitch, so as to be opened before the take-up tightens the stitch. By clamping of the thread before the pull-off acts the latter is prevented from pulling thread back from the needle instead of off the spool, and by releasing the thread before the stitch is tightened, so that if for any reason (such as an imperfection in the thread) it becomes necessary, the take-up can pull more thread through the tension in tightening the stitch rather than break the thread, which would happen if the clamp were closed.

The pull-off consists of a lever 60, fulcrumed to depending post 55 by a pivot-screw 61 and projecting upwardly through a slot in plate 40.

The lever is oscillated on its pivot by a plunger 62, working in a socket 63 in the short arm of the lever, the plunger being pivoted to an ear or projection 64 on the head of pitman-cap 6 by a pivot-screw 65, so that the plunger partakes of all of the movements of eccentric 4, having a longitudinal movement in the socket and also a lateral or vibratory movement. During these movements the pull-off lever is vibrated through a path whose length is proportioned to the throw of the eccentric. It follows that when the eccentric 4 is adjusted by the means already described to vary the length of stitch the throw of the pull-off lever will be lengthened or shortened proportionately, so that it will draw from the tension and spool a sufficient amount of thread to form a stitch. In other words, the adjustment to vary the length of stitch effects an automatic adjustment of the pull-off to correspondingly vary the amount of thread pulled off for each stitch. The pull-off-operating means herein described and shown are similar to the means set forth in Patent No. 572,048, of March 24, 1896.

A spring-arm 70, secured to the pull-off lever at one end and constituting a part of said lever, bears at its other end by its tension against the end of an adjusting-screw 71, passing through the upper end of the lever, said screw having a head by which it may be turned to cause the upper end of the spring-arm to stand out farther from the lever or to assume a position nearer thereto, thereby adjusting the active part of the stroke of the pull-off and proportionately increasing or decreasing the amount of thread pulled from the tension and spool for the stitch. In this connection it is to be understood that in its retracted inactive position, (shown in dotted lines, Fig. 7,) whatever the adjusted position of the spring-arm, the pull-off allows the thread to pass in a straight line, or nearly so, from the tension to the clamp; otherwise the adjustment of the spring-arm would not change the amount of thread pulled off for the stitch. The object of this adjustment (independent of the adjustment according to the length of the stitch) is, as already stated, to enable the pull-off to be set to compensate for inaccuracies in the manufacture of the machine and the length of thread pulled off for each stitch to be regulated to different thicknesses of goods. A pointer 99, Figs. 6 and 7, projects from the upper end of pull-off lever 60 into juxtaposition to a scale extending around the periphery of the circular head 98 of screw 71, thereby enabling the position of adjustment of said screw and of the spring-arm to be accurately determined and observed.

The plate 40 is secured to the gooseneck at one side by a screw 80, Fig. 3, passing through counterbored opening 82, Fig. 5, and at its other side by a screw 81, having a transverse opening 83 in its upper end through which the thread is guided. A pin 90 on plate 40 adjacent to the tension has openings through which the thread passes and constitutes a guide for properly directing the thread to the tension. It has a vertical passage 91, Fig. 6, opening outwardly through a side opening 92, Fig. 4, and a transverse opening 93. Thread from the spool passes downwardly through passage 91, outwardly through side opening 92, through transverse opening 93, thence between the tension-disks, Figs. 1 and 6, in front of the pull-off lever, through the clamp and guide-opening 83, and through a hook 94, Fig. 1, and eye 22 to the rotary take-up. The arrangement of the passage 91 and opening 92 in pin 90 and the projection of the latter above the tension device prevents kinks, twists, and loops in the thread coming from the spool from becoming entangled with these parts, and thereby avoiding breaking of the thread and interruption in the operation of the machine.

The operation of the machine, although apparent from the foregoing description, may be briefly described as follows: In Fig. 2 the take-up is shown in the position in which it has taken up all slack thread and tightened the stitch, the clamp being open, as shown in Fig. 1, and the pull-off in its retracted inactive position, so that the thread is drawn tight from the stitch up to the tension. After the take-up passes this position, turning in the direction indicated by the arrow, the clamp closes and grips the thread, and the pull-off acts to draw thread through the tension for the next stitch. After the pull-off completes its operation and before the take-up tightens the next stitch the clamp is opened. The time of closing and opening the clamp may be varied, as already explained.

My invention is not, of course, limited to the particular form of tension, pull-off, clamp, and operating mechanism therefor and other parts herein shown and described, as other suitable forms may be used without departing from the spirit of the invention.

What I claim is—

1. In a sewing-machine, the combination of a rotary take-up, a tension, a clamp acting to grip and hold the thread between the take-up and tension but to release the same when the take-up is acting to tighten the stitch, and a pull-off acting on the thread between the tension and clamp for drawing the thread through the tension while it is gripped by the clamp.

2. In a sewing-machine, a pull-off lever, operating means therefor, an arm for acting on the thread connected at one end to the lever, and adjusting means engaging the free end of the arm to change the position thereof relative to the lever.

3. In a sewing-machine, a pull-off lever, operating means therefor, and adjusting means on the lever for varying the quantity of thread pulled off thereby, said means comprising a

scale and pointer for indicating the position of adjustment.

4. In a sewing-machine, a pull-off lever, operating means therefor, a spring-arm on the lever for acting upon the thread, and an adjusting-screw for changing the position of the spring-arm.

5. In a sewing-machine, a pull-off lever, operating means therefor, a spring-arm on the lever for acting upon the thread, an adjusting-screw for changing the position of the spring-arm, a scale on the head of the screw and a pointer in juxtaposition to said scale for indicating the position of adjustment.

6. In a sewing-machine, a presser-foot, a lifter-rod connected thereto, a hand-lever for raising the lifter-rod and presser-foot, a bell-crank lever having one end in engagement with the lifter-rod, a rod connecting the other arm of the bell-crank lever with an arm of a second bell-crank lever, treadle connections for raising the presser-foot joined to the other arm of said second bell-crank lever, a thread tension consisting of two disks pressed together, and a tension-release lever adapted to engage between and press said disks apart and having an arm acted upon by said second bell-crank lever, whereby the thread tension is released upon raising the presser-foot.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

STOCKTON BORTON.

Witnesses:
JOHN A. KING,
ALICE M. HENTZ.