(No Model.) 2 Sheets—Sheet 1.

F. A. MILLS.

SHOE SEWING MACHINE.

No. 549,206. Patented Nov. 5, 1895.

Fig. 1.

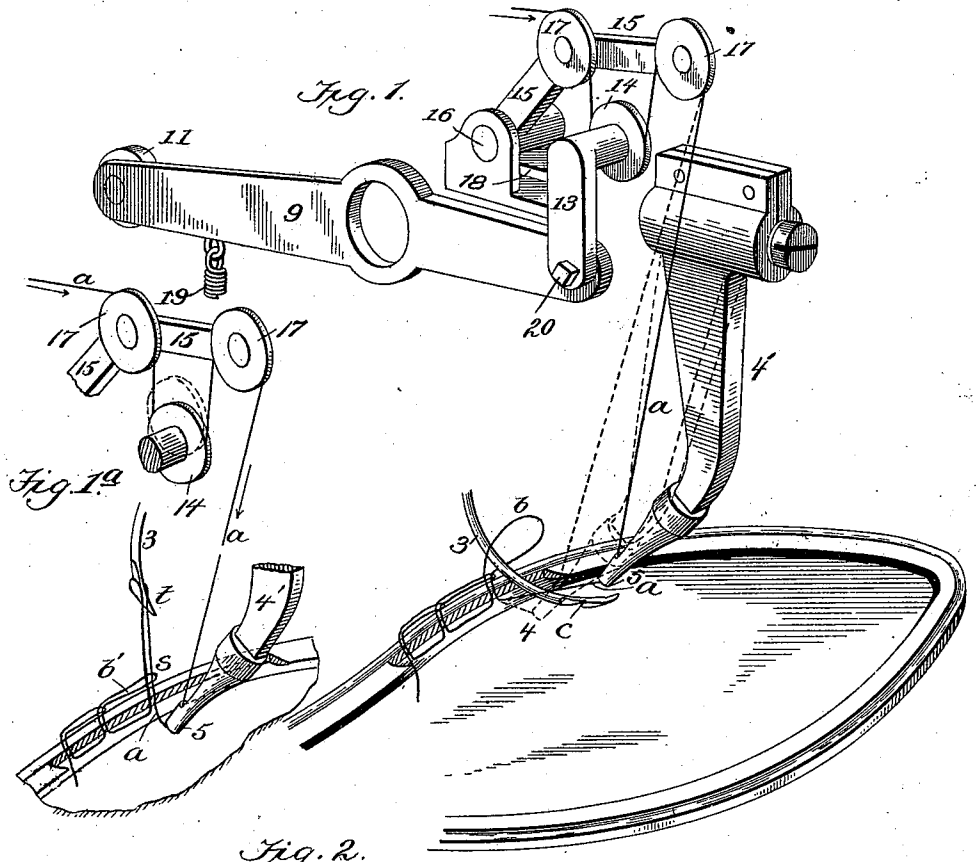
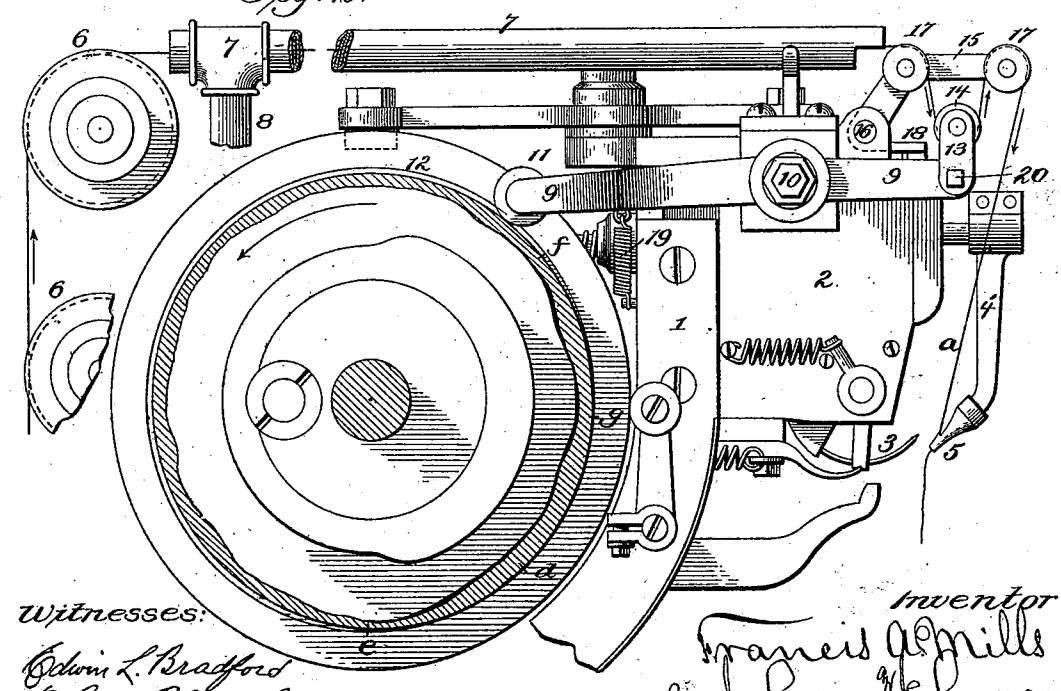


Fig. 1a.

Fig. 2.



Witnesses:
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

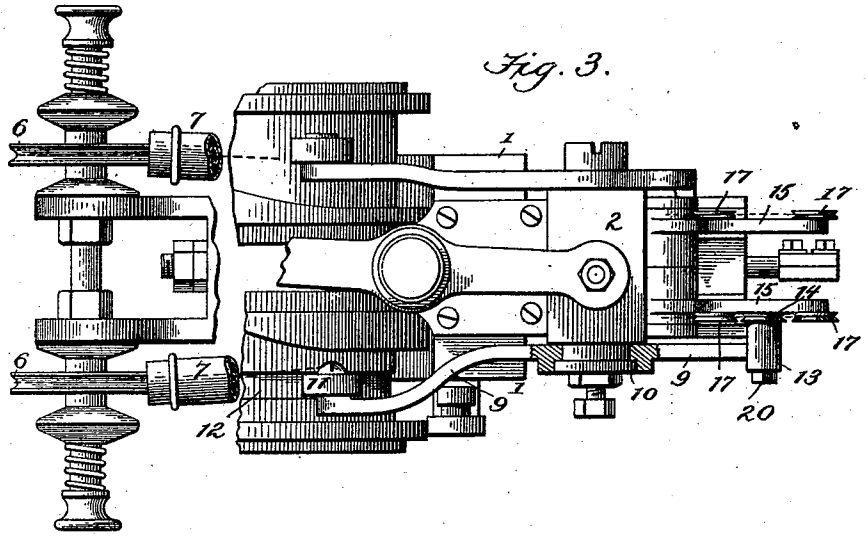


Fig. 4.

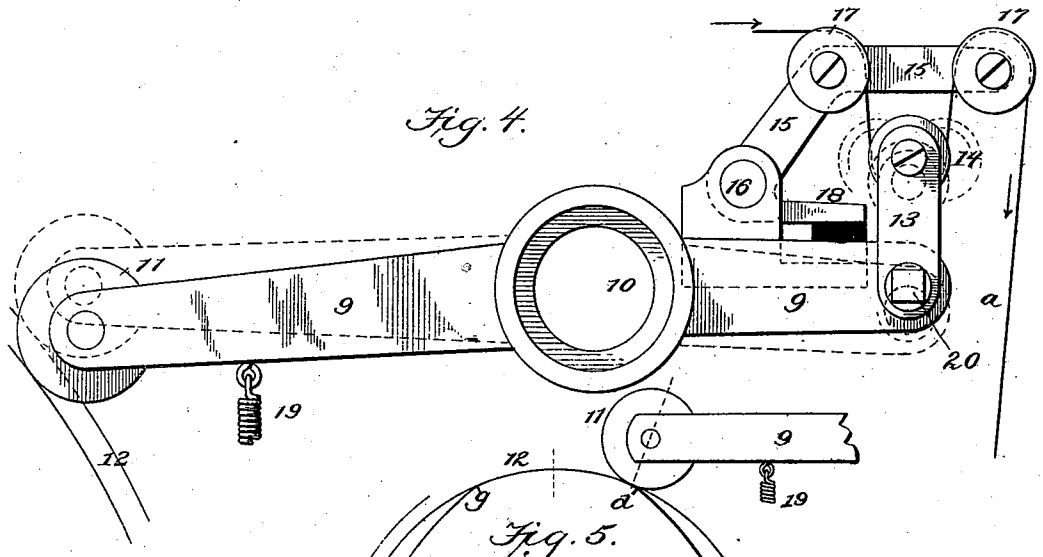
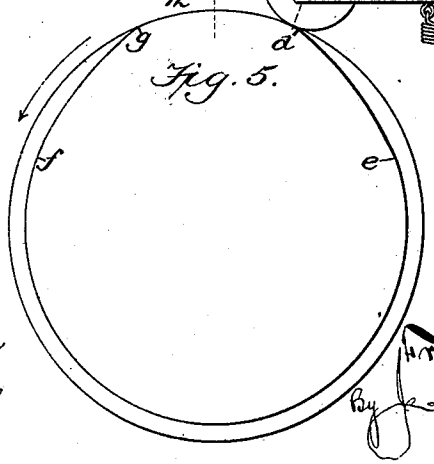


Fig. 5.



Witnesses:
Edwin L. Bradford
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UNITED STATES PATENT OFFICE.

FRANCIS ARTHUR MILLS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO JAMES MUNDELL, OF SAME PLACE.

SHOE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 549,206, dated November 5, 1895.

Application filed July 9, 1894. Serial No. 516,952. (No model.)

To all whom it may concern:

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

My invention relates to machines particularly adapted for sewing shoes, wherein a curved barbed needle operates to set a chain or loop stitch. In machines wherein the loop or chain stitch is set by the needle the pulling in of the loop and setting the stitch by the needle act to abrade the thread and constantly tend to break it. The cause of this abrasion and breakage of the thread is the shortening of the loop last formed on the needle by the rotation of the looper around the needle. This shortening is caused by the tension on the thread from the tension device being greater than the friction of the thread in the hole last made by the needle in the between substance. This greater tension must be overcome to allow the looper-thread to encircle the needle and leave behind the looper the thread it has pulled through the said last-named hole in order to prevent this shortening of the loop. In this shortening of the loop the needle has not thread enough left to make its full backward stroke without causing the thread to be abraded by slipping under high tension in the barb of the needle in setting the stitch. As the thread is under its full tension in the backward stroke of the needle, the slipping causes the abrasion and consequent weakening and breaking of the thread. This result is due to the looper taking or "stealing" the thread from the last loop while the looper is moving to form the next loop on the barb of the needle, because the tension on the thread from the tension device is greater than the friction of the looped thread in the stock, and for this reason the looper draws the thread from the hole in the stock. This explanation is to show that in the chain or loop stitch machine now in use the looper does not receive sufficient thread to form the required loop around the needle without drawing the thread from the loop, which is the cause of the breaking and cutting the thread in the eye of the needle. This is the difficulty my improvement is designed to remedy, and this I do by the letting out of the thread as the loop is being drawn in and taking this supply direct from the tension device at the time the needle is on its backward stroke pulling in the stitch. This allows a given length of thread to be placed in the barb of the needle to form the next loop and permits the needle to make its full backward stroke in pulling in and setting the stitch, and the abrading and breaking of the thread are prevented.

So far, therefore, as I know and can find I am the first to provide for retaining the loop last formed on the back of the needle and at the same time providing the looper and the needle with thread to form the next loop without abrading in the eye of the needle. The means I have provided for retaining the loop on the back of the needle, as shown in Fig. 1, is caused to act at a certain time in the operation of the machine, which is at the instant the looper begins to encircle the needle and which in machines now in use is the precise time when the loop on the needle is shortened by the looper. The thread necessary to supply the looper to obtain this loop is drawn from the tension device at the time the needle is pulling in and setting the stitch, and it is at this moment that the meter device is getting the supply of thread for the looper to encircle the needle for the next loop without shortening the loop last formed on the back of the needle, as seen, as this loop appears in Fig. 1. It is by the co-operation of the tension device and the looper-finger that I form and retain the loop on the back of the needle and set the stitch, and the timing of the action of these devices is an important matter of my improvement to effect the forming and retaining of the loop. My loop-meter, however, is also well adapted for working under a greater tension than that ordinarily used in needle-stitch-tightening machines.

The following description read in connection with the accompanying drawings will enable any person skilled in the art to which my invention relates to understand its nature and to practice it in the form which I prefer to employ it; but it will be understood that

my invention is not limited to the precise form and details of construction herein illustrated and described, as various modifications may be made without departing from its spirit and without exceeding the scope of the claims concluding this specification.

Referring to the drawings, Figure 1 shows a portion of the sole of a shoe and the needle and the looper in their relation thereto and to the loop-meter device in forming the stitches, the dotted lines showing the position of the looper when at its point of starting on its path around the needle and the full lines showing the position of the looper to which it has drawn the thread *a* from the loop-meter device, and not from the loop *b*, as heretofore has been the case. Fig. 1ª shows the same parts in the positions they occupy in setting the stitch, the loop *b* (seen in Fig. 1) having been drawn in and set by the needle having its full backward stroke and the meter-roll 14 having its full downward stroke, obtaining thereby a given amount of thread to prevent the looper in its arc around the needle from shortening the loop *b*. In this figure the looper-finger is at its starting-point ready to receive the thread obtained by the meter device, and this is the position of the looper-finger shown by dotted lines in Fig. 1. Fig. 2 shows in side elevation so much of a sewing-machine and tension device as illustrates the use therewith of my loop-meter device. Fig. 3 shows a top view of the same. Fig. 4 shows the loop-meter device in elevation in the position it occupies relatively to its operating-cam and raised by the spring 19 to dispense the thread to the looper, and the dotted lines show the device in the position it occupies when depressed by the cam 12 to draw the thread from the tension device; and Fig. 5 shows the cam for operating the meter-lever.

In the drawings I have shown so much of a shoe-sewing machine as illustrates the parts with which my present invention co-operates as a loop-retainer and thread-dispenser, and it will be understood that my invention may be used with any sewing-machine wherein a looper is used to place the thread in the barb of a needle.

Of such machine let 1 designate a part of the frame; 2, that part which contains the sewing mechanism; 3, the barbed needle; 4′, the looper-arm; 5, the looper-finger; 6, the tension device, and 7 the thread-conduit, of which 8 is a branch, which conducts heat to the thread-conduit to keep the thread hot. As shown in Figs. 2 and 3, the loop-meter device is mounted upon the side of the frame part above the looper-finger and between the tension device and the stitch-forming mechanism. The function of this loop-meter or pull-out is to draw thread from the tension device to supply the looper with the given quantity to form the next loop on the needle at its barb without having to take such supply from the loop *b* on the back. (Shown in Fig. 1.) This quantity of thread given to the looper to prevent it from shortening the loop *b* in its arc around the needle to form the next loop in the barb of the needle is obtained, as shown in Fig. 1ª, while the needle is pulling in the stitch. This latter figure shows the needle in the position of its extreme backward movement and having set the loop *b* and formed thereby the stitch *b*′. In drawing the thread and setting the stitch *b*′ the loop-meter lever-roll 14 has moved from its extreme upward position (seen in Fig. 1) to its extreme downward position, (seen in Fig. 1ª,) and this latter movement is effected by the cam 12 moving from *f* to *g*, Fig. 5, thus drawing from the tension the given quantity of thread and retaining the same while the cam is moving from *g* to *d*. While the cam is moving between these points the needle has moved from *s* to *t*, pulling the thread and setting the stitch. At the same time the looper has moved from the point 5, Fig. 1, to a point midway between 4 and 5, which is opposite the hole last made by the needle in the between substance. In these positions of the looper-finger and the meter-thread roll 14, I have obtained and held in the meter device the given quantity of thread for the next loop. While the cam 12 moves from *d* to *e* the thread-roll 14 is raised, giving out the stored thread to the looper after the needle has descended and pierced the between substance, as seen in Fig. 1. At this moment the looper has moved from 4 to 5, leaving behind it the thread which has been stored by the meter. In this operation of the meter device the spring 19 serves to hold the lever-roll 11 to the cam 12 at all times during the revolution of the latter. In this operation the function of the loop-meter device acts to relieve entirely the drawing of the thread by the looper from either the tension device or from the formed loop *b*, and thereby relieves the looper of all strain due to the tension of the thread, and gives a free and easy working of the looper.

The loop-meter devices consist, essentially, of two parts, a cam-actuated meter part and a storing and dispensing part, the said parts being connected by the thread and operate in connection with the tension device and the looper-finger.

The cam-actuated part consists of a lever 9, mounted upon a suitable fixed pivot-support 10 and having at its inner end a roll 11, which by means of a spring 19 constantly engages a cam 12, suitably mounted on the machine. The front end of said lever has a pivoted arm 13, which at its upper end has a pulley 14. The thread storing and dispensing part consists of an arm 15, preferably pivoted at 16 on the machine and having a pair of pulleys 17 arranged to overhang the pulley 14 of the cam-actuated lever.

The pair of pulleys is preferably disposed equally on each side of the lever-pulley and a little distance above it, so that the three pulleys have a triangular relation, over one of

which the thread passes from the tension device to and under the lever-pulley 14, and from thence to and over the other of the pair of pulleys to the looper.

I prefer to cushion the arm which bears the pair of pulleys, as shown, by a spring-seat 18, whereby the said arm may have a slight yielding function under the pulling action of the cam-lever upon the thread.

The object of combining the loop-meter device with the cushioned roll-arm 15 which supplies the thread to the meter device is to avoid the sudden tension upon the thread in the eye of the needle while setting the stitch, and in doing this the rolls 17 of said cushioned arm are depressed by the combined action of the pulling down on the thread *a* by the needle in setting the stitch and the pulling down of the roll 14 on the thread between the said rolls 17 17. This makes each and every stitch automatically tightened without regard to the thickness of the between substance, and also prevents the liability of the thread cutting through the between substance.

The operation of the loop-meter and dispensing device is as follows: The machine being in operation and the loop—the first one, for instance, the loop *b*—having been formed on the needle 3 and the looper-finger 5 being at its starting position 4, as shown by the dotted lines in Fig. 1, to form the next loop in the barb *c* of the needle the looper then moves to the position 5 (shown in full lines) to draw the thread from the meter device as it is being given to the same to form the next loop on the barb of the needle. In this position 5 of the looper the meter device is moved to its extreme upward vibration by the pulling-down action of the spring 19, which connects the cam-controlled end of the lever 9 with the frame of the machine, as seen in Figs. 2 and 4, such movement of the meter device having been effected during the rotation of the cam from its surface-point *d* to *e*, as seen in Fig. 5. The meter device maintains this position until the looper has formed the loop upon the barb of the needle and the needle has been retracted from the work, during which the cam will have moved from the point *e* to the point *f*, giving no movement to the meter device and the thread being drawn through the meter by the needle direct from the tension device. The cam rotating from the point *f* to the point *g* acts to raise the roll end of the lever and to depress its pulley-bearing end to draw the thread from the tension device as the needle is pulling in and setting the stitch. At this point *g* in the rotation of the cam the needle has finished its retracting movement and completed the stitch. In the rotation of the cam from *g* to *d* the meter device reserves the measured quantity of thread which it has received from the tension device until the needle makes its forward movement to pierce the between substance and has completed such movement. From this point *d* to *e* the looper is moving from the point 4 to 5 to repeat the operation of supplying the thread and allowing the looper to leave behind it the thread which has heretofore been taken from the loop *b* in the way I have stated. In this operation it is the descending movement of the pulley end of the lever 9 which draws the thread from the tension device, and the ascent of this end of the lever allows the meter device to dispense the measured quantity of the thread to the looper.

To regulate the given quantity of the thread drawn by the meter device from the tension device, the pulley-bearing arm 13 is adjusted by swinging it to the right or to the left on its pivot 20 to bring its roll 14 nearer to or farther from the fulcrum 10 of the cam-actuated lever, as shown by dotted lines in Fig. 4. In such regulating adjustment the setting of the arm-roll 14 nearer to said fulcrum brings said arm-roll nearer to the roll 17, which receives the thread direct from the tension device and causes the meter to draw a less quantity of thread from the tension device, and the setting of this arm-roll 14 farther away from the said fulcrum and nearer to the roll 17, which delivers the thread to the looper, causes the meter device to draw a greater quantity from the tension device, and in this way the required given quantity of thread can be regulated and automatically measured to the looper for the purpose stated; but I do not wish to limit myself as to the quantity of thread drawn from the tension device by the meter device.

In the operation of the machine provided with my invention it must be understood that there is no locking and releasing action upon the thread in its feed to the stitch-forming mechanism, but that it is drawn through the meter device and a given quantity measured therein by a vibratory movement imparted to said meter device, the extent of which is the measure of the given quantity of thread which is dispensed to the stitch-forming mechanism, and that the object, purpose, and function of this vibratable meter device are to prevent the shortening of the loop last formed by the needle while forming the succeeding loop, whereby the loop already formed on the needle maintains its proper length to form the next loop. It is from this result in the operation of the loop-meter device that the abrading and breakage of the thread are prevented while forming each and every loop.

I have referred to the needle as having a backward stroke in pulling in and setting the stitch, and it will be understood that such movement of the needle is for the purpose of pulling in the loop to set the stitch whether the loop be on the upper or in the channel of the shoe.

While I have described the looper as first carrying the thread over the needle in the operation of retaining the full length of the loop *b*, yet it is obvious the same result may

be obtained by an underthrow of the thread by the action of the looper.

I have shown in Fig. 3 a duplex tension device and a duplex loop-meter device, and this construction is provided to adapt the machine for using thread to suit light and heavy work, wherein the two threads will be held in readiness for the use of either as the work may require. In such construction a heating-conduit is provided for each thread, and it will be understood that the thread not being at the time in use will be held out of the way on the machine. In this operation it will be understood that the movement of the thread from the tension device is at all times freely permitted and under the complete control of the loop-meter device, but not with the function of a take-up, because my loop-meter is not for controlling the loose slack thread so that it can pass freely downward with the needle in a straightened-out condition, and then as the needle rises to further so control the slack thread that it will have a sharp bight at the eye of the needle, so that the latter can tighten the stitch, for this is the function of a take-up. Take-ups have also been designed for pulling in and shortening the loop last formed by the needle and tightening the same in the work; but my invention resides in the combination of certain coacting devices whereby provision is made for taking care of the loop *b* that has been drawn last by the needle and prevent it from being shortened by the looper in its movement around the needle to form the next loop.

I claim—

1. In a shoe-sewing machine, the combination, with a hooked stitch-tightening needle, of a looper for laying the thread into the hook of said needle, a tension-device, and thread drawing and giving out devices located between said tension-device and said looper whereby thread is drawn from the tension device and is given to the looper free from tension when said looper is actuated to lay the thread into the hook of said needle, thus preventing the shortening of the loop by the looper, as set forth.

2. In a chain or loop-stitch sewing machine, the combination with stitch forming mechanism comprising a stitch tightening needle, a looper-finger and a tension device, of a loop-meter located between the tension device and the looper and comprising a cushioned-arm having two pulleys, a pivoted-lever carrying a single pulley intermediate of the cushioned-arm pulleys, and actuating mechanism for the pivoted-lever, whereby the said cushioned meter part is adapted to yield automatically under the pulling action in setting the stitch, substantially as described.

3. In a chain or loop-stitch sewing machine, the combination with stitch forming mechanism comprising a stitch tightening needle, a looper-finger and a tension-device, of a loop-meter located between the tension device and the looper and composed of an arm carrying two pulleys, a pivoted-lever having a pulley relatively adjustable in a lateral direction to and between the said arm-pulleys, whereby to vary the length of the measured quantity of thread drawn from the tension-device and actuating mechanism for the said lever, substantially as described.

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

FRANCIS ARTHUR MILLS.

In presence of—
A. E. H. JOHNSON,
A. R. JOHNSON.