

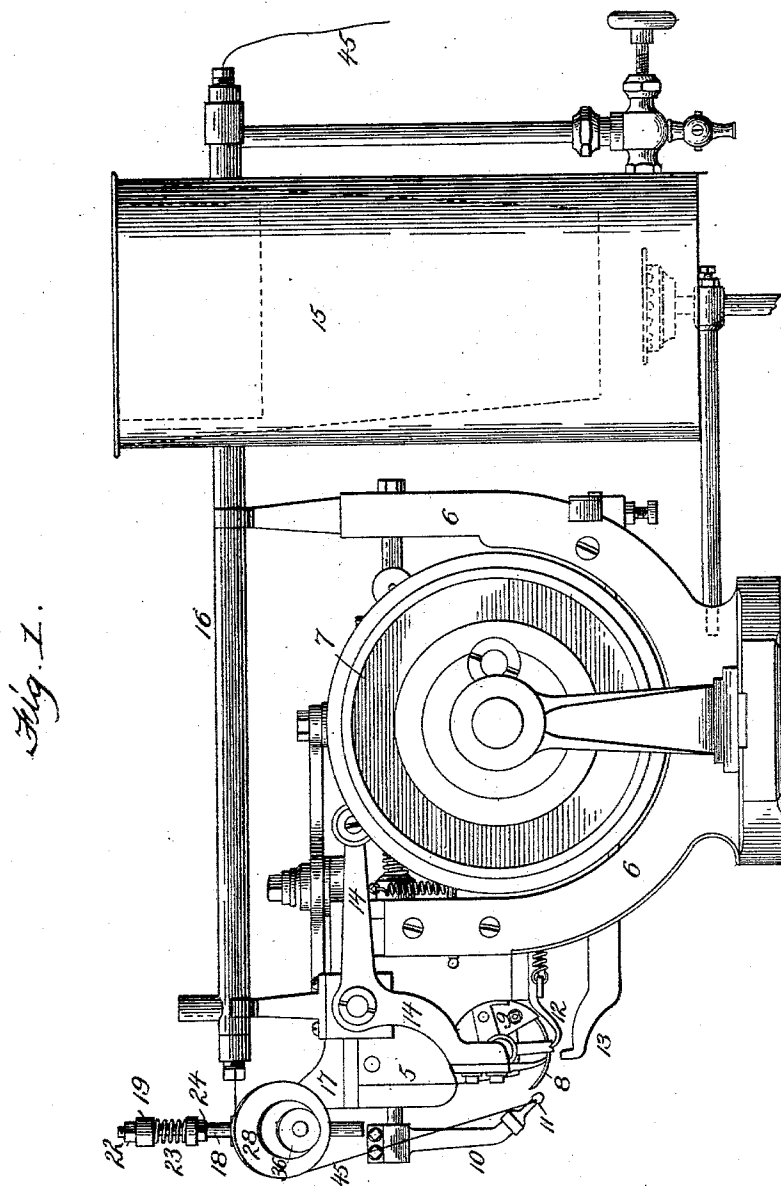
(No Model.)

4 Sheets—Sheet 1.

F. A. MILLS.
SEWING MACHINE.

No. 563,903.

Patented July 14, 1896.



WITNESSES:

Edwin L. Bradford
W. D. Bloude

INVENTOR

Francis A. Mills
BY *John S. Johnson*
ATTORNEYS.

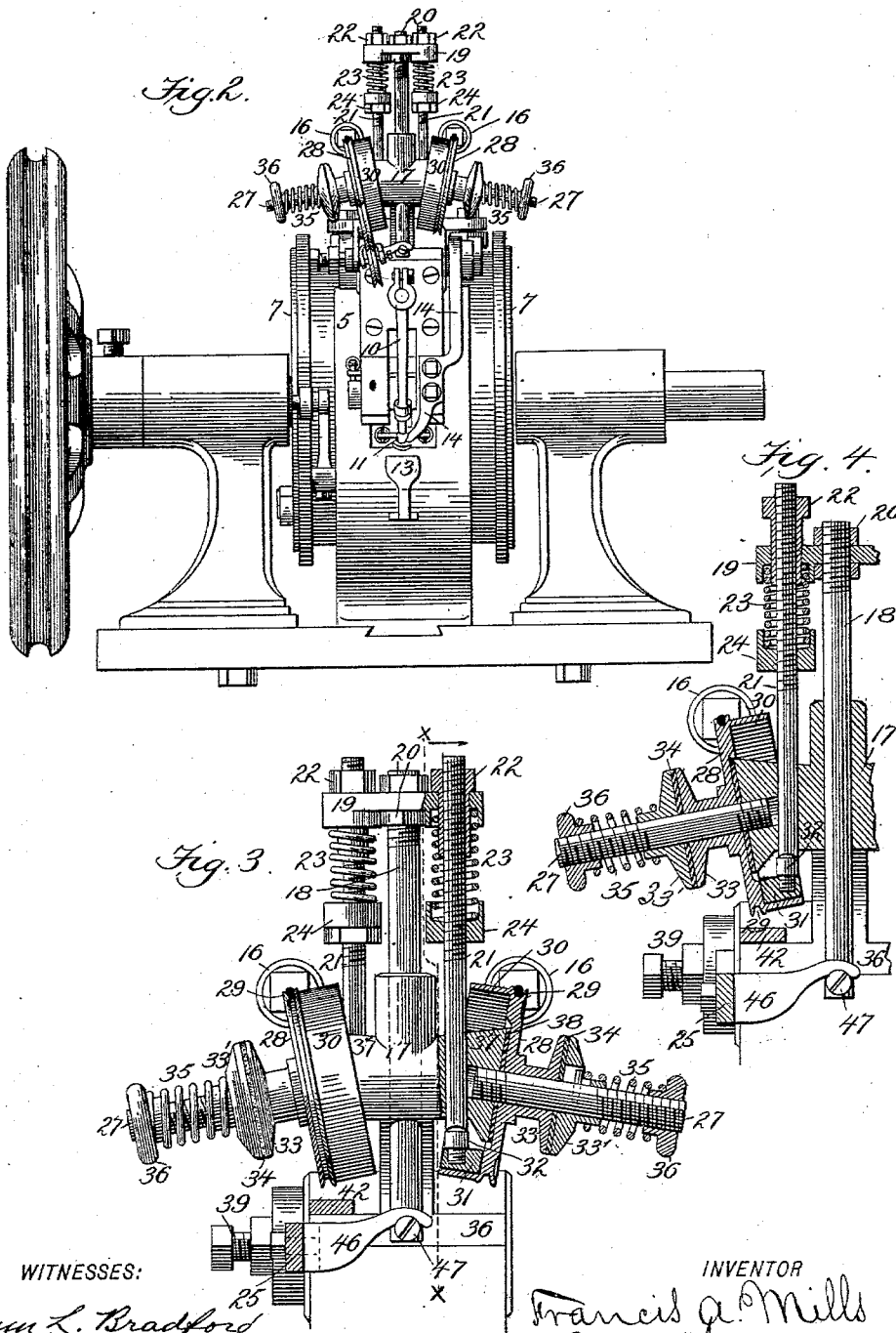
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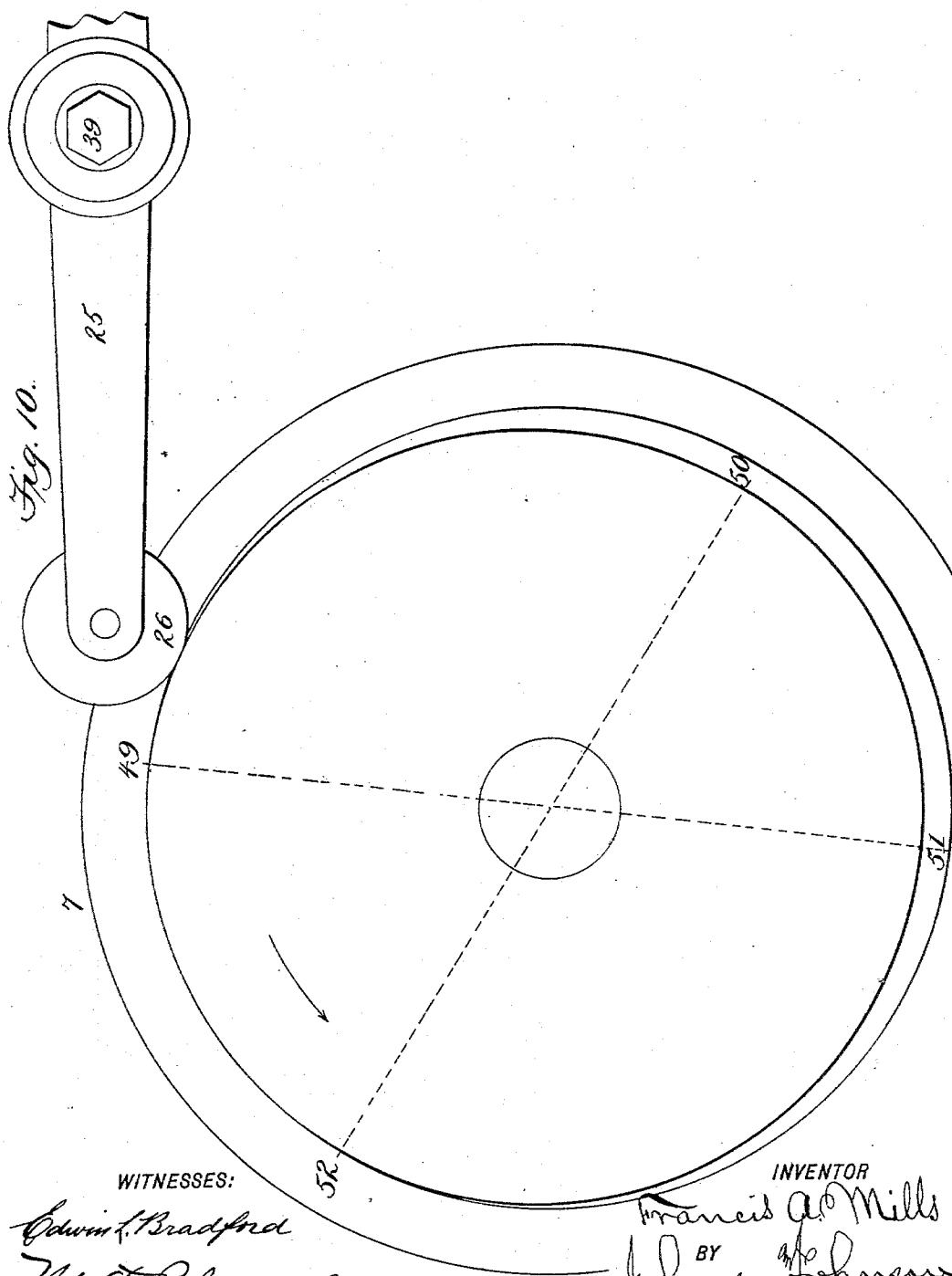
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UNITED STATES PATENT OFFICE.

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

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 563,903, dated July 14, 1896.

Application filed April 17, 1895. Serial No. 546,130. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS ARTHUR MILLS, a citizen of the United States, and a resident of the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Thread-Controlling and Tension Mechanism for Sewing-Machines, of which the following is a specification.

10 In machines for sewing shoes I have provided novel mechanism for controlling the tension of the thread in forming the stitch. In such machines organized for using a curved barbed needle and looper-finger, the operation of the stitch-forming mechanism produces a sudden strain or jerking of the thread in the eye or barb of the needle, at the time the needle is moving in the direction and under the required tension of the thread to set the stitch. In this operation, the looper having placed the thread in the eye or barb of the needle, the latter then pulls the loop through the work, and in doing so movement in the direction to set the stitch is very rapid and sudden, and the thread, having the full degree of tension, causes the loop to be brought in contact with the needle or barb by a sharp snapping action which strains and breaks the thread. It is the object of my invention to avoid this sudden thrusting or snapping of the thread against the needle and in its barb and its bad results during the full retracting movement of the same. The provision which I have made for overcoming this sudden jerking and snapping upon the thread in the eye or barb of the needle, while the thread is under the tension required to set the stitch, embraces a graduating action upon the tension at the time of the sudden snapping or jerking of the thread in the barb of the needle. Such provision operates to distribute or graduate the sudden strain on the thread against the needle during its full retracting movement in the direction of pulling in and setting the stitch. To illustrate this graduation of the tension of the thread, suppose the needle to have moved one-quarter its retracting movement and pulled in the loop that much, the tension will be gradually increased that much; and so on this ratio of increase of the tension will be effected dur-

ing the half, three-fourths, and the full retracting movement of the needle, when the full degree of tension will be put upon the thread. At this point the graduating action upon the tension ceases and the stitch is pulled in and set so that there can be no sudden snapping strain upon the thread in the eye of the needle during the full retracting movement of the same. In the same ratio and order that the tension upon the thread is given, the said tension will be released and this will be at the time of the full forward movement of the needle. It is during this movement of the needle that the graduating tension mechanism is gradually decreasing or releasing the tension and continues doing so until the looper-finger encircles the needle and is about to place the thread in the eye or barb of the same. It is at this point only that the tension upon the thread is fully released and the looper-finger is placing the thread in the barb or eye of the needle for the purpose of repeating the operation in forming the next stitch, as above stated. When the looper-finger places the thread in the eye or barb of the needle, the latter will begin to make its retracting movement, pulling with it a loop of thread through the work, and at this time the graduating tension will begin to gradually increase the tension upon the thread, which allows the needle to pull its own supply of thread from the tension-wheel under a graduated degree of tension.

I prefer to operate the tension device by what I term a "loop-meter" lever device, which, while serving to operate the tension device with a graduated action, serves also to measure out the required quantity of thread to the looper-finger to prevent the same from shortening the loop last formed by the needle and thereby prevent the slipping and abrading of the thread in the eye or barb of the needle while setting the stitch.

I attain the several objects and results by the mechanism illustrated in the accompanying drawings, which, read in connection with the following description, will enable any one skilled in the art to which my invention relates to understand its nature and to practice it in the form in which I prefer to employ it; but it will be understood that my invention

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

Referring to the drawings, Figure 1 represents the right side in elevation of a wax-thread sewing-machine embodying my invention in thread-controlling and tension-graduating mechanism. Fig. 2 shows a front view of such machine. Fig. 3 is a vertical sectional elevation of the tension device and its actuating connections, the parts being in the position they occupy when the tension is fully released upon the thread—that is, when the tension device is at the limit of its upward movement, which positions correspond to the position of the cam in its action upon the tension-operating lever from 4 to 1, as seen in Fig. 5. Fig. 4 shows a vertical section of the tension device, the parts occupying the position when the full tension is given to the thread and the tension device is at the limit of its downward movement, which positions correspond to the position of the cam in its action upon the tension-operating lever from 2 to 3, as seen in Fig. 5. Fig. 5 shows in elevation the left side of the machine and the cam-operated connection for the thread-controlling graduating-tension mechanism, the position of the needle and of the tension device corresponding to the positions of such parts, as in Fig. 3. Fig. 6 is a vertical cross-section of the tension device on the line $x x$ of Fig. 3, the friction-brake being released from pressure. Fig. 7 shows the tension-brake. Fig. 8 shows a cross-section and edge view of the tension-wheel and the wax plugs in the thread-groove thereof. Fig. 9 shows in section the thread-pulley, which is fixed below the tension-wheel; and Fig. 10 shows the cam for effecting the graduated increase and release of the tension on the thread.

Referring to Figs. 1 and 2, the machine shown is organized after the construction illustrated in my patent of August 14, 1894, No. 524,336, and it is to such machine that my present invention is adapted for use; but it is obvious that my invention in thread-controlling mechanism can be applied for use with other forms and constructions of machines.

The sewing mechanism is mounted in a housing structure or head 5, at the front end of a supporting-frame 6, within or upon which is mounted suitable cam-cylinders 7 for operating the several members of the mechanism in sewing with the loop-stitch. As such loop-stitch-forming mechanism is well understood, it is deemed unnecessary to particularly describe the elements or members thereof or their operation. A brief designation, therefore, only of the elements of such mechanism is deemed necessary in connection with my present improvements.

The needle 8 is of the curved barbed construction, and is supported by a guide 8' and

is fitted in a carrier 9, which is mounted to have a reciprocating movement in the arc of a circle in a space between the walls of and at the lower end of the sewing-head of housing 5. In front of the needle a looper-arm 10 hangs, and is mounted at a point above the needle to have an oscillating movement in front of, across the path of, and around the eyed needle 8.

A back gage 12 and a slide-rest 13 support the lasted shoe in position to the sewing mechanism, while the feed-lever 14 is mounted to operate in the channel of the sole to feed the work between each stitch, the work being held by the feed-lever and the back gage while the needle is moving to enter and draw the loop through the between substance.

The wax-pot 15 is mounted at the rear end of the machine, while the tension device is mounted upon the top of the sewing-head at the front above the looper-arm, so that the conduit 16, containing the waxing-tube for the thread, will pass from the wax-pot in a straight line to the tension device to deliver the waxed thread in close proximity to the tension-wheel.

The tension device is constructed to operate as follows: A guide and support 17 is suitably fixed upon the top of and rises from the sewing-head in about a line vertically with the hanging looper-arm. Supported by and passing vertically through this guide is a rod 18, which I call the "graduating-pressure" rod. At its upper end is fixed a horizontal cross head or arm 19, which is made adjustable by jam-nuts 20 on the screw-threaded end of the pressure-rod. At its end this arm carries in a depending position a rod 21, parallel to the pressure-rod and secured in a hole in the arm by a nut 22, by which the rod may be adjusted vertically. A coiled spring 23 is confined upon the rod in a cup-seat in the arm and a cup seated in a nut 24, adjustable upon said rod to increase or to diminish the force of the spring. The lower end of the pressure-rod terminates at about the bottom of the fixed guide and connects with a cam-operated lever 25, which is pivoted to the side of the sewing-head, and extending back has a roll 26, which engages with a cam, (see Fig. 5,) whereby the pressure-rod is caused to be actuated with a graduated vertical movement in the way and for the purpose as I will more particularly presently describe.

The supporting-guide 17 for the pressure-rod has a laterally-extending arm 27 a suitable distance above the base of the said guide, and on the arm is mounted, so as to turn freely, the tension-wheel 28, in vertical central line with which the rod 21 stands, as in Fig. 6. The tension-wheel has a circumferential groove 29 for the sewing-thread and a circumferential flange 30, which stands next to said rod, and this flange receives and supports at its lower side a friction-brake 31, preferably of semicircular form and conforming to the inner walls of the said flange and

wheel. With this brake mediatly of its length the lower end of the rod 21 engages by a socket or other suitable joint connection 32, (see Fig. 6.) so that the rod under pressure will engage the brake 31 with the walls of the tension-wheel.

To allow the rod 21 to stand within the flange of the wheel to engage the brake, the bearing-arm 27 for the tension-wheel is set on an incline downward from the guide part 17 to allow the upper part of the tension-wheel flange to clear the rod, as in Figs. 3 and 4. This inclined position of the tension-wheel with respect to the rod causes the latter, when under pressure, to force the brake against the inner wall of the flange and against the inner wall of the wheel, giving a friction contact of the brake on two of its sides against the tension-wheel and thereby more effectively controlling the wheel under the action of graduating the tension of the thread.

A supplemental tension device may be fitted upon the bearing-arm 27 of the tension-wheel for use in controlling the latter under different requirements. For this purpose the tension-wheel has a fixed sleeved disk 33, faced with a friction-pad 34, against which a like friction-disk 33', loosely mounted on arm 27, is caused to act by a spring 35, the force of which is regulated by a nut 36 on the screw-threaded end of the arm.

The tension-wheel inclining outward and downward at the top causes the wax to drip over the leaning top side of the wheel and thus keep the pressure-rod free from the wax, while the supplemental friction-pad 34, standing away from the tension-wheel, is also kept free from wax. I prefer to make the bearing-arm 27 of the tension-wheel as a separate part and to screw it into a hub part 37 of the guide 17; and I also prefer to provide the hub part with a friction-pad 38, interposed between it and the inner side walls of the tension-wheel, to cooperate with the supplemental tension device in controlling the turning of the wheel to control the tension given to the thread for setting the stitches in the work and to suit different kinds of work.

The slipping of the thread in the groove of the tension-wheel is a serious difficulty because such slipping usually takes place when the required tension is given to the thread for firmly setting the stitches. To prevent this slipping of the thread in the groove of the tension-wheel, I provide the said groove with cells 29', bored in the bottom, as shown in Fig. 8, so that the edges of the cells serve to give a biting action on the thread and thus compel the tension-wheel to turn with the feed of the thread. The cells are bored preferably radial, so that they are in the deepest part of the groove and form V-shaped ends to the holes. These cells are about an eighth of an inch apart and are only deep enough to become filled with wax from the thread, to hold it and to form a sort of sticky

bottom, which increases the friction of the thread in the groove.

I have described the operation of my graduating tension mechanism and I will now describe the connection with a cam-actuated lever of such tension mechanism and the function of such cam-actuated lever as a meter device for measuring a sufficient quantity of thread from the tension-wheel to prevent the shortening of the loop on the back of the needle.

Referring to Fig. 5, the lever 25 is pivoted mediatly of its length to the sewing-head at 39 and extends horizontally beneath and to the front of the tension-wheel, where it carries a roll 40, preferably at the upper side of said lever. A similar roll 41 is mounted on a fixed arm 42 in rear of and below the front roll. At its inner end the lever 25 is constantly pulled down by a spring 43, which connects said lever with the frame, so that the roll 26 is constantly maintained in engagement with the cam 44, which is constructed to operate the tension device under its extreme pressure and under its extreme release from such pressure, and between these extremes the graduating tension and the graduating release of such tension is made active, as I will now describe. The thread 45 from the tension-wheel passes over and around the front pulley 40 of the lever and from thence over the rear pulley 41 to the looper-finger. As the lever-roll 40 is caused to have a vertical movement with respect to the tension-wheel in its downward movement, the said roll 40 serves to pull from the tension-wheel a sufficient quantity of thread to allow the needle to make its full backward movements without shortening the loop, whereby abrading the thread in the eye or barb of the needle is prevented. At the same time this thread is being drawn for the purpose stated the lever 25, by means of an inward-projecting arm 46, engaging by a free connection at 47 the lower end of the pressure-rod 18, is imparting its graduating functions to the tension mechanism by pulling down the pressure-rod 18, and thereby to relieve the sudden contact of the thread in the eye or barb of the needle during the full retracting movement of the same.

In the position of the lever shown in full lines it has given the thread it has previously drawn from the tension device and held in store to the looper-finger to prevent it from shortening the loop. In the position of this lever as shown in dotted lines it has gradually received the thread from the tension-wheel by pulling down the pressure-rod in its graduating function upon the tension-wheel during the movement of the lever between the full lines and the dotted lines. To more particularly explain this graduating function of the tension device upon the thread at the times which I have stated, and referring to Figs. 3 and 5, the pressure-rod is shown in

the position it occupies when the tension is released and when the cam is passing to the point where it acts to raise the roll 26 and correspondingly depress the roll 40 and pull down the pressure-rod to apply the graduated pressure to the tension-wheel. In this operation the cam rotating in the direction of the arrow 48 from the point 1 to the point 2 gradually raises the roll 26 and correspondingly depresses the roll 40 and the outer end of the lever, pulling down the pressure-rod and pressing upon the brake-connecting rod 21, and thereby forcing the brake 31 upon the flange of the tension-wheel, and by such pressure applies gradually and maintains the full tension upon the thread to set the stitch. It is during this action of the tension device, by the cam moving from the point 1 to the point 2, that the loop on the needle is receiving the graduating tension to set the stitch. Continuing its revolution, the cam from the point 2 to the point 3 maintains the full tension on the thread, and the needle has commenced its forward movement to pierce the work. The needle having pierced the work, the cam rotating from the point 3 to the point 4 causes the roll 26, by the action of the spring 43, to descend, and, correspondingly raising the front end of the lever, gradually releases the tension upon the thread. During this releasing of the tension-pressure the looper-finger places the thread in the eye or barb of the needle under the extreme release of the tension. The cam rotating from the point 4 to the point 1 gives no movement to the lever 25 and therefore no vertical movement to the pressure and brake-rods, during which the needle pulls the loop through the work direct from the tension-wheel and the wax-pot and completing the forming of the loop by a graduated degree of tension. This graduated tension has the effect of breaking and distributing the sudden contact of the thread by the instrumentality which sets the stitch.

In the operation of my invention I do not limit myself to a needle-stitch-tightening mechanism, as my graduated-tension mechanism can be applied to and used with a take-up stitch-tightening mechanism. Nor do I limit myself to the loop-measuring device as the means for operating the graduated tension mechanism which I have shown. I, however, prefer the cam-operating lever connections which I have shown and described, because of their simple construction and adaptation for use with means whereby a sufficient quantity of thread is measured to prevent the shortening of the loop last formed on the back of the needle. The timing of the loop-meter and the application and release of the tension on the thread are in unison and effected by the same cam-actuated lever device.

In applying the brake to the tension-wheel it is important to notice that the brake-connecting rod in its function applies the pressure of the spring 23 to the brake, and this is caused by the descent of the pressure-rod,

which, by its cross-head, compresses the said spring, as seen in Fig. 4, the lever by its arm 46 having pulled down the pressure-rod 18 from the nut 22 of the brake-rod 21 against the pressure of the spring.

In Figs. 3 and 6 the spring 23 is shown as having raised the pressure-rod and its cross-head up and in contact with the nut 22 on the brake-rod, while the lever-arm 46 serves as a stop to limit the upward movement of the pressure-rod in releasing the action of the brake and the tension of the thread. In this position of the spring there is no pressure upon the brake and it merely rests upon the flange of the tension-wheel, the point 32 being a coupling that allows free vertical movement of the rod and holds the shoes from turning with the tension-wheel. For this purpose the shoe has a forked lug, with which the end of the rod 21 engages. While the release of the tension on the thread is gradual, the action of springs 23 and 43 keeps the lever-roll 26 down upon the cam and also keeps the other end of said lever in its proper acting connection with the pressure-rod 18. As this rod 18 is constantly pressed upward by the spring 23 and the rod 21 thereby constantly pressed down upon the brake, there can be no jumping movement of the pressure-rod and of the lever 25, and the actuating parts of the tension device work in close contact with easy and smooth movements.

For the purpose of regulating the quantity of thread drawn by the meter device from the tension device, the bearing-arm 49 for the pulley 40 is connected by slot and bolt to the end of the lever 25, so that it can be adjusted vertically to bring its roll nearer to or farther from the fixed roll 41. In this adjustment the setting of the roll-arm higher brings the roll 40 nearer to the tension-wheel and causes the meter to draw a less quantity of thread from the tension device, the setting of the roll 40 away from the tension-wheel gives the reverse action, and in this way the required given quantity of thread can be regulated and automatically measured to the looper for the purpose stated.

I prefer to make the thread-roll 41 with points bearing on the ends of screws in the forked end of the arm 42, as seen in Fig. 9, because it reduces the wear-surface to a minimum, and lessens the friction which the accumulation of wax would produce and gives an easier movement to the roll.

While I have described the tension for a single thread, I have shown a duplex construction of such device and an adaptation for two separate and independent threads for use separately with the machine for light and for heavy work. These two independent tension devices are mounted upon the same support 17 on arms on the opposite sides thereof.

Each tension-wheel is loosely mounted on its arm and both arms stand inclining downward from the support.

The parts of each tension device are of identical construction and the brake-connecting rod of each device connects with the cross head or arm 19 of the pressure-rod and the brake-shoe of each tension-wheel. Each tension device can be properly set or adjusted, one for a thread for heavy work and the other for a thread for light work, so that the machine may be kept in readiness for using either thread to suit the work. For each tension-wheel and its thread, it will be understood, there is a wax-conduit 16, which is suitably supported upon the top of the frame and connect with and are supplied with wax from the same wax-pot 15.

In sewing shoes of light and heavy stock it is the practice to change the thread in the machine to suit the different work. This gives much trouble with a single tension device. In the duplication of the tension each is provided with its thread and kept in readiness for use, the one not being in use being held out of the way on the looper-arm or otherwise. The tension of each device can be set to suit the thread with which it is supplied, and this gives a uniform tension for all work of the same class. Any suitable heating, waxing, and stripping devices may be used that will deliver the waxed threads in close proximity to the tension-wheels; but my tension device is neither limited to its location upon the machine or its connection with the waxing appliances.

The same pressure-rod by its cross-head operates either brake-rod or both together, and the same meter-lever and its connections operate either brake-rod or both together; but it will be understood that one of the tension devices can be put out of use, if desired, when the other is being used. It will make no difference, however, in the operation of the machine if both tension devices are operated together. As the tension-wheel stands obliquely to the pressure-rod, the thread-rolls 40 and 41 stand in the same line to receive the thread therefrom and deliver it to the looper, as shown in Fig. 2. The thread 45 is waxed as it passes through the conduit 16, which is also heated by steam from the water-chamber of the wax-pot.

It is evident that immaterial changes may be permitted from the general construction and arrangement of parts contributing toward my invention, and for this reason I do not wish to be understood as limiting myself in precise details and construction.

It will also be understood that many of the devices above described are not all essential to the several features of my invention separately considered.

In Fig. 10 I have shown an enlarged view of the cam and a part of the lever 25 for operating the tension device, and reading this drawing with the following description will enable any person skilled in the art to readily understand the graduating action of the tension upon the thread. Supposing the

cam-wheel to be moving in the direction of the arrow, the surface from 49 to 50 acts gradually to release the tension on the thread, and during this time the needle has made its full forward movement and pierced the work to receive the thread. During this movement of the needle the looper-finger has encircled the needle and is about to place the thread in its barb. In the turning of the cam from 50 to 51 the tension upon the thread is fully released and the looper-finger is placing the thread in the barb of the needle, and it is at this time only that the thread is fully released of tension from the brake. It is immediately between these points 50 and 51 that the needle has made its full forward movement, and has commenced its backward movement with a loop of thread. In the turning of the cam from 51 to 52 the tension upon the thread is being gradually added or increased and the needle is making its backward movement in the direction of pulling in and setting the stitch. It is therefore during the full backward movement of the needle that the thread is receiving the required amount of tension to set the stitch, and it therefore does not have a snapping action in the barb of the needle, but has a yielding function therein. When the cam has reached the point immediately between 52 and 49, the stitch has been set and the needle has made its full backward movement, and it is at the same point it commences its forward movement again to form another stitch.

Whatever may be the degree of tension set upon the thread, the tension-wheel is free to rotate under its graduated tension, and in this particular is distinguished from tension devices that are locked and released. As it is important that there should be no lost motion in the action of the pressure-rod and its connected brake-rod upon the tension-wheel, I provide for adjusting the pressure-rod cross-head in its relation to the brake-rod by the jam-nuts 20 20, so that the lever-roll 26 will always be in contact with its operating-cam and the lever-arm 46 will always have a bearing contact at its connection with the pressure-rod 18, as seen in Figs. 3 and 5. In this connection it will be seen that the spring 43 of the lever and the spring 23 of the brake-rod cooperate to force the lever down on its cam and to lift the pressure-rod, while the cam and the nut 22 cooperate to lift and to limit the upward movement of the brake-rod in releasing the brake, the nut 22 giving the proper adjustment, so that when released from pressure the brake will merely rest upon the flange of the tension-wheel. In this action the free joint connection of the brake-rod with the brake allows the rod 22 to rise without lifting the brake, and the vertical movement of this rod is only sufficient to give a gradual pressure upon the brake and a gradual release of such pressure during certain parts in the revolution of the cam.

I claim as my invention—

1. In a sewing-machine, the combination with stitch-forming mechanism and a stitch-tightening device, a tension-wheel for the thread and a brake-shoe for said wheel, of a pair of vertically-guided rods one of which is spring-sustained upon the upper end of the other, the lower end of which rests upon the said shoe, and suitable means connecting the spring sustained rod for depressing it against the resistance of its sustaining-spring in the way and for the purpose stated.

2. In a sewing-machine, the combination with stitch-forming mechanism and a stitch-tightening device, a tension-wheel for the thread and a brake for said tension-wheel, of a device for applying a graduated tension and a graduated release of said tension upon the thread-wheel, consisting of a spring-sustained rod mounted to have a free vertical movement and having free connection with said brake, a cam and a spring-actuated lever connecting said spring-sustained rod and cam for operation in the way described.

3. In a sewing-machine, a tension-wheel for the thread having a groove for the thread and circumferential flange, a brake arranged to operate upon said flange, a pressure-rod connecting said brake, a spring for releasing the pressure of said brake, a cam, and a lever connecting said pressure-rod and cam for operation in graduating the tension and the release of said tension upon the thread substantially in the way and for the purpose stated.

4. The combination, substantially as described, of a tension-wheel having a groove for the thread and a circumferential flange, a brake arranged to operate upon said flange, a pressure-rod, a fixed guide for the latter, a brake-connecting rod and fixed guide therefor, a spring on said brake-rod, and a cam and a lever connecting said cam and pressure-rod for operation in graduating the tension and the release of the tension upon the thread for the purpose stated.

5. In a sewing-machine, the combination, with a fixed guide having a downwardly-inclined side arm, a tension-wheel mounted to turn freely on said arm, having a groove for the thread and a circumferential flange, a brake arranged to act on the inner wall of said flange, a rod vertically movable in a guide in said arm and having a spring acting to force said rod away from said brake, a pressure-rod movable vertically in said guide and having a sliding connection upon said brake-rod and upon the spring thereon, a lever at one end connecting said pressure-rod and a cam connecting the other end of said lever, the said cam being constructed and timed to operate the brake in the way and for the purpose stated.

6. The combination, in a sewing-machine, of a lever and a cam and a spring for actuating said lever vertically, with a pressure-rod arranged to be depressed by said lever, a supplemental rod arranged to be depressed by the pressure-rod under the compression of a

spring, a tension-wheel having a circumferential flange, a brake conforming to the curve of the inner wall of said flange and engaging the lower end of said spring-pressed rod, and a supplemental friction device acting on the tension-wheel at right angles to the action of the brake, whereby the tension upon the thread is controlled in the way and for the purpose stated.

7. The combination of waxing and heating appliances for wax-thread sewing-machines, with a tension-wheel for the thread having a circumferential flange or rim, a fixed downwardly-inclined arm on which the said wheel is mounted, a fixed guide and a rod vertically movable within said guide, crossing the center of the wheel, a pressure-rod vertically movable within said guide and connecting and suspending the side rod, a spring upon the latter exerting an upward force upon the pressure-rod, a brake acting upon the inner wall of said flange and engaging the said suspended rod, and a spring-pressed friction-pad interposed between the inner wall of said wheel and the said guide and suitable means for depressing the said pressure-rod and its connected brake with a graduated movement and for releasing such pressure with a corresponding graduated movement, substantially as set forth.

8. In a sewing-machine, a tension device for the thread, consisting of a tension-wheel having a circumferential flange, a brake maintained in its seat by gravity upon the inner wall of said flange, a spring-controlled pressure device having a free connection with said brake and a cam and spring-actuated lever having a free connection with said pressure device for operating the brake in the way described.

9. In a sewing-machine, the combination of the grooved tension-wheel for the thread, the brake 31, its connected brake-rod 21, the spring 23 and nut 22 thereon, the pressure-rod 18, its cross head or arm 19 and jam-nuts 20, the lever-arm 25, its spring 43 and the cam 44, constructed to operate substantially as described.

10. For a sewing-machine, a duplex-tension device for the thread, consisting of a fixed guide having oppositely-projecting arms, a flanged tension-wheel upon each arm, a brake-pad seated loosely upon the inner wall of the flange of each wheel, a spring-sustained pressure-rod vertically movable within said guide between said wheels and carrying spring-pressed rods freely engaging said brakes, in combination with a lever engaging said pressure-rod, a cam and a spring actuating said lever in the way and for the purpose stated.

11. In a sewing-machine, the combination, with sewing mechanism and a grooved tension-wheel, a brake arranged to act upon said wheel, the lever 25 having the rolls 26 and 40, and the fixed thread-roll 41 disposed as described, mechanism connecting said lever

and brake, and a cam timed and constructed to operate the tension device with a graduated action and to measure out the required quantity of thread to the looper of said sewing mechanism in the way and for the purpose stated.

12. In a sewing-machine, a grooved tension-wheel having a circumferential flange and arranged oblique to a vertical line, in combination with a brake having a form corresponding with the said flange, a rod vertically crossing the axis of said wheel at its flanged side and engaging the brake, and means for operating said rod to force the brake in frictional contact with the flange and with the inner side of said wheel, substantially as described.

13. In a sewing-machine, the combination, with a tension-wheel for the thread, a brake for said wheel, a pressure-rod and means constituting a yielding connection between said pressure-rod and the brake, of a cam and a spring-pressed lever connecting the cam and the pressure-rod, the said cam being con-

structed and timed to operate the said pressure-rod with a graduated descent upon the yielding brake connection to apply the brake and with a gradual ascent to release said brake and to maintain the pressure-rod without movement for the purpose stated.

14. In a thread-tension mechanism, the combination of the grooved and flanged tension-wheel, with a curved friction-brake loosely seated upon the inner wall of the wheel-flange, and means for positively and gradually pressing said brake against the wheel and for positively and gradually releasing said brake from the wheel in the way and for the purpose stated.

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

FRANCIS ARTHUR MILLS.

Witnesses:

EUGENE ZIEGLER,
THOMAS M. BINKER.