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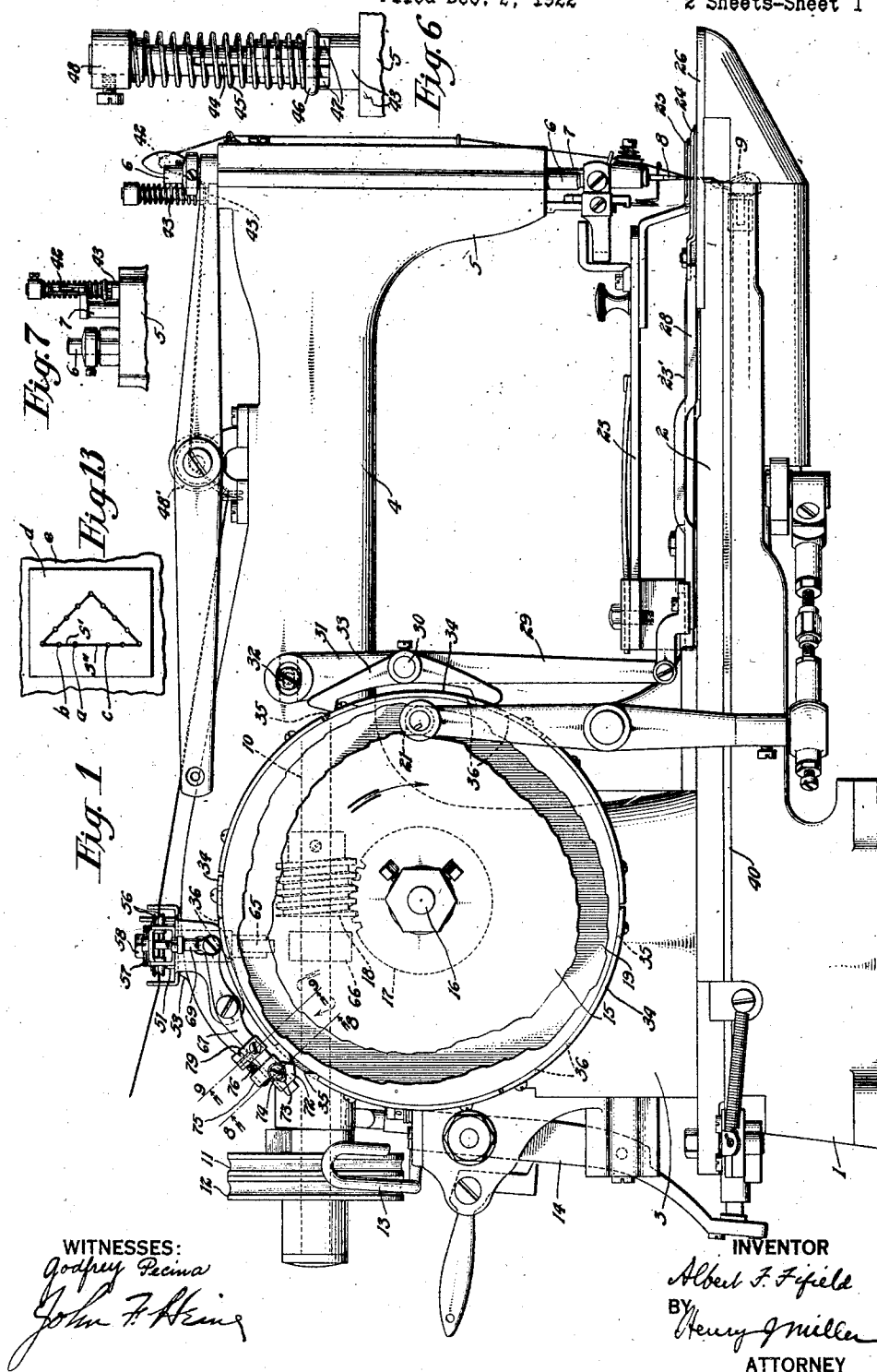
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THREAD TENSION MECHANISM FOR SEWING MACHINES

Filed Dec. 2, 1922

2 Sheets-Sheet 1



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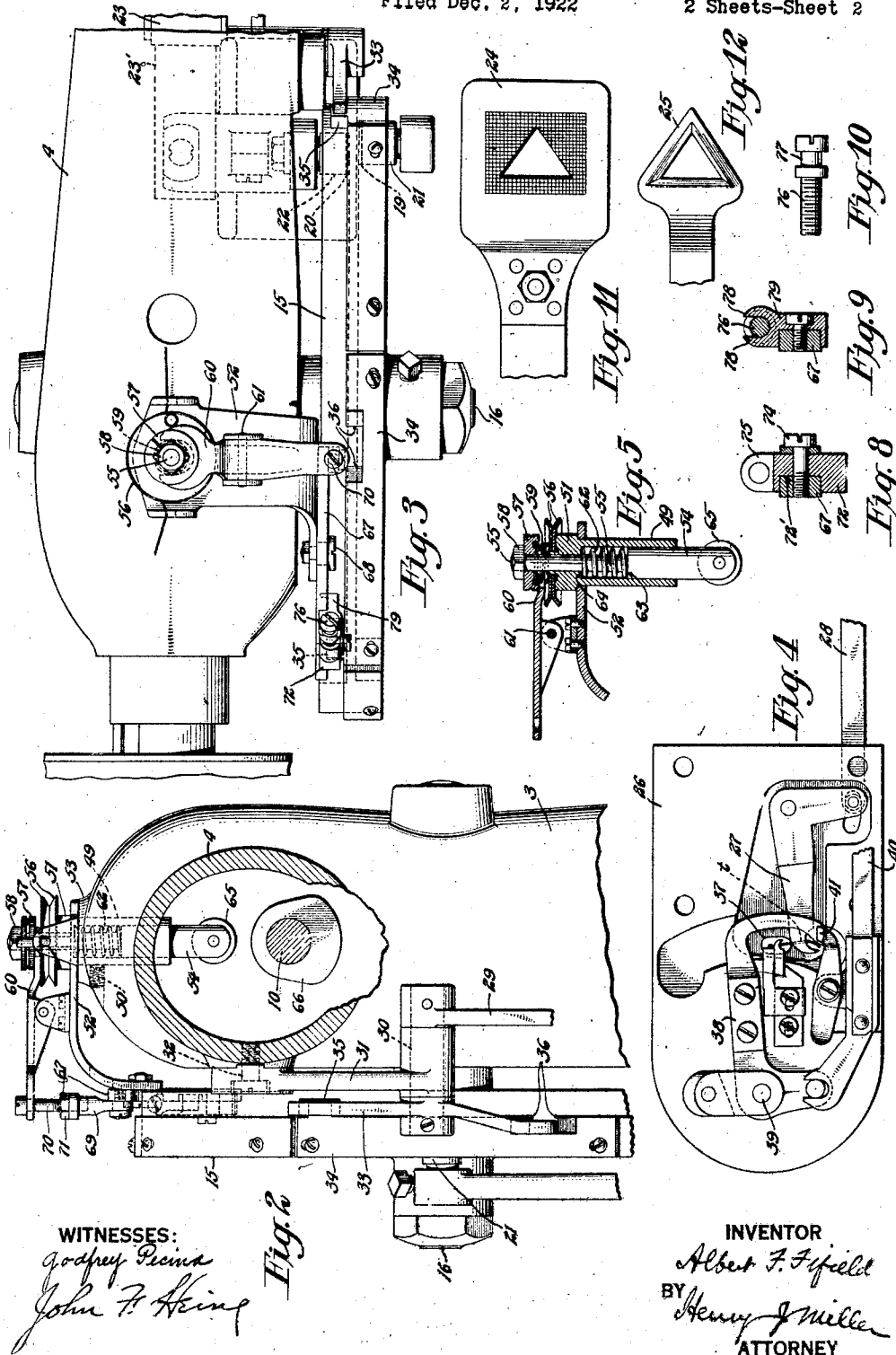
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THREAD TENSION MECHANISM FOR SEWING MACHINES

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE.

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THREAD-TENSION MECHANISM FOR SEWING MACHINES.

Application filed December 2, 1922. Serial No. 604,469.

To all whom it may concern:

Be it known that I, ALBERT F. FIFIELD, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Thread-Tension Mechanisms for Sewing Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to sewing machines and particularly to sewing machines of the type adapted to form a group or predetermined number of stitches and then come to rest. Such machines are adapted for tacking, barring, sewing on buttons etc., and are customarily equipped with a stop-motion device for arresting the operation of the machine after the desired group of stitches has been formed. Such machines are also customarily equipped with thread-cutting and thread-end holding mechanism for severing the sewing thread at the completion of each sewing operation and for holding the beginning end of the needle-thread during the formation of the initial stitches of a group.

Heretofore, more or less difficulty has been experienced, particularly with rotary-looper chain-stitch machines having an intermittent thread-tension, in sewing the initial stitches; the thread being either broken or pulled out of the thread-end holding device. Some machines employ a pull-off for supplying slack thread to enable the initial stitches to be formed but it is difficult to produce satisfactory work on such machines for the reason that where a pull-off is used there is a pronounced tendency for the initial stitches to be loosely set up.

In the machine disclosed in my copending application Serial No. 435,599, filed January 7, 1921, there is employed a thread-gripper below the throat-plate and an intermittent tension or thread-lock at the rear end of the bracket-arm; a yielding thread-guide being provided adjacent the upper end of the needle-bar to yield enough slack thread to prevent the beginning end of the thread from being pulled out of the gripper on the second up-stroke of the needle-bar. In this machine, however, the tension of the yielding thread guide is made heavy so that said guide will not yield to normal sewing

strains on the thread but will function as a stationary thread guide except when the thread is subjected to abnormal strain, as when sewing the initial stitches, at which latter time the thread is subjected to the rather heavy tension imposed by the yielding thread-guide as it yields enough to balance the rather heavy tension of the thread-gripper below the throat-plate. While such a machine is satisfactory for sewing on buttons it is found that it is not well adapted for sewing work of a yielding or easily damaged character, such as the sewing of paper tickets on clothing, inasmuch as the heavy initial tension on the thread causes the thread between the first and second needle punctures to cut through the paper.

An object of the invention, therefore, is to improve the thread-controlling mechanism disclosed in my said copending application, so that the machine will sew soft or easily damaged work in a satisfactory manner.

Another object of the invention is to provide a sewing machine of the class described, with means whereby the beginning thread-end may be controlled and the initial stitches properly formed and set up, without subjecting the thread to heavy tension.

Another object of the invention is to obviate the necessity of providing the machine with a pull-off for supplying slack thread for the sewing of the initial stitches, as has heretofore been done to prevent the beginning thread end from being pulled out of the gripper, as the use of a pull-off usually results in loosely set up initial stitches.

Further objects of the invention will in part be obvious and in part more fully hereinafter described.

To the ends in view, the tension device and, in rotary-looper chain-stitch machines, the intermittent tension device or thread-lock, is provided with an automatic or feed-cam operated connection whereby the thread will be permitted to run under a light tension from the supply as the looper is drawing out the second needle-loop and the needle-bar is completing its second up-stroke; the beginning thread-end being held below the work.

In the accompanying drawings, Fig. 1 is a side elevation of a sewing machine embodying the invention. Fig. 2 is a vertical

transverse section through the overhanging bracket-arm of the machine, looking toward the standard. Fig. 3 is a fragmentary top plan view of the machine. Fig. 4 is a bottom plan view of the throat-plate of the machine. Fig. 5 is a vertical section through the tension device. Fig. 6 is a large scale elevation of the yielding thread guide adjacent the needle-bar. Fig. 7 is a fragmentary front end elevation of the bracket-arm. Fig. 8 is a section on the line 8, 8, Fig. 1. Fig. 9 is a section on the line 9, 9, Fig. 1. Fig. 10 is an elevation of the adjusting screw for timing the tension releasing mechanism. Fig. 11 is a plan view of the lower work clamping member or work supporting plate. Fig. 12 is a plan view of the upper clamping member or foot, and Fig. 13 illustrates a sample of work produced by the particular machine chosen for the purposes of the present disclosure.

For the purposes of the present disclosure, the invention will be described as embodied in a Singer class 114 single-thread sewing machine such as disclosed in my said copending application. Such a machine comprises a base 1, work-supporting arm 2, standard 3 and overhanging bracket-arm 4, terminating in the head 5 in which are journaled the usual clamp-opening and needle-bars 6 and 7, respectively, the latter carrying the needle 8 which cooperates with the rotary looper 9 to form single-thread chain-stitches.

The mechanism of the machine is operated by the usual connections with the main-shaft 10 which is journaled within and longitudinally of the bracket-arm 4 and at its rearward end carries the tight and loose pulleys 11, 12, for the driving belt which runs through the belt-shifting guide 13 carried by the starting and stopping lever 14 of the usual automatic stop-motion device such as shown in the patent to J. J. Sullivan, No. 777,564, of December 13, 1904. This stop-mechanism automatically brings the machine to rest with the needle out of the work at the end of each stitching period, or after a predetermined number of stitches have been formed.

As is usual in machines of this character, mechanism is provided for producing relative movement between the work and needle to group the stitches according to the desired arrangement. This mechanism, which is substantially that disclosed in the Sullivan patent above referred to, comprises a feed-wheel 15 mounted in a vertical plane at one side of the standard 3 on a shaft 16 passing transversely through the standard 3 and carrying a gear 17 with which meshes a driving worm 18 on the main-shaft 10. The feed-wheel is formed in its side faces with lateral and longitudinal feed cam-grooves 19 and 20, respectively, entered by follower rolls 21, 22, carried respectively by the usual lateral and longitudinal feed connections with the work-clamp 23 carried by the clamp supporting bar 23' slidably mounted on the bed 2. The work-clamp includes a lower work-supporting plate 24 and an upper clamping foot 25 between which the work is held for the stitching operation. The present machine is adapted to attach paper tickets *d* to clothing *e* by a triangular "tack" or group of single thread chain-stitches, such as shown in Fig. 13; the first needle puncture being made at *a*, the second at *b* and so on around the triangle. The next to the last needle penetration is made at *c* and the last one at *a*. The last stitch *s''* between the points *c* and *a* is noticeably longer than the adjacent stitches and the stitch *s''* therefore stands out prominently and may be selected at a glance for raveling out the seam when it is desired to remove the ticket from the article to which it is attached. The feed-wheel 15 is adapted to make one revolution for three complete groups of stitches and may therefore be divided into three similar sections each 120° in extent.

The machine is preferably equipped with thread-cutting and thread-end gripping mechanism constructed substantially in accordance with the disclosure of my copending application Serial No. 435,599, filed January 7, 1921, and comprising the throat-plate 26 having mounted on its under side the thread-end gripping lever 27 in the form of a bellcrank actuated by a link connection 28 from the lower end of an arm 29 fixed to a rock-shaft 30 journaled in a bracket 31 screwed rigidly at 32 to the bracket-arm 4. A two-armed lever 33 is secured to the rock-shaft 30 and is actuated by the three similar cam-plates 34 mounted peripherally on the feed-wheel 15. Each of the cam-plates 34 comprises a lateral projection 35 and notch 36 so spaced peripherally of the feed-wheel 15 as to coact simultaneously with the opposite ends of the lever 33. That is, when the upper end of the lever 33 rides up on the projection 35, Fig. 1, the lower end of such lever enters the notch 36. Also, when the lower end of the lever 33 rides out of the notch 36, the upper end rides off of the projection 35. The lever 33 is thus given a single to-and-fro rocking motion for each stitching period, and the timing is such as to cause the thread-gripper 27 to wipe across the needle-hole 37 after the looper has pulled down the beginning end *t* of the needle-thread and substantially as the needle reaches the end of its first up-stroke, thus seizing the needle-thread end *t* and gripping it against the under surface of the throat-plate, as shown in Fig. 4, until the needle reaches the end of its second up-stroke. The thread-cutting mechanism comprises a bell-

crank-lever 38 pivoted at 39 on the under side of the throat-plate and connected to be operated by means of the usual over-throw side-motion of the stop-lever 14, which gives an endwise impulse to the link 40 as the main-shaft 10 is brought to rest. This well-known endwise impulse given to the link 40 causes the lever 38 to be swung about its pivot 39 whereby it is caused to seize the work limb of the last needle-loop on the looper and carry it over into engagement with the fixed knife 41, thus severing the thread.

The machine is fitted with the usual take-up thread-guide 42 which is mounted on the upper end of the needle-bar 7 and cooperates with the thread-guiding post 43 adjacent thereto. The thread-guiding post 43 is essentially a fixed or stationary thread-guide. It is slotted at 44 and surrounded by a spring 45 which presses downwardly upon a collar 46 normally seated upon the raised portions 47 at each side of the slot 44. A collar 48 adjustably secured to the upper end of the post 43 permits the tension of the spring 45 to be regulated. In practice, the tension of the spring 45 is made rather heavy so that the collar 46 will normally remain seated upon the raised portions 47 during the sewing. The spring 45 will yield, however, to abnormal strains or strains in excess of a predetermined limit. This thread-guide is disclosed in my copending application Serial No. 407,623, filed September 2, 1920. A constant tension device 48' is provided for applying a normal uniform tension to the needle-thread.

The usual intermittent tension or thread-lock is also employed for arresting the feed of the thread while a new needle-loop is being drawn out by the looper and the previous needle-loop drawn up. This tension device is of common construction and comprises a sleeve 49 secured in a vertical hole in the top of the standard 3 by means of the set-screw 50. The sleeve 49 is formed with a head 51 which clamps the bracket 52 firmly against the seat 53 on the standard 3. Slidably fitted within the sleeve 49 is the plunger 54 having a reduced upward extension 55 projecting above the head 51 of the sleeve 49 and through apertured tension disks 56. A thumb-nut 57 and lock-nut 58 are screwed onto the upper end of the plunger 54. A light spring 59 is interposed between the thumb-nut 57 and upper tension disk 56. The spring 59 and extension 55 are embraced by the forked end of a tension releasing lever 60 fulcrumed at 61 on the bracket 52. The thumb-nut is caused to exert pressure upon the tension disks 56 by means of a spring 62 which surrounds the reduced portion 55 of the plunger 54 within the sleeve 49 and reacts against the shoulder 63, Fig. 5, on the plunger and a shoulder

64 within the sleeve 49. The plunger 54 carries a roller 65 at its lower end which is lifted to open the tension once for each stitch by a cam 66 on the main-shaft 10. The cam 66 is so shaped and timed as to release the tension when the needle has executed about nine-tenths of its complete up-stroke or has moved about three-fourths of its distance above the work on its up-stroke or, in other words, when the looper has almost fully expanded the new needle-loop and has drawn up the previous needle-loop. When the intermittent tension is released, the looper, in completing its expansion of the needle-loop and the needle-bar in completing its up-stroke, draw needle-thread from the supply through the constant tension 48' and the released intermittent tension. The intermittent tension is permitted to close tightly under the influence of the spring 62 as the point of the needle enters the work. The purpose of the light spring 59 is to exert a very light tension on the thread when the plunger 54 is lifted to relieve the thread of the heavy tension of the spring 62. This light tension prevents the thread from over-running under sudden jerks or demands upon the thread by the stitch-forming mechanism or thread controlling devices, and thus insures repeatedly uniform results from the action of the thread-controlling devices.

The machine disclosed in my said copending application Serial No. 435,599, embodies substantially the constructive features heretofore described, with the exception of the tension release lever 60. This prior machine is adapted for sewing on buttons and the beginning end of the needle-thread is gripped as usual against the under side of the throat-plate by the gripper 27, as the needle reaches the limit of its first up-stroke. During the second reciprocation of the needle, from the time the needle enters the work until it executes about nine-tenths of its second up-stroke, the thread is practically locked by the intermittent tension and, its free end being also gripped below the work, it follows that there is not normally enough slack-thread between the points where the thread is gripped to permit the needle-loop to be expanded by the looper. Under these conditions in said prior machine the strain on the thread causes the spring 45 of the stationary thread-guide 43 to yield enough thread to the stitch-forming instrumentalities to permit the needle-loop to be expanded and, as soon as the intermittent tension releases the thread, the spring 45 reseats the collar 46 upon the raised portions 47 and pulls thread from the supply, being much stronger than the tension 48'.

A machine of this character is, however, not adapted for certain classes of work, such as sewing paper-tickets on clothing, for the

reason that the abnormal tension exerted on the thread during the second reciprocation of the needle causes the first stitch *s'* laid on top of the paper, Fig. 13, to cut through the same and damage the work. Any work of delicate texture would be damaged in a like manner whereas a button, being hard, will resist this strain on the thread. To overcome this tendency to damage the work is one of the particular objects of the present improvement.

This object is attained by providing suitable connections with the tension-releasing lever 60 previously described, whereby the heavy intermittent tension is relieved or prevented from closing during the second reciprocation of the needle. Such connections may comprise a cam-follower lever 67 fulcrumed on the screw 68 carried by the bracket 52 and having connected to one of its ends the link 69 of adjustable length and including a headed screw 70 passing freely through a hole in the free end of the lever 60 and threaded to the desired extent into the main body-portion of the link 69. A lock-nut 71 secures the screw 70 in the desired position of adjustment. Adjustably mounted on the other end of the lever 67 is the cam-follower 72 having a groove 72', Fig. 8, the walls of which embrace the lever 67. The follower 72 has a slot 73, Fig. 1, in its side face through which passes a screw 74 for tightening it upon the lever 67. It also has an upward extension 75 in which is threaded an adjusting screw 76, the head of which is circumferentially grooved at 77, Fig. 10, to receive the spaced extensions 78 of the anchor block 79 fixed to the lever 67. By turning the screw 76 the cam-follower 72 may be adjusted lengthwise of the lever 67 to vary the time at which it is acted upon by the actuating cams 35.

The lever 67 is so located that the cam-follower 72 is in position to be acted upon by the cam extension 35 of one of the three peripheral cam-plates 34 previously described. It is preferred to so adjust the follower 72 that the plunger 54 of the intermittent tension will be lifted to release the work on its second reciprocation, and hold it open until the needle reaches the end of its second up-stroke. The thread will thus be substantially free to run from the supply through the constant tension 48' as the looper expands the needle-loop first seized after the thread-end is gripped by the gripper 27. The strain on the thread will be materially relieved and the danger of the thread breaking or cutting into the work obviated. Also, the danger of pulling the free end of the needle-thread out of the gripper 27 will be overcome, and greater certainty of operation secured.

Many machines having a thread-cutter and thread-end gripper provide a pull-off for drawing a supply of slack-thread through the tension preparatory to the sewing operation, so that enough thread will be available on the work side of the tension to meet the requirements of the stitch-forming instrumentalities during the formation of the first stitch after the thread end is gripped.

Unless the pull-off is carefully adjusted to pull off exactly the correct amount of thread the result will be unsatisfactory. If too little thread is pulled off the thread will be unduly strained by the demands of the stitch-forming mechanism. If too much thread is pulled off there will be a surplus of thread between the intermittent tension and the work at the beginning of the third reciprocation of the needle and the needle-loop shed by the looper will not be fully drawn up as the looper expands the new needle loop. Even if it were possible to closely adjust the pull-off to meet the requirements of a given thread, at a given time, the results would not be permanent since the elasticity of the thread varies with its quality, and also varies with changes in the humidity of the atmosphere. For these and other reasons it has been found difficult to maintain a correct adjustment of a pull-off under varying sewing conditions. By eliminating the pull-off and permitting the stitch-forming mechanism to pull from the supply under a constant tension the exact amount of thread required for the expansion of the first needle-loop during the second reciprocation of the needle, it follows that the correct amount of thread is always thus provided between the intermittent tension and the work for the first complete loop shed by the looper to be fully drawn up under normal sewing strains. The initial stitches are thus well set up under all conditions apt to be met with in practice and without the necessity of repeatedly making careful adjustments to meet changing conditions.

Having thus set forth the nature of the invention, what I claim herein is:—

1. A sewing machine having, in combination, stitch-forming mechanism, a work-holder, means for relatively moving them to sew a group of stitches, a take-up, a tension device above the work-holder, means for holding the beginning end of the needle-thread, and means for holding the tension device released during the second reciprocation of the needle to permit the thread to run freely from the supply and prevent abnormal straining of the thread.

2. A sewing machine having, in combination, stitch-forming mechanism, a work-holder, means for relatively moving them to sew a group of stitches, an intermittent tension device normally operating to ten-

sion and release the thread during each stitch-forming cycle, means for holding the beginning end of the needle-thread and automatic means for preventing the closing of the intermittent tension device during the second reciprocation of the needle.

3. A sewing machine having, in combination, stitch-forming mechanism, a work-holder, means for relatively moving them to sew a group of stitches, a constant tension device, an intermittent tension device normally operating to tension and release the thread during each stitch-forming cycle, means for holding the beginning end of the needle-thread, and automatic means for preventing the closing of the intermittent tension device during the second reciprocation of the needle, whereby the exact amount of thread required by the stitch-forming mechanism during the second reciprocation of the needle will be pulled from the supply through the constant tension device.

4. A sewing machine having, in combination, stitch-forming mechanism, a work-holder, means including a feed-cam and connections for relatively moving the stitch-forming mechanism and work-holder to sew a group of stitches, means for nipping the free end of the needle-thread at the beginning of the sewing, an intermittently operated thread-tension on the thread-supply side of the needle, and means on the feed-cam and connections for preventing the normal closing of the intermittent thread-tension during the second reciprocation of the needle.

5. In a sewing machine, a thread-tension device, a tension-releasing cam, a tension-releasing lever connected to said thread-tension device and extending substantially tangentially of said cam, and a cam-follower carried by said lever and adjustable lengthwise of the latter.

6. In a sewing machine, a thread-tension device, a tension-releasing cam, a tension-releasing lever connected to said thread-

tension device and extending substantially tangentially of said cam, a cam-follower carried by said lever, and means for adjusting said cam-follower lengthwise of said lever.

7. In a single-thread sewing machine, in combination, stitch-forming mechanism including a reciprocating needle and a rotary chain-stitch looper, an intermittent thread-tension device normally operating to tension and release the thread during each stitch-forming cycle, a nipper for holding the beginning end of the needle-thread during the formation of the initial stitches, a take-up, a work-holder, a feed-wheel and connections for relatively moving the stitch-forming mechanism and work-holder to sew a group of stitches, and means for preventing the normal action of said intermittent thread-tension device during the second reciprocation of said needle, whereby thread may be pulled from the supply by the stitch-forming instrumentalities during the formation of the stitch next following the nipping of the beginning end of the needle-thread.

8. In a single-thread sewing machine, in combination, stitch-forming mechanism including a reciprocating needle and a rotary chain-stitch looper, an intermittent thread-tension device, a nipper for holding the beginning end of the needle-thread during the formation of the initial stitches, a take-up, a work-holder, a feed-wheel and connections for relatively moving the stitch-forming mechanism and work-holder to sew a group of stitches, and a cam on said feed-wheel and connections for preventing the normal action of said intermittent thread-tension device during the second reciprocation of said needle, whereby thread may be pulled from the supply by the stitch-forming instrumentalities during the formation of the stitch next following the nipping of the beginning end of the needle-thread.

In testimony whereof, I have signed my name to this specification.

ALBERT F. FIFIELD.