Nov. 20, 1945. F. ASHWORTH 2,389,124

THREAD CONTROLLING DEVICE FOR SEWING MACHINES

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Fig. 1

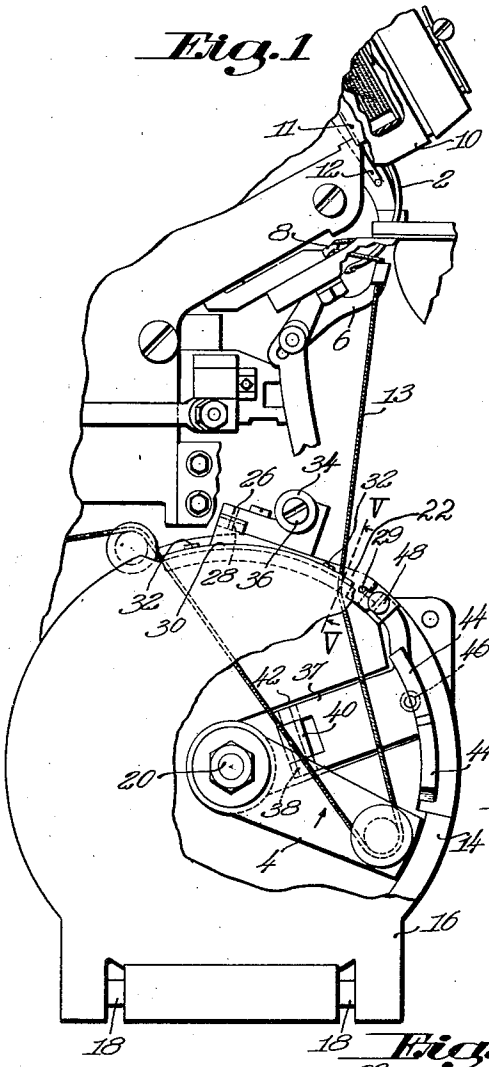


Fig. 2

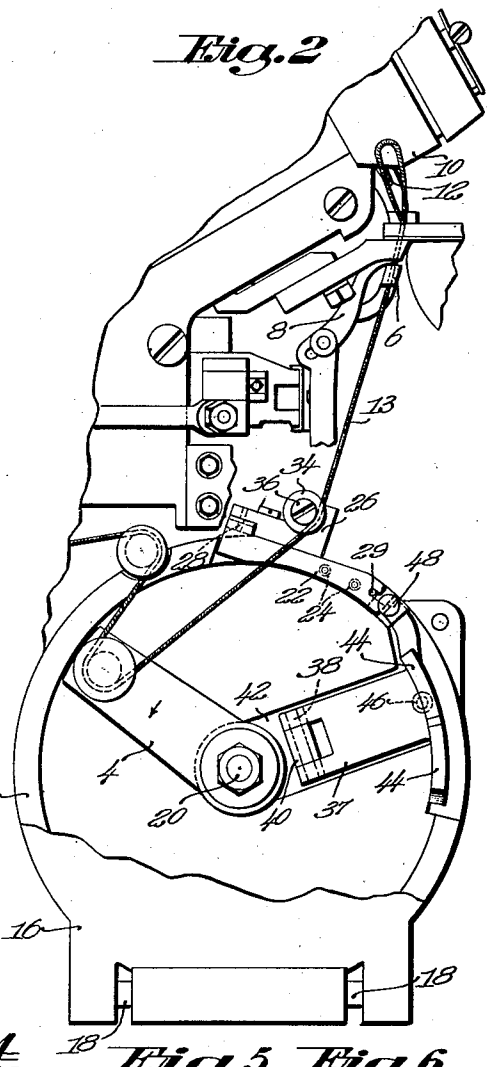


Fig. 4

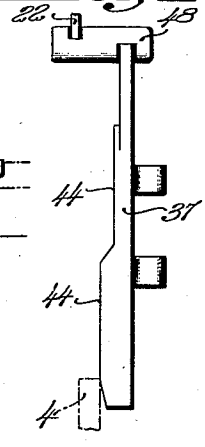


Fig. 5

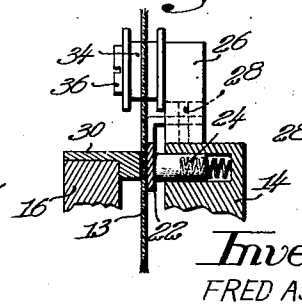


Fig. 6

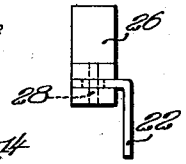
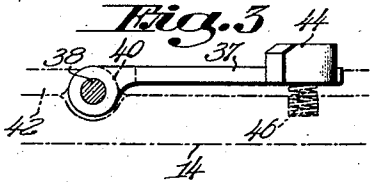


Fig. 3



Witness
Frederick S. Greenleaf.

Inventor
FRED ASHWORTH
BY HIS ATTORNEY

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THREAD CONTROLLING DEVICE FOR SEWING MACHINES

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Fig. 7

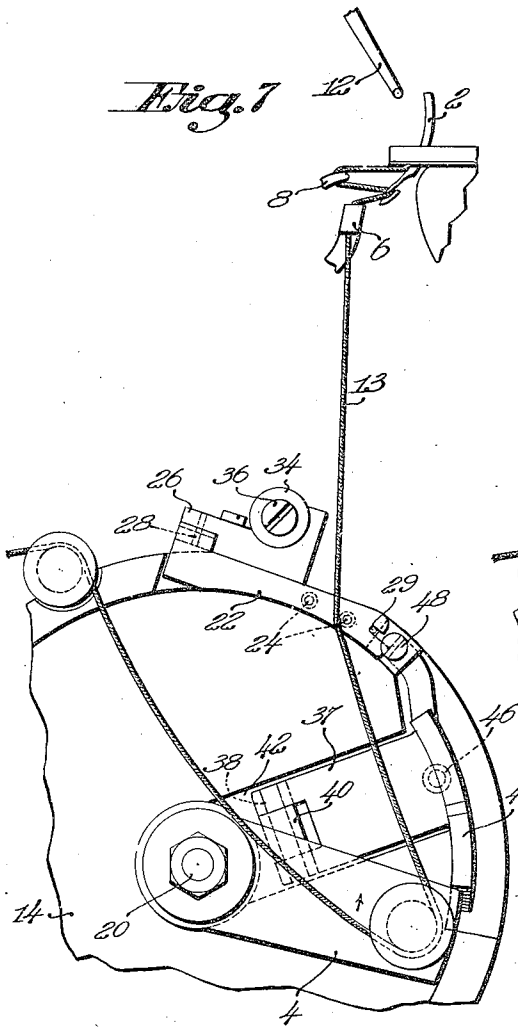


Fig. 8

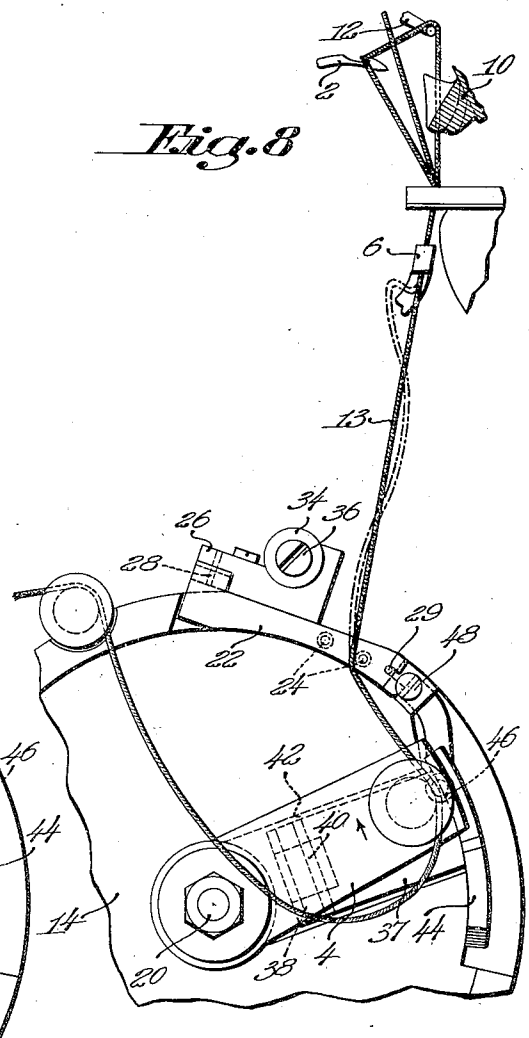


Fig. 9

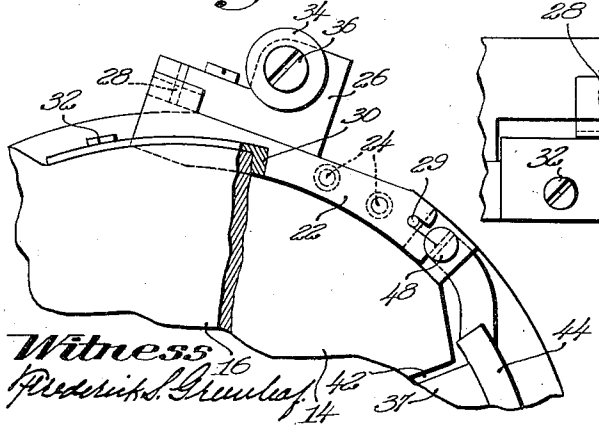
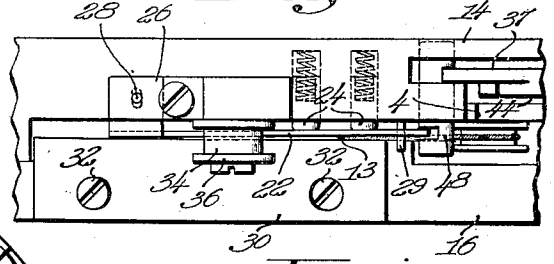


Fig. 10



Witness
Frederick J. Grundy

Inventor
FRED ASHWORTH
BY HIS ATTORNEY

Patented Nov. 20, 1945 2,389,124

UNITED STATES PATENT OFFICE

2,389,124

THREAD CONTROLLING DEVICE FOR SEWING MACHINES

Fred Ashworth, Wenham, Mass., assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application April 4, 1944, Serial No. 529,465

10 Claims. (Cl. 112—59)

The present invention relates to improvements in thread controlling devices for use in sewing machines of the type intended for operation on shoes or other heavy materials and provided with a curved hook needle and a take-up acting to take up each loop of thread drawn through the work by the needle and to give up thread during each sewing cycle at a rate greater than required by the other stitch forming devices, so that the portion of thread engaging the take-up becomes slack during a substantial part of each sewing cycle. An example of a machine of this type is disclosed in United States Letters Patent No. 2,271,611 of February 3, 1942, of which the present inventor is joint patentee and, in certain respects, the present invention is related to features disclosed in inventor's United States Letters Patent No. 2,350,995 of June 13, 1944.

In the machine of Patent No. 2,271,611, a thread tensioning device acts on the thread between the take-up and the last formed stitch in the work to keep those portions of the thread engaging the stitch forming devices, other than the take-up, under control while the take-up is giving up thread to said other stitch forming devices. In order to avoid the effects of excessive friction and abrasion on the thread while the take-up is taking up thread and particularly while a stitch is being set, mechanism driven from the main sewing shaft of the patented machine is provided for actuating the tensioning device to relieve the frictional effect on the thread in each sewing cycle while the take-up is taking up thread. In the machine of Patent No. 2,350,995, the change in tension of the thread is controlled directly by the thread itself without the use of any positively driven actuating mechanism separate from the tensioning device. The tensioning device of Patent No. 2,350,995 consists of a spring-pressed plate and a stationary surface between which the thread is compressed, the arrangement being such that the transverse movement of the thread, as a result of the action of the take-up, causes the thread to move along the plate from a position where the frictional tension produced by spring pressure is greater during the giving-up stroke of the take-up to a position where the pressure is substantially less during the take-up stroke of the take-up. This arrangement is advantageous in that it provides effective control of the slack thread during high speeds of operation, but in order to provide accurate control of the thread under all conditions of operation, it is desirable to relieve the tension entirely on the thread during a portion of the giving-up stroke of the take-up as well as during the taking-up stroke, while during the remainder of the giving-up stroke, the usual amount of tension imparted by the spring-pressed plate is needed.

In the operation of a hook needle sewing machine after the needle enters the work from one side and emerges from the other side, a loop of thread is laid in the needle hook by a looper, the thread having previously been engaged with a thread finger and measured off from the supply sufficiently in amount to provide slack thread between the previously formed stitch and the needle at least until the needle hook has been withdrawn with the thread a substantial distance from the side of the work at which it entered. If insufficient slack thread is provided between the last formed stitch and the needle to enable the threaded needle hook to pass through and be withdrawn a substantial distance from the work, the thread between the needle and the last stitch may be pulled too tightly while the needle hook is being drawn through the work, at which time, a maximum amount of abrasion on the thread occurs, the thread of the loop carried by the needle being compressed in the form of a sharp bight in the needle hook. Under these conditions, a number of difficulties arise. The abrasion of the thread at the bight engaging the needle hook may be so excessive as to strand the thread, the previously formed stitch may be displaced by stealing thread therefrom, or the thread may become stretched excessively or broken.

After the threaded needle has been withdrawn fully from the work, if the machine is of the lock-stitch type, some form of thread lifter or loop spreader and a loop taker are employed which enter the loop carried by the needle hook, drawing thread from the supply as the needle continues to withdraw from the work. Some sliding movement or reeving of the thread through the needle hook is unavoidable at this time, but the thread no longer has a sharp bight formation in the needle, so that there is less likelihood of injury to the thread. During this action, the thread is being dragged through the needle perforation in the work which in itself causes some tension in the thread, so that control of the thread on the needle side of the work is assured. If at this time further frictional drag is imparted by the tensioning device, the drag on the thread while sliding through the needle hook under some circumstances may be excessive. If no drag at all is imparted to the thread beneath the work at the take-up side, there may be other undesirable results, to be explained.

During the transfer of the needle loop from the thread lifter and needle to the loop taker, the speed of movement of the thread, as it is being withdrawn from the work, changes abruptly, being withdrawn at first rapidly by the thread lifter and then more slowly as the loop is entered by the loop taker. If the thread between the take-up and the work is substantially free of tension at this time, the momentum of the thread under movement of the thread lifter will carry the thread beneath the work out of its straight-line path between the take-up and the work, causing it to twist and slap against adjacent parts of the machine or the work in an irregular manner. Engagement of the thread in this way with other parts of the machine or with the work tends to apply periods of momentary erratic resistance to the movement of the thread, contributing to non-uniformity in movements of the thread while being disengaged from the thread lifter and engaged by the loop taker. Non-uniformity in movements of the thread during formation of a stitch at this time is reflected in irregularly formed stitches and varying tensions in the threads of completed stitches.

One object of the present invention is to provide a curved hook needle sewing machine of the type referred to which will insert an extremely uniform seam with little or no abrasion to the thread and in which the difficulties above enumerated are overcome. Another object is to simplify and improve the construction and mode of operation of a lockstitch shoe sewing machine, particularly with respect to regularity of stitch formation and location of stitches in the work operated upon. Another object of the invention is to provide a frictional thread tensioning device between the take-up and the work for a lockstitch shoe sewing machine which will operate in a desirable manner and will prevent erratic movements in the thread during the giving-up stroke of the take-up as a result of changes in velocity of thread movement, particularly while each needle loop is being transferred from the needle to the loop taker.

In the illustrated embodiment of the invention, a hook needle sewing machine, having a needle looper for laying the thread in the needle hook and a take-up, is equipped with means acting on the needle thread between the take-up and the looper to cause tension to be imparted to the thread while the thread is being laid in the needle hook and, thereafter, to relieve the tension on the thread, at least until the hook of the needle has drawn the bight in the thread loop carried thereby into the work. Preferably, the tension imparting means consists of a device actuated during each sewing cycle by suitable positively driven mechanism rather than depending wholly upon the movements of the thread while being acted upon by the take-up, and in the illustrated form of this feature the tensioning device is actuated to relieve the tension until the needle has withdrawn its loop from the work. At the time of withdrawal, while the needle still engages the thread, the loop is first entered by the thread lifter, the lifter in the form of the invention hereinafter described having substantially reached the extreme end of its spreading movement before the tension is reapplied. In order to prevent irregular movements of the thread while the needle loop is being transferred from the thread lifter to the loop taker, the tension is again applied to the thread by the tensioning device just before the loop escapes from the needle and lifter, thus preventing the thread between the take-up and the looper from becoming loose as a result of its inertia and slapping against the adjacent machine parts or portions of the work.

These and other features of the invention consist of the novel constructions, combinations and arrangements of parts, as will become more fully apparent from the following detailed specification taken in connection with the accompanying drawings, in which

Fig. 1 is a view in left-hand side elevation of so much of a curved hook needle lockstitch shoe sewing machine as is necessary for an illustration of an embodiment of the present invention, the parts of the machine being indicated in positions assumed while the needle is being looped;

Fig. 2 is a similer view of the same portions of the machine illustrated in Fig. 1 with the parts in positions assumed after the needle has been withdrawn from the work with its loop of thread and the loop is being retracted toward stitch setting position;

Fig. 3 is a detail view on an enlarged scale of a tension releasing member illustrated in Figs. 1 and 2;

Fig. 4 is another detail view on a similar scale of the tension releasing member illustrated in Fig. 3, together with a connecting rod for actuating the tensioning device, the parts being viewed at right angles to the direction in which Fig. 3 is taken;

Fig. 5 is a sectional view on an enlarged scale taken along the line V—V of Fig. 1;

Fig. 6 is a detail view of a yielding tensioning plate forming the movable part of the tensioning device;

Fig. 7 is a detail view on a slightly enlarged scale of some of the parts of the machine illustrated in Fig. 1 in positions assumed at the time in each sewing cycle when the frictional tension on the thread is relieved;

Fig. 8 is a similar view of the parts in positions assumed while a needle loop is being transferred from the loop spreader to the loop taker;

Fig. 9 is a view on a still further enlarged scale of a portion of the housing for the take-up, indicating the cover for the housing in closed position and the tensioning device operative, and

Fig. 10 is a plan view of the take-up housing and tensioning device illustrated in Fig. 9.

The machine illustrated in the drawings is a lockstitch shoe outsole sewing machine having a curved hook needle **2**, a continuously rotating take-up **4**, a looper **6**, a thread finger **8**, a loop taker or shuttle **10** enclosing a thread case **11** having a supply of locking thread, a thread lifter or loop spreader **12** for opening each needle loop for the shuttle, and other stitch forming devices similar in construction and mode of operation except as hereinafter pointed out to those disclosed in Patent Nos. 2,271,611 and 2,350,995 above referred to. As in the machine of the patents, the stitch forming devices are so operated that substantially no tension will be imparted to the needle thread **13** by the take-up in each sewing cycle except when each stitch is being set. To control the needle thread while each loop is being formed and carried about the thread case in the machine of the patents, a frictional thread tensioning device is provided between the take-up and the work so that sufficient tension will be applied to the thread between the time the needle is looped and drawn through the work and the time the needle loop reaches a position of maximum extension about the thread case, the ten-

sioning device assisting the needle looping operation and preventing displacement of the thread from the hook of the needle as the threaded needle moves upwardly through the work. The tensioning device of Patent No. 2,350,995 is mounted directly upon a stationary circularly flanged shield comprising a housing for the take-up, a corresponding flanged shield being indicated at 14 in the present illustrated machine. Cooperating with the shield 14 to prevent escape of the needle thread from control of the take-up is a cover plate 16 hingedly mounted on pins 18 on the take-up housing.

The take-up 4 consists of an arm rotating continuously in the direction of the arrow between the cover and the shield with a take-up shaft 20 passing through the shield and carrying the take-up arm at one end. The rotation of the shaft 20 is timed with the operation of the other stitch forming devices to cause the thread engaging the take-up to be given up as the looper 6 lays the thread in the hook of the needle. The needle draws the thread into a loop while moving upwardly through the work, the two sides of the loop forming a sharp bight engaging the needle. While the thread bight of the needle loop is being carried through the work with the needle hook, it is subject to substantial compression against the inner surfaces of the needle perforation and to frictional abrasion. The compression of the thread in the bight carried by the needle varies with the type of work operated upon and, in some instances, may produce excessive friction and abrasion and injury to the thread.

To avoid unnecessary injury to the thread in many sewing machines of the hook needle type, a predetermined length is measured between the thread finger and the last formed stitch in the work, as illustrated in Fig. 1, before the looper lays the thread in the needle hook. The length of thread thus measured is intended to enable passage of the needle loop through the work without requiring sliding movement of the thread through the needle hook. In many machines heretofore used commercially, the thread is kept under control by actuating the take-up to give up thread only in the amount required, no slack being permitted. The take-up 4 of the machine disclosed in the patents is actuated to provide slack thread by giving up more thread than is required for the needle looping operation, and the tensioning device on the take-up housing imparts only a light frictional drag on the thread to keep the thread between the tensioning device and the work under just enough tension to insure laying the thread securely within the needle hook. As soon as the thread is laid in the needle hook, however, the thread finger moves to give up its supply of measured thread and, in so doing, reduces the tension in that part of the thread between the needle hook and the last formed stitch. Tension in the thread between the needle hook and the tensioning device at this time may cause the thread to slide in the needle hook before the threaded hook enters the work since the thread tends to move in the direction of greatest tension. The result of such sliding movement is to cause at least partial loss of thread measured by the thread finger so that the thread between the needle and the last formed stitch may be subject to the same excessive tension and abrasion before the threaded needle hook is withdrawn from the opposite side of the work, as though no measurement had occurred. If the thread is exceptionally strong, satisfactory stitches may still be formed even under these conditions, particularly where an excessively large size of needle hook is employed or the machine is operated at slow speeds. With a small-sized needle hook as compared to the size of thread utilized, it is necessary to compress the thread tightly into the hook in order to prevent a few strands from escaping and, with relatively poor quality thread, any tendency to slide in the needle hook before the threaded needle is withdrawn from the work, subjects the thread to certain injury or breakage.

To overcome these difficulties, while at the same time enabling easy passage of the needle thread through the work without liability of injury or excessive abrasion on the thread in the machine embodying the features of the present invention, the take-up housing has mounted on it a frictional tensioning device actuated at suitable times both by transverse movement of the thread and by separate mechanism to change the tension in the thread in a desired manner. The tensioning device comprises a vertical plate 22 backed at its forward end by a pair of spring-pressed plungers 24 slidingly mounted in horizontal passages in the take-up housing. At its rearward end, the plate has a horizontal slotted tab slidingly mounted in a cut formed in a block 26 secured to the housing. To hold the tab loosely in position, the block has a vertical passage into which is driven a retaining pin 28 entering the slot in the tab. At its forward end, the tensioning plate has an open slot to receive a horizontal positioning pin 29 secured in the take-up housing.

In the tensioning device of Patent No. 2,350,995, the tensioning plate is drawn against a horizontal surface of a block on the housing for the take-up, requiring the thread to be introduced between the plate and block while threading the machine. In the present illustrated machine, the necessity of introducing the thread between the tensioning plate and the supporting block is avoided, the tensioning plate being pressed by the plungers 24 against a horizontal friction surface on a block 30 secured by means of screws 32 to the take-up cover plate 16. The arrangement is such that, with the thread located in operating position on the take-up 4 while the cover plate 16 is open during threading of the machine, proper location of the thread with respect to the tensioning plate is insured when the take-up cover plate is closed.

The operation of the tensioning plate 22 in imparting tension to the thread is substantially the same as that in Patent No. 2,350,995 in which there is a very light frictional pressure on the thread while the take-up is taking up thread from the other stitch forming devices, as in Fig. 2, thus avoiding unnecessary abrasion on the thread. While the take-up is taking up thread, the thread is drawn against a flanged guide wheel 34 rotatable on a screw 36 threaded into the block 26. When the take-up reaches the lower end of its taking-up stroke after the stitch being formed is set in the work, the thread between the take-up and the looper moves transversely of its length away from the guide wheel 34 and, thereafter, the stitch setting tension on the thread is substantially relieved. As soon as the take-up begins its giving-up stroke, the thread is engaged with the thread finger 8 (Fig. 1) and is laid in the hook of the needle by the looper 6, the take-up providing slack thread during these operations. In moving away from the guide wheel 34, the thread is carried forwardly toward the portion of the tensioning plate acted upon by the plungers

24. While engaged by that portion of the tension plate acted upon by the plungers 24, a substantial amount of frictional tension is imparted to the thread. In addition to operation of the tensioning device by transverse movement of the thread, it is also actuated by suitable mechanism to prevent loss in thread measured by the thread finger.

The mechanism for actuating the tensioning device apart from the transverse movements of the thread includes a swinging tension release member 37 pivotally mounted at 38 in a lug 40 located within a radial depression 42 formed in the shield 14. The lug 40 is located near the take-up shaft on the shield, and the release member is bifurcated to embrace the lug at one end. At its other end, the release member is provided with an arcuate extension having a cam surface 44 disposed within the rotary path of the take-up to be actuated thereby. Between the release member and the shield, there is a compression spring 46 for pressing the release member into the path of the take-up. The cam surface 44 is so shaped that, during the giving-up stroke of the take-up, the release member will be swung about its pivot 38 at a time in the sewing cycle directly after the thread is laid in the hook of the needle 2 and before substantial forward thread releasing movement of the thread finger occurs (see Fig. 7).

The connections between the release member 37 and the tension plate comprise an upwardly extending arm on the release member having its upper extremity fitting within a slot in a horizontal connecting rod 48 slidingly mounted in a suitable guideway in the take-up housing beyond the range of the take-up path. Diametrically opposite to the release member receiving slot in the connecting rod 48 and at its other end, is a second slot into which is loosely engaged an extension of the tensioning plate 22, the parts being so arranged that, when the release member is engaged by the take-up, the tensioning plate is moved away from the thread engaging surface of the block 30, thereby relieving the compression on the thread. The tension on the thread between the tensioning device and the work is held relieved in this way until after the threaded needle has fully been withdrawn from the work and the thread lifter 12 has not only entered and spread the needle loop but has approached the extreme end of its loop spreading movement. At this time, the shuttle is beginning to enter the loop spread by the thread lifter, as best shown in Fig. 8. As the thread lifter approaches the extreme upper end of its loop spreading movement, its rate of travel is retarded so that, unless tension is immediately applied to the thread between the take-up and the work, there will be an opportunity for the thread to whip and become displaced, twisting itself around adjacent parts, particularly the looper, or slapping against the upper of a shoe being operated upon, in an irregular manner indicated by the dot-dash lines. When the machine is operating at high speeds, such irregular movements of the thread impart momentary tension and resist uniform movements of the thread in the needle loop from one sewing cycle to another, tending to cause breakage or imperfect stitch formation. As soon as the shuttle enters a needle loop, the thread is disengaged, first from the needle and then from the thread lifter, and is carried about the thread case in the usual way.

At all other times in each sewing cycle, the tension device is effective to maintain the thread between the take-up and the work under control in the same manner as that disclosed in inventor's Patent No. 2,350,995, the temporary relief of tension on the thread occurring only between the times the needle is looped and the approach of the thread lifter to the extreme end of its loop spreading movement before the loop has been disengaged from the needle and thread lifter. Relief of the tension on the needle thread in this way not only is advantageous in preventing non-uniform sliding movements in the hook of the needle and elsewhere and consequent abrasion of the thread while each needle loop is being drawn through the work but also assists in a uniform location of the spread loop for the shuttle and a subsequent uniform loop spreading action of the shuttle in opening up the loop for its passage about the thread case during each sewing cycle. Uniform movements of the loop during the formation of each stitch are conducive to uniform location and setting of stitches in the work. A secondary advantage, resulting from the actuation of the tensioning device directly from the take-up, rather than from mechanism actuated by the main sewing shaft as in the machine of Patent No. 2,271,611, follows from the use of a relatively simple mechanism for relieving the tension positively in addition to its variation as the result of transverse thread movement.

The nature and scope of the invention having been indicated and a particular embodiment thereof having been specifically described, what is claimed is:

1. A sewing machine having a hook needle, a looper for laying the thread in the needle hook and a take-up, in combination with means acting on the needle thread between the take-up and the looper to cause tension to be imparted to the thread while the thread is being laid in the needle hook and to relieve the tension on the thread after the thread is laid in the needle hook until the hook of the needle has drawn the thread into the work.

2. A sewing machine having a hook needle, a looper for laying a loop of thread in the needle hook, a thread finger for measuring thread between the needle and the last-formed stitch in the work and for giving up the measured thread after the thread is laid in the needle hook, a take-up, mechanism for actuating the take-up to provide slack in the needle thread as the needle hook carries each needle loop through the work and to set each stitch, and a tensioning device acting on the thread between the take-up and the looper, in combination with mechanism for actuating the tensioning device during each sewing cycle to relieve the tension on the thread after being laid in the needle hook and until the hook of the needle has drawn the needle loop into the work.

3. A sewing machine having a hook needle, a looper for laying a loop of thread in the needle hook, a thread finger for measuring thread between the needle and the last-formed stitch in the work and for giving up the measured thread after the thread is laid in the needle hook, a take-up, mechanism for actuating the take-up to provide slack in the needle thread as the needle hook carries each needle loop through the work and to set each stitch, and a tensioning device acting on the thread between the take-up and the looper, in combination with mechanism for actuating the tensioning device during each sewing cycle to relieve the tension on the thread before the hook

of the needle draws the needle loop into the work and until the needle has withdrawn the loop from the work.

4. A lockstitch sewing machine having stitch forming devices including a hook needle, a looper, a locking thread case, a rotary loop taker for passing loops of needle thread over the thread case, a thread lifter for spreading each needle loop for the loop taker, a continuously rotating take-up arranged to provide slack in the needle thread as each needle loop is being drawn through the work by stitch forming devices other than the take-up and to pull each needle loop from the loop taker, and a frictional tensioning device acting with a yielding pressure on the thread between the looper and the take-up, in combination with mechanism for actuating the tensioning device during each sewing cycle to relieve the tension on the thread before the hook of the needle draws the thread into the work and until the thread lifter approaches the extreme end of its loop spreading movement.

5. A lockstitch sewing machine having stitch forming devices including a hook needle, a looper, a locking thread case, a rotary loop taker for passing loops of needle thread over the thread case, a continuously rotating take-up arranged to provide slack in the needle thread as each needle loop is being drawn through the work by stitch forming devices other than the take-up and to pull each needle loop from the loop taker, and a frictional tensioning device acting with a yielding pressure on the thread between the looper and the take-up and comprising members having opposed thread engaging surfaces, in combination with a tension release member actuated by the take-up, and a connection between the tension release member and one of the tensioning members acting to separate the members while the needle is being looped and before the hook of the threaded needle enters the work.

6. A lockstitch sewing machine having stitch forming devices including a hook needle, a looper, a locking thread case, a rotary loop taker for passing loops of needle thread over the thread case, a continuously rotating take-up arranged to provide slack in the needle thread as each needle loop is being drawn through the work by stitch forming devices other than the take-up and to pull each needle loop from the loop taker, and a frictional tensioning device located outside the rotary path of the take-up to act on the thread between the looper and the take-up, in combination with a tension release member located within the rotary path of the take-up to be actuated thereby, and a connecting rod between the tension release member and the tensioning device.

7. A sewing machine having stitch forming devices including a hook needle, a take-up acting to take up and give up thread and to move the thread transversely of its length, and a frictional tensioning device constructed and arranged to impart a variable tension to the thread the variation of which is controlled by transverse movement of the thread between the take-up and the work, in combination with mechanism for actuating the tensioning device to relieve the tension on the thread during each sewing cycle before the hook of the needle has drawn the thread into the work.

8. A sewing machine having stitch forming devices including a hook needle and a take-up, a shield for the take-up, and a hinged cover to enclose the take-up in the shield, in combination with a frictional tensioning device acting on the thread and comprising members having thread engaging surfaces, one of which is carried by the cover and one of which is actuated by the take-up toward and from the other member.

9. A sewing machine having stitch forming devices including a hook needle, a looper for laying a loop of thread in the needle hook, a continuously rotating take-up arranged to provide slack in the needle thread as each needle loop is being drawn through the work by stitch forming devices other than the take-up and to pull each needle loop into the work, a shield for the take-up, and a hinged cover plate to enclose the take-up in the shield, in combination with a frictional tensioning device acting on the thread and comprising members having thread engaging surfaces, one of which is carried by the cover plate and the other of which is mounted on the shield for relative movement toward and from the tensioning member on the cover plate while the cover plate is closed, and mechanism actuated by the take-up to separate the tensioning members between the times in each sewing cycle when the thread is laid in the hook of the needle by the looper and when the needle draws the thread into the work.

10. A sewing machine having stitch forming devices including a hook needle, a looper for laying a loop of thread in the needle hook, a continuously rotating take-up arranged to provide slack in the needle thread as each needle loop is being drawn through the work by stitch forming devices other than the take-up and to pull each needle loop into the work, a shield for the take-up, and a hinged cover plate to enclose the take-up in the shield, in combination with a frictional tensioning device acting on the thread and comprising members having thread engaging surfaces, one of which is carried by the cover plate and the other of which is mounted on the shield for relative movement toward and from the tensioning member on the cover plate while the cover plate is closed, a tension release member mounted on the shield within the rotary path of the take-up to be actuated thereby, and a connecting rod between the tension release member and the tensioning plate slidingly mounted on the shield for separating the tensioning members when the take-up engages the tension release member.

FRED ASHWORTH.