May 5, 1959 H. C. DONALDSON, JR 2,884,882

SEWING MACHINE WITH FINGER TO CONTROL BOBBIN THREAD

Filed Nov. 1, 1955

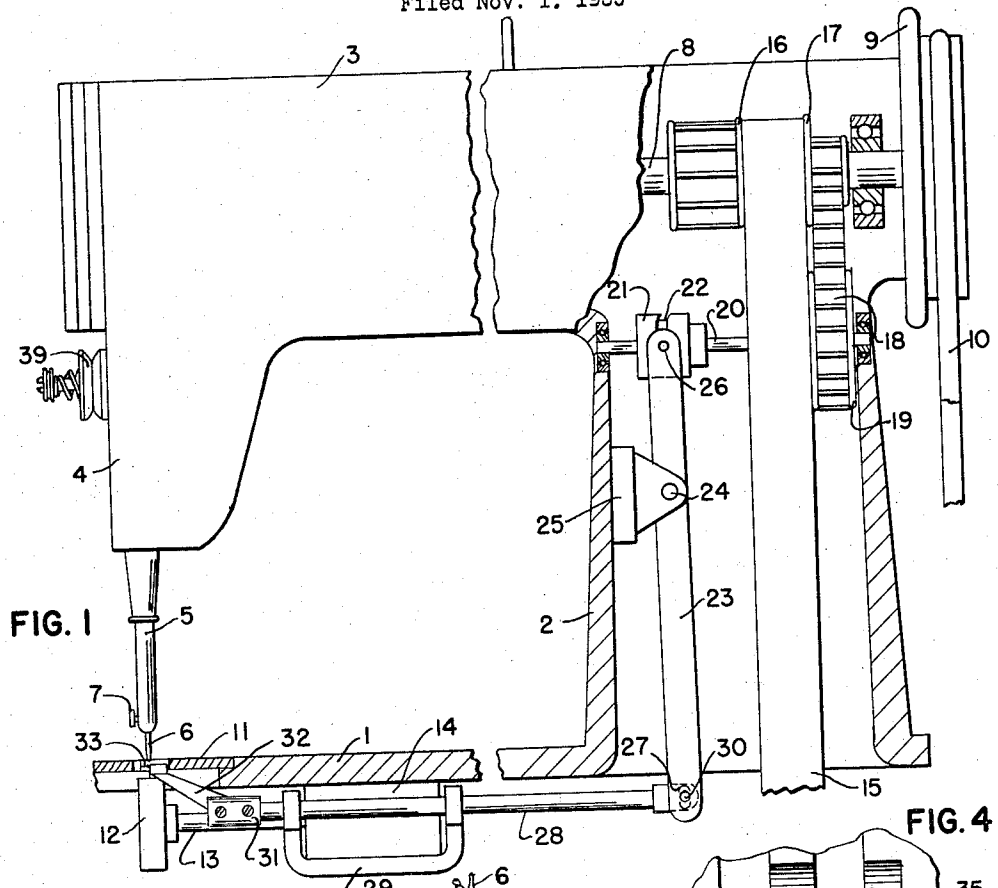


FIG. 1

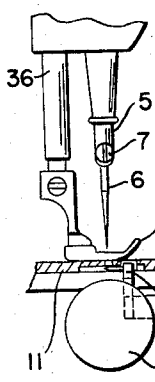


FIG. 2

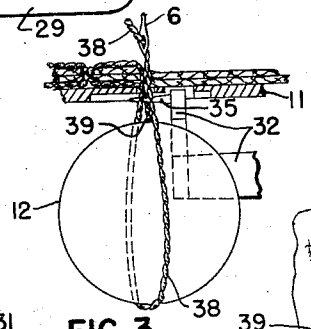


FIG. 3

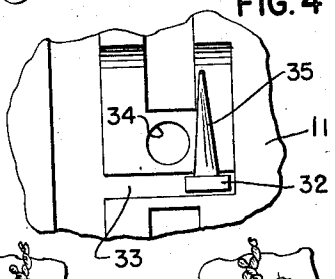


FIG. 4

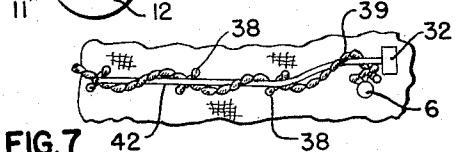


FIG. 7

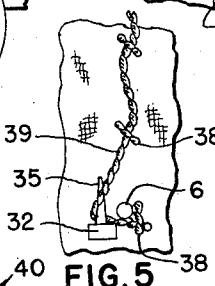


FIG. 5

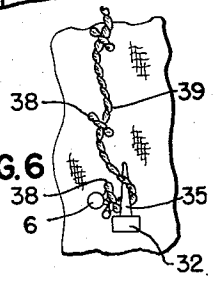


FIG. 6

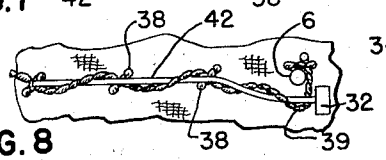


FIG. 8

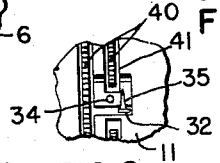


FIG. 9

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SEWING MACHINE WITH FINGER TO CONTROL BOBBIN THREAD

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Application November 1, 1955, Serial No. 544,127

5 Claims. (Cl. 112—154)

This invention relates to sewing machines, and particularly to such machines which may be employed to join fabric layers with a seam that will have a minimum of stitch pucker and seam shrinkage.

When a plurality of layers of fabric are sewn together in the usual manner, particularly so when using relatively high speed commercial sewing machines, the sewing threads and particularly that of the needle thread, are under high tension because of the rapid operation of the machine, and as a result the yarns of the fabric layers which are enclosed in each stitch loop are tightly confined by the thread of each loop. When such fabrics are laundered, the water on the layers tends to cause the yarns of the fabric to swell, particularly so when cotton or rayon yarns are employed in the fabric. The yarns of the fabric layers which are encircled in a loop, when attempting to swell, will distort the loop by making it elongated at right angles to the faces of the fabrics. When the stitch loop is elongated in this manner, the seam shrinks in length, and when the fabric later dries, the yarns in the loop and stitch thread do not always return to their former positions and sizes, with the result that we have stitch pucker and seam shrinkage, even though the fabric layers had been previously preshrunk.

Attempts have been made heretofore to solve this problem of stitch pucker and seam shrinkage in a number of different ways. One way to insert, in a direction sidewise of the seam, a finger beneath the needle thread of each stitch as each stitch is formed, and then to withdraw the finger after the stitch is completed. This procedure was not entirely satisfactory, because of the fact that such machines could not be operated at the speed at which sewing machines are normally operated in commercial garment making factories, and when slackness in the thread is caused in this manner, it will appear on the top face where it is visible to the customer. Another attempt to solve this problem was to intertwist a permanent sewing thread or yarn with a water soluble or destructible yarn, and use that composite thread to form the seam. Then after the garment was completed, the soluble or destructible component of the composite yarn or thread would be removed. If the composite thread had a water soluble component, it would be automatically removed in the first laundry treatment or washing of the garment, so that the slackness would be created at exactly the same time that the yarn tended to swell and cause shrinkage in the seam. The slack which is created in such a way by removal of the temporary component permits the permanent thread or yarn with which the temporary component was intertwisted, to straighten out and thus provide the desired slackness to accommodate swelling of the yarns and hence avoid shrinkage along the seam. This type of composite thread is larger than the standard sewing thread, and one of the threads tends to slide on the other and bunch up, and thus often interferes with the free movement of the thread through the needle eye. There is also the extra expense of making the composite thread, a part of which is entirely lost when it is destroyed after the garment is made.

An object of this invention is to provide an improved method and apparatus for uniting fabrics by stitching, with which the stitching may be performed at relatively high speeds that are common in commercial sewing machines used in garment making factories, which will provide a seam which will have a minimum of stitch pucker and seam shrinkage, with which the amount of allowance for seam shrinkage and stitch pucker may be varied, with which different lengths of stitch loops may be employed as desired, with which slackness in the sewing thread for preventing seam shrinkage and stitch pucker will not be visible from the top of the united layers, with which the slackness in a thread will not be objectionably visible, and which will require a minimum of modification of the existing commercial sewing machines.

Another object of this invention is to provide an improved sewing machine for uniting superposed layers of fabric by a line of stitching which will have minimum stitch pucker and seam shrinkage, which will have an unobstructed working surface and throat plate, and which will be relatively simple, effective, practical and inexpensive.

Other objects and advantages will be apparent from the following description of two embodiments of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawing:

Fig. 1 is an elevation of a sewing machine constructed in accordance with this invention, with certain portions broken away to illustrate the mechanism of the present invention and showing the needle in its lower position during the cycle of forming a stitch;

Fig. 2 is an end elevation of part of the sewing machine, with certain portions broken away to show the needle in its raised position during the cycle of forming a stitch;

Fig. 3 is an end elevation of part of the machine, with certain parts broken away to show the thread being looped by the looper mechanism prior to the tightening of the loop by the sewing machine, and just prior to the engagement of the loop by the slack creating finger of the present invention;

Fig. 4 is a plan view of the throat plate of the sewing machine, with the presser foot and needle removed to illustrate one of the positions of the finger with respect to the needle hole, as used in the present invention;

Fig. 5 is a bottom plan of the under side of the fabrics being united by a sewing machine, and showing the bobbin thread as it is engaged and deflected by the finger of the present invention;

Fig. 6 is a view similar to Fig. 5 but showing the finger in its alternate position;

Fig. 7 illustrates a modification of the present invention, utilizing a long and flexible finger engaging a number of stitches at the same time;

Fig. 8 is a view similar to Fig. 7 but showing the finger in its alternate position; and

Fig. 9 is a plan of the throat plate and feed dog.

In the embodiment of the invention illustrated in Figs. 1 to 6, and 9, a standard type of sewing machine is employed. In that machine only that part of the standard sewing machine which is directly cooperative with the present invention has been illustrated in order to avoid confusion. The illustrated sewing machine in accordance with this invention includes a base **1** having at one end thereof, an upright pedestal **2** which is hollow or tubular. A horizontal arm **3** extends from the upright end of the pedestal over the base **1** but in spaced relation to the base. At its free end, this horizontal

arm 3 is provided with a head 4 in which is mounted the mechanism for causing vertical reciprocation of a needle bar 5. A sewing needle 6 is detachably held in the lower end of the needle bar 5 by means of a set screw 7 and the needle reciprocating mechanism in the head 4 and horizontal arm 3 are driven by a main shaft 8, which fixedly carries on its outer end a pulley 9 over which runs a driving belt 10 which in turn is driven by a suitable source of power not shown. Immediately below a throat plate 11 of the machine is a looper 12 for looping the bobbin thread with the needle thread. The looper is mounted on one end of a shaft 13 which is driven at the proper speed through mechanism in a gear box 14 mounted in the base 1. There is the usual connection not shown between the reduction box 14 and a belt 15 which drives it, the latter running over and being driven by a pulley 16 that is fixed on the main shaft 8. Since the manner in which the gear reduction box 14 is driven from the belt 15 is old in prior machines, and is not per se a part of the present invention, that mechanism has been omitted in order to reduce the danger of obscuring the changes or additions which have been made in accordance with this invention.

A gear 17 is fixed on the main shaft 8, and a driving chain or belt 18 operates over this gear 17 and also over another gear 19 which is fixed on an auxiliary shaft 20 within the upper part of the pedestal 2. This auxiliary shaft 20 is rotatably mounted in bearings at opposite sides or walls of the pedestal, and the drive ratio between the gears 17 and 19 is preferably one that will operate the auxiliary shaft at half the speed of the main shaft 8. A cam 21 is fixed on the auxiliary shaft 20 for rotation therewith, but is removable therefrom so that other similar cams can be substituted for the one illustrated. This cam 21 is provided with a peripherally extending, endless cam groove 22 which cam groove undulates from side to side for a purpose which will appear later herein.

A lever 23 is rockably mounted on a pivot pin 24 that is provided on a bracket 25, which in turn is fixed on an upright interior wall of the pedestal 2. The upper end of the lever 23 extends along one side of the cam 21 and there carries a cam follower pin 26 that extends sidewise of the lever and runs in the cam groove 22, so that as the cam 21 rotates, the lever 23 will be rocked back and forth about a horizontal axis to an extent, and in a pattern, determined by the undulation of the cam groove 22. The lower end of the lever 23 extends into the base 1 and there is provided with a vertically elongated slot 27. A rod 28 is mounted to reciprocate endwise in a bearing bracket 29 which, for convenience, may be mounted on the gear reduction box 14.

The direction of reciprocation of the rod 28 is toward and from the looper 12. The end of rod 28 which is nearest the pedestal 2 is provided with a laterally extending pin 30 which is received in the vertically elongated slot 27, so that as the lever 23 rocks back and forth under the action of the cam groove 22, it will reciprocate the rod 28. The other end of the rod 28, which is the end nearest the looper 12, carries a finger supporting bracket 31, which is fixed on the rod, and this bracket carries an arm 32 that extends to a position immediately below the throat plate 11 and into a recess 33 (Fig. 1) provided around the aperture 34 in the throat plate 11, through which the needle may reciprocate in the sewing operation. The free end of this arm 32 carries a finger or pin 35 which, when the arm 32 is reciprocated with the rod 28 under the action of the cam 21, moves from side to side of the needle aperture 34 in the throat plate. The groove 22 of the cam 21 is designed to cause a reciprocation of the finger 35 from one side of the aperture 34 in the throat plate

to the other at each complete operation of the needle, so that at the end of successive operations of the needle, the finger 35 will be at opposite sides of the needle 34. This finger 35 extends in the direction of travel of the fabric as it passes beneath the needle 6 in a sewing operation.

Immediately in back of the needle and needle bar is the usual presser foot bar 36, (Fig. 2) which at its lower end carries a presser foot 37 as usual in sewing machines, so that the presser foot may be raised or lowered in the usual manner. The sewing machine illustrated employs a needle thread 38, see Fig. 4, which passes through the eye of the needle 6. A source of this thread is normally supported on the top of the horizontal arm 3, and guided through various guides including a thread tensioning device 39, see Fig. 1, to and through the eye of the needle, as usual in sewing machines. The bobbin thread 39, see Figs. 4 and 5, extends from the bobbin (not shown) to the last formed stitch loop as usual in sewing machines. During the descent of the needle 6, the eye of the needle carries the needle thread 38 with it downwardly into and through the superposed layers of fabric that are disposed over the throat plate, these superposed layers being shown in Figs. 4 and 5, at which time the needle thread extends from one side of the eye to the last formed stitch, and from the other side of the eye toward the tensioning device 49. It follows that after the needle passes through the superposed layer of fabrics there will be two stretches of the needle thread extending upwardly from the eye, and at this time a finger on the looper 12 engages this needle thread below the throat plate and loops it with the bobbin thread. Then when the needle rises, it pulls this loop upwardly into the fabric and decreases its size at the same time.

During the descent of the needle and prior to the penetration of the fabric layers by the needle, the finger 35 which extends in a direction parallel to the direction of feed of the fabric, which will be parallel to the line of the seam, is shifted sidewise across the needle opening 34 in the throat plate from one side of the needle opening to the other side. During this travel, this finger engages with the bobbin thread and pushes or deflects it to one side and holds it in such deflected position while the needle continues to descend through the fabrics and during the formation of the loop around the bobbin thread. During the subsequent rise of the needle, and after it has left the fabric, the usual feed dog 40, see Fig. 9, rises through an opening 41 in the throat plate to engage the fabric layers and move those layers bodily in the direction of the seam, which would be to the rear in Fig. 1. This is the normal feeding operation of the fabric which by the distance that the dog moves the fabric, determines the length of each stitch loop. The manner in which the finger deflects the bobbin thread to one side of the needle path is illustrated in Figs. 5 and 6 which are views looking upwardly from the throat plate. It will be observed from this, that the finger 35 holds the bobbin thread in a deflected position while the loop is formed, and by varying the extent of movement of the finger 35 sidewise from the path of the needle, one can determine the amount of slack which will be formed in the loop in the usual manner. This movement of the finger 35 is under the control of the cam groove 22 so that by substituting different cams 21 on the auxiliary shaft 20, one can select and use any of a group of cams with a cam groove with the desired amount of throw therein, and thus one can selectively determine the amount of slack that will be left in each loop. As the fabric is stitched and fed along in step by step increments by the feed dog, the fabric and stitches will move in a direction to clear the loops successively from the finger 35, so taht each loop will slide off the free end of the finger merely by the feeding of the fabric. To facilitate this,

the finger **35** may, if desired be slightly tapered toward its free end.

If desired, the relatively rigid finger **35** may be replaced by a freely flexible finger such as by a wire **42**, as shown in Figs. 7 and 8 and this flexible wire extends through a plurality of successive loops, which is possible since the wire can flex, as the end thereof which is anchored to the arm **32** moves across the path of the needle. This wire **42**, near its end which is anchored to the finger **32**, will engage and deflect the bobbin thread **39** first to one side and then to the other of the needle path, in the same manner that the bobbin thread was deflected by the rigid finger **35**. As the fabric is fed along by the feed dog, the loops of the various stitches will slide along this wire **42** and eventually slide off its free end. This wire **42** should extend through the loop being formed and also at least one loop beyond the loop that is being formed, although it may, if it is desired, extend further than these two loops.

The relatively rigid finger **35** is particularly advantageous where one desires to make sharp turns in the direction in which the seam is being formed, whereas the flexible finger or wire **42** can be used effectively where the seam runs for a substantial distance in the same direction without sharp turns. By way of example, a very satisfactory and successful finger **35** had an overall length of 3/16 inch and it extended 1/8 inch beyond the sewing needle in the direction of the finished stitches. Its diameter at its anchored end was 0.040 inch and it tapered to a diameter at its free end of from 0.025 inch to 0.035 inch. A flexible finger successfully used was a spring wire having a diameter of 0.030 inch, and it extended through the stitch loop being formed and also at least one completed stitch loop.

It will be understood that various changes in the details, materials and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

I claim:

1. In the sewing together of superposed plies of fabric with a stitched seam during the formation of each stitch of which a needle and a bobbin thread interengage, the improved method for forming the seam so as to produce minimal seam shrinkage and stitch pucker, which improved method includes creating a preselected and measured amount of excessive looseness in the bobbin thread by alternately holding the bobbin thread on opposite sides of the path of the needle and the seam during the formation of each successive stitch.

2. In the sewing together of superposed plies of fabric with a stitched seam during the formation of each stitch of which a needle and a bobbin thread interengage, the improved method for forming the seam so as to produce minimal seam shrinkage and stitch pucker, which improved method includes creating a preselected and measured amount of excessive looseness in the bobbin thread by sequentially holding only the bobbin thread to one side of the path of the needle until the tensions associated with the formation of a first stitch are relaxed following which the bobbin thread is released, and then holding only the bobbin thread on the opposite side of the path of the needle until the tensions associated with the formation of a second stitch are relaxed, following which the bobbin thread is released, and thereinafter repeating said sequence by alternately holding only the bobbin thread on opposite sides of the path of the needle.

3. In an apparatus for producing a seam with excess thread so as to minimize seam shrinkage when superposed plies of fabric are sewn together, a sewing machine means for forming a threaded seam both on the top and the bottom of said superposed plies, said sewing machine having a reciprocating needle and drive means for reciprocating said needle, a fabric supporting surface carried by said sewing machine, feed means below the level of said fabric supporting surface but extending upwardly therebeyond for advancing fabric incrementally after each stitching operation, finger means beneath the level of said fabric supporting surface for engaging and holding that portion and only that portion of said threaded seam which is beneath the superposed plies to be sewn, said finger having one end anchored to driving connection means adjacent the reciprocal path of the needle and having another end free and extending lengthwise past the needle path in the direction of advance of said feed means, said driving connection means interconnecting said drive means and the anchored end of said finger means for shifting the free end of said finger alternately back and forth a pre-selected and measured distance across said needle path in coordination with said needle reciprocation sequentially to engage and hold said portion of the threaded seam beneath the superposed plies during each stitch formation until after the next succeeding fabric advance by said feed means.

4. In the sewing together of superposed plies of fabric with a stitched seam during the formation of each stitch of which an upper thread and a lower thread interengage, the improved method for forming the seam so as to minimize seam shrinkage and stitch pucker during subsequent laundry, which improved method includes forming a preselected and measured amount of excessive looseness in the lower thread by alternately holding the same at opposite sides of the needle path and the seam during and until completion of the formation of each successive stitch.

5. In the sewing together of superposed plies of fabric with a stitched seam during the formation of each stitch of which an upper thread and a lower thread interengage, the improved method for forming the seam so as to produce minimal seam shrinkage and stitch pucker, which improved method includes creating a pre-selected and measured amount of excessive looseness in the lower thread by sequentially holding only the lower thread to one side of the path of the needle until the tensions associated with the formation of a first stitch are relaxed following which the lower thread is released, and then holding only the lower thread on the opposite side of the path of the needle until the tensions associated with the formation of a second stitch are relaxed, following which the lower thread is released, and thereinafter repeating said sequence by alternately holding only the lower thread on opposite sides of the path of the needle.

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