The invention relates to a method for producing a lock stitch seam by means of a rotating hook which is provided with a bottom thread bobbin rotating with the hook and the axis of which is disposed vertically to the axis of bobbin rotation.

Frequent attempts have been made in the past to develop sewing machines the looper or hook of which is arranged for inserting large bottom thread bobbins in order to avoid frequent exchanging of the bobbin and the resultant interruption of working operations. Most of the proposals aimed at this problem did not meet with success, because the loop of the upper thread must be spread out very widely in order to guide it around the bobbin housing. The wide deflection of the thread lever required for this purpose necessarily requires very slow operating speed for such sewing machines. Furthermore, the increase of the loop of the upper thread introduces limits as a result of the increased frequency at which a particular section of thread is drawn through the eye of the needle, which limits cannot be exceeded because each thread has only a predetermined friction resistance.

It is a prerequisite in the use of a bottom thread bobbin of large dimension in rapidly operating sewing machines that in order to avoid the aforementioned shortcomings the thread loop required for passing through the bobbin housing is not broadened out any more or only little more than in connection with conventional loopers or hooks.

In known sewing machines this recognized problem is met in that the axis of the bottom thread bobbin which rotates with the hook is disposed in the plane of movement of the hook point. In this manner the bottom thread bobbin is moved longitudinally through the spread out loop of the upper thread when the hook rotates, so that this loop does not have to be larger or not essentially larger than in a machine with a conventional hook.

With this type of hook arrangement the bottom thread is brought out approximately in the axis of rotation of the hook laterally to the bobbin housing built into the hook by which it is carried. However, in this connection a twisting action is effected on the thread end which has been pulled from the bobbin during each rotation of the hook so that the amount of twisting in the bottom thread which was already imparted to the thread when it was made is either increased or eliminated. Such a change in the twisting is very disturbing for the sewing operation, because it results in an undesirable loop formation which produces an unfavorable seam or under certain circumstances it even makes the sewing entirely impossible.

It is an object of the invention to provide a method which prevents in a reliable manner that the twisted condition of the bottom thread is changed during sewing. In accordance with the invention the problem is solved in that for maintaining the twisted condition of the bottom thread, the withdrawing of the bottom thread from the bobbin is effected alternately, first on one side and then on the other side of the plane defined by the rotating axis of the bobbin or the plane in which the axis of the bobbin rotates.

For controlling or guiding the withdrawing of the bottom thread from the bobbin housing it is possible to provide in the sewing machine and abutment which is guided by or under control of the hook drive which at each rotation of the hook changes the position of a thread guiding member which controls the course of the bottom thread.

In order to insure even thread length of the bottom thread from the thread exit at the bottom housing to the stitch hole, apertures for the exit of the bottom thread are provided at the intersections of the outer wall of the bobbin housing with the axis of rotation of the hook across the base of the hook point by a slot in the bobbin housing for guiding the bottom thread. For the safe guidance of the upper thread over the guiding slot the center portion of the guiding slot is provided with a thread sliding plane for the upper thread.

Further objects, features and details of the invention and the advantages obtained thereby will become apparent from the following description of an embodiment of the invention illustrated in the drawings, in which:

FIG. 1 is a side view, partly in section, of a sewing machine having a hook arrangement which is suitable for carrying out the new method; FIG. 2 shows the hook and its driving means; FIGS. 3 to 5 illustrate different forms of hook construction; FIGS. 6 to 8 illustrate the guiding of the thread guiding member by the abutment rotating with the hook in three positions of operation with the position of the stitch hole indicated in dotted lines; and FIGS. 9 to 12 show the shifting of the bottom thread from one side of the bobbin housing to the other by means of the thread guiding member.

The hook drive shaft 1 (FIG. 2) arranged below the base plate or work plate of the sewing machine is provided with two driving arms 2 and 3 having paws 4 and 5 which are adapted to engage corresponding recesses 6 and 7 of a hook 8a and which are displaced at an angle of 180° relative to one another. The hook 8a (FIG. 1) is journaled in its bearing rings 9 and 10 in a guiding groove 11 of a hook race ring 12 secured between a work plate of the machine. The center part of the hook 8a is formed as a bobbin housing 13a consisting of a bottom cap 8 and a removable top cap 13 securely connected with the hook 8a and which receives a bottom thread bobbin 14. A tension spring 15 secured to the inner wall surface of the top cap 13 (FIG. 5) is provided with a slot 16 into which the bottom thread is inserted and is passed through under the wall of the bobbin housing 13a to emerge through a slot 17 provided in the bobbin housing 13a. The bottom thread bobbin 14 (FIG. 1) is provided with studs 18 which engage recesses 20 in the bottom cap 8.

The hook 8a is provided with a point 23 which is joined to the bottom cap 8 at its base 22a. The slot 17 connects two apertures 17a and 17b arranged at the intersections of the outer wall of the bobbin housing 13a with the axis of rotation of the hook for the exit of the bottom thread by way of the base 22a of the hook point 22. In order to safely guide the upper thread during its slinging around the bobbin housing 13a over the slot 17 the center portion thereof is covered by a sliding surface 25 for the upper thread arranged at the base 22a of the hook point 22.

A double lever 27 having two cutout portions 25 and 26 which are connected with one another is arranged below the stitch hole 24 (FIGS. 6-8), which lever is pivotally secured to the hook race ring 12 by means of a screw 27a (see FIG. 1). A wall portion 27b which limits the two cutouts 25 and 26 is formed in a manner that it defines a thread guiding member 27c having guiding edges 27d and 27e for the control of the bottom thread. A wedge shaped abutment 25 which is pivotally connected
to the bearing rib 16 of the hook 8a by means of a screw 28a projects into the path of a stud 29 on the double lever 27 opposite the cutouts 25 and 26 and through a transverse slot 35 of the hook race ring 12 (see also FIG. 2).

The drive arms 2 and 3 which rotate with the hook drive shaft 1 (FIG. 2) are connected by way of bearing balls 31 and 32 with guiding grooves 34 and 35 which are provided in a bearing 33 which is securely mounted on the machine. The bearing balls 31 and 32 are retained in the guiding grooves 34 and 35 by springs (not shown) which engage the arms 2 and 3. Shields 36, 37 (FIG. 4), one each provided on the sides of the bobbin housing 13a, cover the abutment 25 to guard against contact with the upper or bottom thread.

The invention operates as follows:

The hook 8a, which is journaled in the guiding groove 11 (FIGS. 1 and 2) of the hook race ring 12, is driven by the hook shaft 1 by way of the two drive arms 2 and 3. The guiding grooves 34 and 35 rock pivots 4 and 5 of the two drive arms 2 and 3 in a known manner alternately into the recesses 6 and 7 of the hook 8a, so that the upper thread loop which is conducted around the bobbin housing 13a is not impeded.

The abutment 25 which rotates with the hook 8a places itself against the stud 29 of the double lever 27 which is journaled on the hook race ring 12 and thus controls the movement of the thread guiding member 27c. FIG. 9 indicates the position of the thread guiding member 27c in the end position to the right. The hook point 22 has seized the upper thread loop, which for clarity is not illustrated, and guides it around the bobbin housing 13a while the guiding plane 23 prevents entrance of the thread loop into the slot 17. The bottom thread moves out of the right aperture 17a of the bobbin housing 13a and extends in a straight line to the stitch hole 24. As the hook 8a continues to rotate, the upper thread loop slides over the bobbin housing 13a and is pulled up by the thread lever after dropping from the hook in a known manner.

FIGS. 6, 10 indicate the position where the shifting of the double lever 27 begins. By the engagement of the abutment 28 with the stud 29, the thread guiding member 27c of the double lever 27 is shifted to the left. The guiding edge 27d now carries along the bottom thread (FIG. 11). The wall of the slot 30 (see FIG. 2) limits the rocking range of the double lever 27 in a manner that the point of the wedge shaped abutment 28 is shifted to the right during the further rotation of the bobbin housing 13a by the stud 29, which is now standing still, as indicated in FIGS. 7 and 8.

During the further rotation of the bobbin housing 13a the bottom thread is pulled by the lateral pull which the thread guiding edge 27d effects on it from the right aperture 17a across the center of the slot 17, and is then guided as a result of the increasing distance of the center of the slot from the stitch hole to the left aperture 17b. Simultaneously the bottom thread slides from the guiding edge 27d of the thread guiding member 27c, since it is positioned obliquely as a result of the rotation of slot 17 and extends in a direct line from the left aperture 17b of the bobbin housing 13a.

As a result of the symmetrical shape of the abutment 28 of the double lever 27 the bottom thread is again guided to the right side of the bobbin housing 13a during the next rotation of the hook 8a. In that bottom thread which is now on the left side is pulled to the right by the guiding edge 27e of the thread guiding member 27c upon contact of the stud 29 on the abutment 28 in a manner analogous to the operation described, whereupon the thread slides from the aperture 17b through the slot 17 to aperture 17a. Upon being placed in an oblique position as a result of the rotation of the slot 37 it likewise slides from the guiding edge 27e and thus extends in a direct line from the right aperture 17a of the bobbin housing 13a to the stitch hole 24.
groove and secured proximate the stitch hole below the work plate of the machine, a rotatable housing having bearing ribs in engagement with said guiding groove, a hook defined on said housing and rotatable therewith, a bottom thread bobbin disposed in said housing and rotatable therewith, said bobbin having its axis disposed transversely of the axis of rotation of said hook, and means comprising a hook shaft drivingly linked to said housing, means operative to maintain the normal twisted condition of the bottom thread comprising a stationary pivot on said support member, a thread guiding member having one end presenting a guiding aperture proximate said stitch hole and an end defining a guided member extending radially of the path of rotation of said hook and pivotally supported intermediate said ends on said stationary pivot, a pivot member on said housing, an abutment member supported on said pivot member circumferentially of said housing and having edges adapted during rotation of said housing to alternately engage and move said guided member and thereby said guiding member in opposite directions and means limiting the movement of said guided member comprising an abutment means provided on said stationary member, said housing having opposite outer walls provided with apertures for the exit of the thread therethrough and a slot defined by spaced wall portions of said housing and extending transversely of said housing between said apertures and across the base of said hook, and a sliding surface disposed proximate the base of said hook and extending transversely of the center portion of said slot.

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