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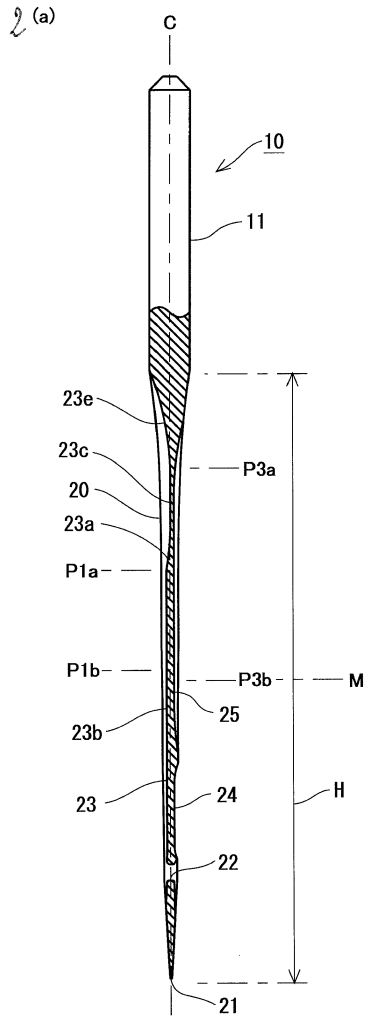
(54) COVERING CHAIN STITCH SEWING MACHINE NEEDLE AND SEWING METHOD USING COVERING CHAIN STITCH SEWING MACHINE

(57) A front groove 23 of a covering chain stitch sewing machine needle 10 has a step portion 23 a on the shank portion 11 side with respect to a scarf portion 24. The front groove 23 is formed so that a depth of the groove at the step portion 23a increases from a needle tip 21 side toward the shank portion 11. That is, a shallow groove portion 23b is formed on the needle tip 21 side with respect to the step portion 23a, and a deep groove portion 23c is formed on the shank portion 11 side with respect to the step portion 23a. Thus, it is possible to provide a covering chain stitch sewing machine needle that can be used as each of needles in a covering chain stitch sewing machine to reduce differences in size among loops formed by the needles as much as possible, and a sewing method.



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Description

TECHNICAL FIELD

[0001] The present invention relates to a needle used for a covering chain stitch sewing machine, and a sewing method using the covering chain stitch sewing machine.

BACKGROUND ART

[0002] For example, as described in JP-A-2012-45134, a covering chain stitch sewing machine has a configuration in which a plurality of (two to four) needles are attached in parallel and at different heights in a direction perpendicular to a fabric feeding direction. The plurality of needles move up and down so as to form a plurality of loops under a fabric, and the plurality of loops are then scooped by a looper. In this manner, the covering chain stitch sewing machine performs sewing.

[0003] Incidentally, the loops under the fabric are formed by the following actions. That is, first, each of the needles is lowered to a position of a bottom dead center, and a needle thread that has been run through a needle eye is pulled down to be tensed under the fabric. When the needle moves upward at this state, the needle thread is pressed due to its friction against the fabric. Therefore, the needle thread loosens under the fabric so that the loop is formed. Since the plurality of needles move up and down simultaneously, the loops are formed as many as the number of the needles.

[0004] When one looper scoops the plurality of loops formed thus under the fabric, the looper scoops them sequentially one by one. Therefore, the looper jumps into the loops respectively at different timings from one another. The looper scoops the loops sequentially one by one when the needles are rising from the positions of the bottom dead centers. Therefore, when the jumping timings of the looper are different from one another, movement distances of the needles from the positions of the bottom dead centers are also different from one another. Even if the movement distances of the needles from the positions of the bottom dead centers are different from one another in this manner, the heights of the needles at the jumping timings of the looper need to be equalized (it is necessary to adjust each of heights of scarf portions to a height of the looper). To solve this problem, the needles are attached to a needle bar of the sewing machine at different heights respectively.

[0005] Specifically, the first needle onto which the looper jumps is attached at a highest position. Conversely, the last needle onto which the looper jumps is attached at a lowest position. By attaching the needles in this manner, the heights of the needles when the needles encounter the looper are set to be substantially equal for all the needles even though the timings at which the needles encounter the looper (that is, rising distances of the needles from the bottom dead centers) are different from one another.

[0006] However, the first needle onto which the looper jumps encounters the looper at a comparatively early timing after the needle starts rising. Therefore, the rising distance of the needle required for forming a loop (the rising distance of the needle from the position of the bottom dead center to the position where the needle encounters the looper) is small. Therefore, there is a possibility that the loop may be formed too insufficiently to be scooped by the looper, thereby causing occurrence of stitch skipping.

[0007] On the contrary, the last needle onto which the looper jumps encounters the looper at a comparatively late timing after the needle starts rising. Therefore, the rising distance of the needle required for forming a loop is large. Therefore, there is a possibility that the loop may be excessively large to fall down so that the loop cannot be scooped by the looper, thereby causing occurrence of stitch skipping.

SUMMARY OF INVENTION

[0008] Therefore, an object of the present invention is to provide a covering chain stitch sewing machine needle that can be used as each of needles in a covering chain stitch sewing machine so as to reduce differences in size among loops formed by the needles as much as possible, and a sewing method.

[0009] In order to achieve the aforementioned object, a first invention provides a covering chain stitch sewing machine needle used as each of needles in a covering chain stitch sewing machine that performs sewing in such a manner that the needles arranged in parallel and at different heights in a direction perpendicular to a fabric feeding direction move up and down so as to form loops under a fabric, and the loops are then scooped by a looper, the covering chain stitch sewing machine needle including: a shank portion that is held when the covering chain stitch sewing machine needle is attached to the sewing machine; and a needle shaft portion that has a thread hole formed at a front end portion of the needle shaft portion and that can be inserted into and extracted from the fabric; wherein: in the needle shaft portion, a front groove extending from an opening edge of the thread hole toward the shank portion is formed, and a scarf portion having a shape formed by recessing the contour of the needle shaft portion is formed on a back side of the front groove; and the front groove that has a step portion on the shank portion side with respect to the scarf portion is formed so that the groove at the step portion increases from a needle tip side toward the shank portion.

[0010] Moreover, a second invention provides a sewing method using a covering chain stitch sewing machine performing sewing in such a manner that covering chain stitch sewing machine needles arranged in parallel and at different heights in a direction perpendicular to a fabric feeding direction move up and down so as to form loops under a fabric, and the loops are then scooped by a loop-

er, wherein: each of the covering chain stitch sewing machine needles includes a shank portion that is held when the covering chain stitch sewing machine needle is attached to the sewing machine, and a needle shaft portion that has a thread hole formed at a front end portion of the needle shaft portion and that can be inserted into and extracted from the fabric; in the needle shaft portion, a front groove extending from an opening edge of the thread hole toward the shank portion is formed, and a scarf portion having a shape formed by recessing the contour of the needle shaft portion is formed on a back side of the front groove; and the front groove that has a step portion on the shank portion side with respect to the scarf portion is formed so that a depth of the groove at the step portion increases from a needle tip side toward the shank portion.

[0011] According to the present invention, as described above, the front groove of the covering chain stitch sewing machine needle that has the step portion on the shank portion side with respect to the scarf portion is formed so that the depth of the groove at the step portion increases from the needle tip side toward the shank portion. That is, a shallow groove portion is formed on the needle tip side with respect to the step portion, and a deep groove portion is formed on the shank portion side with respect to the step portion. When the needle shaft portion in a range where the shallow groove portion is formed is extracted from the fabric, resistance of a needle thread interposed between the shallow groove portion and the fabric is large. Accordingly, the needle thread is pressed so that a loop is easy to grow. On the contrary, when the needle shaft portion in a range where the deep groove portion is formed is extracted from the fabric, resistance of the needle thread interposed between the deep groove portion and the fabric is small. Accordingly, a loop is hard to grow.

[0012] Here, the first needle onto which the looper jumps is attached at a highest position. Therefore, the first needle onto which the looper jumps is inserted into the fabric comparatively shallowly even in the case where the needle has moved to a position of a bottom dead center. Since the needle rises at this state to form a loop, the loop is formed by use of the shallow groove portion on the needle tip side. Accordingly, even in a case where a rising distance of the needle required for forming the loop (the rising distance of the needle from the position of the bottom dead center to a position where the needle encounters the looper) is small, the loop is still allowed to grow sufficiently largely by use of the shallow groove portion.

[0013] In addition, the last needle onto which the looper jumps is attached at a lowest position. Therefore, the last needle onto which the looper jumps is inserted into the fabric comparatively deeply when the needle has moved to another position of another bottom dead center. Since the needle rises at this state to form a loop, the loop is formed by use of the deep groove portion on the shank portion side and the shallow groove portion on the needle tip side. Accordingly, even in a case where a rising distance of the needle required for forming the loop (the rising distance of the needle from the position of the bottom dead center to a position where the needle encounters the looper) is large, the loop does not grow so largely when the deep groove portion passes through the fabric, and the loop is allowed to grow when the shallow groove portion passes through the fabric. That is, since the growth of the loop can be suppressed by the deep groove portion, the loop can be prevented from becoming excessively large.

[0014] Thus, by use of the covering chain stitch sewing machine needles according to the present invention, differences in size among the loops formed when the needles encounter the looper can be reduced even if the needles are attached at the different heights. The sizes of the loops are made as uniform as possible, so that stitch skipping can be prevented.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIGS. 1A, 1B and 1C are a front view, a side view and a back view of a covering chain stitch sewing machine needle;

FIGS. 2A and 2B are a view of a section taken along a line A-A shown in FIG. 1A, and a partial enlarged view of the section taken along the line A-A shown in FIG. 1A; and

FIGS. 3A to 3C are views for explaining movement of covering chain stitch sewing machine needles when a covering chain stitch sewing machine is used to perform sewing, i.e. FIG. 3A is the view showing positions of bottom dead centers for the covering chain stitch sewing machine needles respectively, FIG. 3B is the view showing positions of the covering chain stitch sewing machine needles at a timing at which a right one of the needles encounters a looper, and FIG. 3C is the view showing the positions of the covering chain stitch sewing machine needles at a timing at which a left one of the needles encounters the looper.

DESCRIPTION OF EMBODIMENT

[0016] An embodiment of the present invention will be described with reference to the drawings.

[0017] Covering chain stitch sewing machine needles 10 according to the present embodiment are needles used in a covering chain stitch sewing machine. Since the covering chain stitch sewing machine has been well known in the background art, detailed description thereof will be omitted here. The covering chain stitch sewing machine performs sewing as follows. That is, the covering chain stitch sewing machine needles 10 that are arranged in parallel and at different heights in a direction perpendicular to a fabric feeding direction move up and

down so as to form loops under a fabric, and the loops are then scooped by a looper. The covering chain stitch sewing machine needles 10 according to the present embodiment, which have one and the same configuration, are in use attached to such a covering chain stitch sewing machine.

[0018] As shown in FIGS. 1A to 1C, each of the covering chain stitch sewing machine needles 10 includes a shank portion 11 and a needle shaft portion 20. The shank portion 11 is held when the covering chain stitch sewing machine needle 10 is attached to the sewing machine. The needle shaft portion 20 is provided on a front end side with respect to the shank portion 11.

[0019] As shown in FIGS. 3A to 3C, the shank portions 11 are held by a needle stopper portion 31 of the sewing machine so as to be attached thereto. Incidentally, the needle stopper portion 31 of the sewing machine is provided on a front end of a needle bar 30 that moves up and down when sewing is performed by the sewing machine. Since the sewing machine according to the present embodiment uses three covering chain stitch sewing machine needles 10, the three covering chain stitch sewing machine needles 10 are attached to the needle stopper portion 31. As shown in FIGS. 3A to 3C, the three covering chain stitch sewing machine needles 10 are attached with needle tips 21 gradually higher from left to right of FIGS. 3A to 3C. At the same time, the three covering chain stitch sewing machine needles 10 are attached in parallel in the direction perpendicular to the fabric feeding direction. Incidentally, the sewing machine using the three covering chain stitch sewing machine needles 10 will be described in the present embodiment. However, the number of the needles is not limited to three but may be two or may be four or more. Further, in the present embodiment, the needles are attached to be gradually higher from the left to the right when viewed from a front side (a downstream side in the fabric feeding direction). However, the present embodiment is not limited thereto. The needles may be attached to be gradually higher from the right to the left.

[0020] The needle shaft portion 20 is a part that can be inserted into and extracted from a fabric 35 when sewing is performed. A front end of the needle shaft portion 20 has a sharp shape to form the needle tip 21. A thread hole 22 required for running a needle thread therethrough is bored in the vicinity of the front end of the needle shaft portion 20. Incidentally, the needle tip 21 does not always have to have the sharp shape, but may, for example, have a ball shape or the like.

[0021] As shown in FIG. 1A, a front groove 23 extending from an opening edge of the thread hole 22 toward the shank portion 11 is formed on a front side of the needle shaft portion 20. The front groove 23 that is a groove required for guiding the needle thread run through the thread hole 22 is provided to extend in a longitudinal direction of the needle shaft portion 20.

[0022] Further, as shown in FIGS. 1B and 1C, a scarf portion 24 is formed on a back side of the needle shaft portion 20 (in an opposite face to a face where the front groove 23 is formed) and on the shank portion 11 side with respect to the thread hole 22. The scarf portion 24 is formed into a shape formed by recessing the contour of the needle shaft portion 20. Further, the scarf portion 24 is provided adjacently to the thread hole 22 (a distance between the scarf portion 24 and the thread hole 22 is formed to be shorter than a width of the thread hole 22 in the longitudinal direction in the present embodiment).

[0023] A back groove 25 is further formed on the shank portion 11 side with respect to the scarf portion 24. The back groove 25 that is a groove required for guiding the needle thread run through the thread hole 22 is provided to extend in the longitudinal direction of the needle shaft portion 20.

[0024] By the way, the aforementioned front groove 23 is formed to have a depth changing as it goes in the longitudinal direction. Specifically, as shown in FIGS. 2A and 2B, the aforementioned front groove 23 has a step portion 23a, and the front groove 23 is formed so that a depth of the groove at the step portion 23 a increases from the needle tip 21 side toward the shank portion 11. The step portion 23a is provided on the shank portion 11 side (an upper side in FIGS. 2A and 2B) with respect to the scarf portion 24. More specifically, the step portion 23a is provided on the shank portion 11 side with respect to a halved place (a longitudinally middle position M of the needle shaft portion 20) of a length H of the needle shaft portion 20.

[0025] The depth of the groove in the present embodiment is defined by a distance between a center line C of the needle (see FIGS. 2A and 2B) and a bottom face of the groove. That is, the depth of the groove is defined with reference to the center line C of the needle regardless of the contour shape of the needle. Therefore, "the groove is deep" means that the distance between the center line C of the needle and the bottom face of the groove is short, and "the groove is shallow" means the distance between the center line C of the needle and the bottom face of the groove is long.

[0026] As shown in FIG. 2B, the step portion 23a is formed to be inclined in its bottom face so that the groove is gradually deeper as it goes from the needle tip 21 side toward the shank portion 11. The bottom face of the step portion 23a is formed to be slightly curved. That is, the bottom face of the step portion 23a is a curved face that bulges in a direction in which the groove is deeper. Incidentally, the shape of the step portion 23a is not limited to such a curved face. The shape of the step portion 23a may be a curved face bulging in a direction in which the groove is shallower, or may be a flat face.

[0027] A portion of the front groove 23 on the needle tip 21 side with respect to the step portion 23a is a shallow groove portion 23b in which the groove is relatively shallow. In other words, the step portion 23a is formed continuously to the shank portion 11 side of the shallow groove portion 23b. A depth of the shallow groove portion 23b is constant. Specifically, as shown in FIG. 2B, a dis-

tance K between the center line C of the needle and a bottom face D1 of the shallow groove portion 23b is formed to be constant over an entire length of the shallow groove portion 23b.

[0028] A portion of the front groove 23 on the shank portion 11 side with respect to the step portion 23a is a deep groove portion 23c in which the groove is deeper than the shallow groove portion 23b. In other words, the step portion 23a is formed continuously to the needle tip 21 side of the deep groove portion 23c. A depth of the deep groove portion 23c is constant. Specifically, as shown in FIG. 2B, a distance between the center line C of the needle and a bottom face D2 of the deep groove portion 23c is formed to be constant over an entire length of the deep groove portion 23c. Incidentally, in the present embodiment, the bottom face D2 of the deep groove portion 23c is formed so as to pass through the center line C of the needle.

[0029] A portion of the front groove 23 on the shank portion 11 side with respect to the deep groove 23c is an inclined portion 23e that is gently inclined so as to be gradually shallower as it goes toward the shank portion 11. In other words, the inclined portion 23e is formed continuously to the shank portion 11 side of the deep groove portion 23c.

[0030] Thus, the front groove 23 according to the present embodiment is formed so that the depth of the front groove 23 changes at the step portion 23a. Even if the depth changes at the step portion 23a, a width of the front groove 23 is constant. That is, the width of the front groove 23 is constant over the shallow groove portion 23b, the step portion 23a, and the deep groove portion 23c.

[0031] When the covering chain stitch sewing machine needles 10 have been attached to the covering chain stitch sewing machine and moved to the bottom dead centers respectively as shown in FIG. 3A, the step portions 23a at each of which the depth of the front groove 23 is changed thus are formed at the following positions. That is, the step portion 23a in a covering chain stitch sewing machine needle 10 (right needle N1 in FIG. 3A) attached at a highest position among the covering chain stitch sewing machine needles 10 does not penetrate the fabric 35 placed on a needle plate 32, and the step portion 23a in a covering chain stitch sewing machine needle 10 (left needle N3 in FIG. 3A) attached at a lowest position among the covering chain stitch sewing machine needles 10 penetrates the fabric 35 placed on the needle plate 32. In other words, the right needle N1, which is the covering chain stitch sewing machine needle 10 attached at the highest position among the covering chain stitch sewing machine needles 10, is set so that the step portion 23a of the right needle N1 is not positioned under the fabric 35 in the state that the right needle N1 has moved to the position of the bottom dead center. Further, the left needle N3, which is the covering chain stitch sewing machine needle 10 attached at the lowest position among the plurality of covering chain stitch sewing machine needles 10, is set so that the step portion 23a of the left needle N3 is positioned under the fabric 35 in the state in which the left needle N3 has moved to the position of the bottom dead center.

[0032] Next, timings at which the covering chain stitch sewing machine needles 10 encounter the looper (not shown) of the sewing machine will be described.

[0033] In the present embodiment, the three covering chain stitch sewing machine needles 10 are attached to the needle bar 30 (the needle stopper portion 31) of the sewing machine. The three covering chain stitch sewing machine needles 10 are arranged in parallel and at the different heights in the direction perpendicular to the fabric feeding direction. Of the three covering chain stitch sewing machine needles 10, the needle attached at the highest position is referred to as right needle N1, the needle attached at the lowest position is referred to as left needle N3, and a needle attached at an intermediate height between the right needle N1 and the left needle N3 is referred to as middle needle N2. These needles are attached in parallel at equal intervals in the order of the right needle N1, the middle needle N2, and the left needle N3 in a direction from right to left of FIGS. 3A to 3C. All the three covering chain stitch sewing machine needles 10 are the same needles.

[0034] The needle plate 32 required for placing the fabric 35 to be sewn thereon is provided under the needle bar 30 of the sewing machine. Holes are bored in the needle plate 32 so that the covering chain stitch sewing machine needles 10 can be made to penetrate through the holes.

[0035] When sewing is performed using the covering chain stitch sewing machine needles 10 according to the present embodiment, the covering chain stitch sewing machine needles 10 in the needle bar 30 of the sewing machine move to the positions of the bottom dead centers, and needle threads (not shown) run through the thread holes 22 are pulled down to be tensed, as shown in FIG. 3A. On this occasion, the step portion 23a of the right needle N1 is not positioned under the fabric 35. Further, the step portion 23a of the left needle N3 is positioned under the fabric 35. Incidentally, when each of the needles has risen from the position of the bottom dead center, resistance is generated between the needle thread and the fabric 35. As a result, a loop is formed. Therefore, the position of an upper face of the fabric 35 when the needle is at the position of the bottom dead center becomes a reference line where the resistance required for forming the loop is generated. Specifically, P1a shown in FIG. 3A is the position of the upper face of the fabric 35 when the right needle N1 is at the position of the bottom dead center, i.e. a reference position where the formation of the loop is started in the right needle N1. Further, P3a shown in FIG. 3A is the position of the upper face of the fabric 35 when the left needle N3 is at the position of the bottom dead center, i.e. a reference position where the formation of the loop is started in the left needle N3.

[0036] When the needles move upward from the positions of the bottom dead centers, the needle threads are pressed due to their friction against the fabric 35. Therefore, the needle threads loosen under the fabric 35 so that the loops are formed.

[0037] Then, when the needles have risen to positions shown in FIG. 3B (when a height of the scarf portion 24 of the right needle N1 and a height of a front end of the looper are consistent with each other), the right needle N1 and the looper first intersect each other so that the loop formed by the right needle N1 is scooped by the looper. Thus, the formation of the loop is terminated at a timing at which the right needle N1 and the looper encounter each other. Therefore, the position of a lower face of the fabric 35 on this occasion is a reference line where the formation of the loop is terminated. Specifically, P1b shown in FIG. 3B is the position of the lower face of the fabric 35 at the timing at which the right needle N1 encounters the looper, i.e. a reference position where the formation of the loop is terminated in the right needle N1. Therefore, as shown in FIGS. 2A and 2B, a range from P1a to P1b is a loop forming section S1 in the right needle N1.

[0038] When the needles then further rise, the middle needle N2 and the looper intersect each other so that the loop formed by the middle needle N2 is scooped by the looper.

[0039] Then, the needles farther rise. When the needles have risen to positions shown in FIG. 3C (when a height of the scarf portion 24 of the left needle N3 and the height of the front end of the looper are consistent with each other), the left needle N3 and the looper intersect each other so that the loop formed by the left needle N3 is scooped by the looper. Therefore, P3b shown in FIG. 3C is the position of the lower face of the fabric 35 at a timing at which the left needle N3 encounters the looper, i.e. a reference position where the formation of the loop is terminated in the left needle N3. Therefore, as shown in FIGS. 2A and 2B, a range from P3a to P3b is a loop forming section S3 in the left needle N3

[0040] Then, the needles rise to positions above the fabric 35. Covering chain stitching is performed by such vertical movement of the needles.

[0041] Incidentally, in the present embodiment, the loop forming section S1 in the right needle N1 is entirely the shallow groove portion 23b, as shown in FIGS. 2A and 2B. Therefore, the resistance between the needle thread and the fabric 35 during the formation of the loop is so large that a sufficiently large loop can be formed even by the right needle N1 which is small in rising distance to the position where the right needle N1 encounters the looper.

[0042] Further, as shown in FIGS. 2A and 2B, the loop forming section S3 in the left needle N3 includes the deep groove portion 23c and the shallow groove portion 23b. Therefore, when the deep groove portion 23c is passing through the fabric 35, the resistance between the needle thread and the fabric 35 is reduced so that growth of the loop is suppressed. Therefore, the loop can be prevented from growing too largely even by the left needle N3 which is large in rising distance to the position where the left needle N3 encounters the looper.

[0043] According to the present embodiment, as described above, the front groove 23 of the covering chain stitch sewing machine needle 10 that has the step portion 23a on the shank portion 11 side with respect to the scarf portion 24 is formed so that the depth of the groove at the step portion 23a increases from the needle tip 21 side toward the shank portion 11. That is, the shallow groove portion 23b is formed on the needle tip 21 side with respect to the step portion 23a, and the deep groove portion 23c is formed on the shank portion 11 side with respect to the step portion 23a. When the needle shaft portion 20 in the range where the shallow groove portion 23b is formed is extracted from the fabric 35, the resistance of the needle thread interposed between the shallow groove portion 23b and the fabric 35 is large. Therefore, the needle thread is pressed so that the loop is easy to grow. On the contrary, when the needle shaft portion 20 in the range where the deep groove portion 23c is formed is extracted from the fabric 35, the resistance of the needle thread interposed between the deep groove portion 23c and the fabric 35 is small. Therefore, the loop is hard to grow.

[0044] Here, the first needle (the right needle N1) onto which the looper jumps is attached at the highest position. Therefore, even when the needle has moved to the position of the bottom dead center, the needle is inserted into the fabric 35 relatively shallowly. Since the needle rises at this state to form a loop, the loop is formed by use of the shallow groove portion 23b on the needle tip 21 side. Accordingly, even in the case where the rising distance of the needle required for forming the loop (the rising distance of the needle from the position of the bottom dead center to the position where the needle encounters the looper) is small, the loop is still allowed to grow sufficiently largely by use of the shallow groove portion 23b.

[0045] Further, the last needle (the left needle N3) onto which the looper jumps is attached at the lowest position. Therefore, when the needle has moved to the position of the bottom dead center, the needle is inserted into the fabric 35 relatively deeply. Since the needle rises at this state to form a loop, the loop is formed by use of the deep groove portion 23c on the shank portion 11 side and the shallow groove portion 23b on the needle tip 21 side. Accordingly, even in the case where the rising distance of the needle required for forming the loop (the rising distance of the needle from the position of the bottom dead center to the position where the needle encounters the looper) is large, the loop does not grow so largely when the deep groove portion 23c passes through the fabric 35, and the loop is allowed to grow when the shallow groove portion 23b passes through the fabric 35. That is, since the growth of the loop can be suppressed by the deep groove portion 23c, the loop can be prevented from

becoming excessively large, and stitch skipping caused by fall down of the loop can be prevented.

[0046] Thus, by use of the covering chain stitch sewing machine needles 10 according to the present embodiment, differences in size among the loops formed when the needles encounter the looper can be reduced even if the needles are attached at different heights. The sizes of the loops are made as uniform as possible, so that stitch skipping can be prevented.

Claims

1. A covering chain stitch sewing machine needle used as each of needles in a covering chain stitch sewing machine that performs sewing in such a manner that the needles arranged in parallel and at different heights in a direction perpendicular to a fabric feeding direction move up and down so as to form loops under a fabric, and the loops are then scooped by a looper, the covering chain stitch sewing machine needle comprising:
   a shank portion that is held when the covering chain stitch sewing machine needle is attached to the sewing machine; and a needle shaft portion that has a thread hole formed at a front end portion of the needle shaft portion and that can be inserted into and extracted from the fabric; wherein:

   in the needle shaft portion, a front groove extending from an opening edge of the thread hole toward the shank portion is formed, and a scarf portion having a shape formed by recessing the contour of the needle shaft portion is formed on a back side of the front groove; and
   the front groove that has a step portion on the shank portion side with respect to the scarf portion is formed so that a depth of the groove at the step portion increases from a needle tip side toward the shank portion.

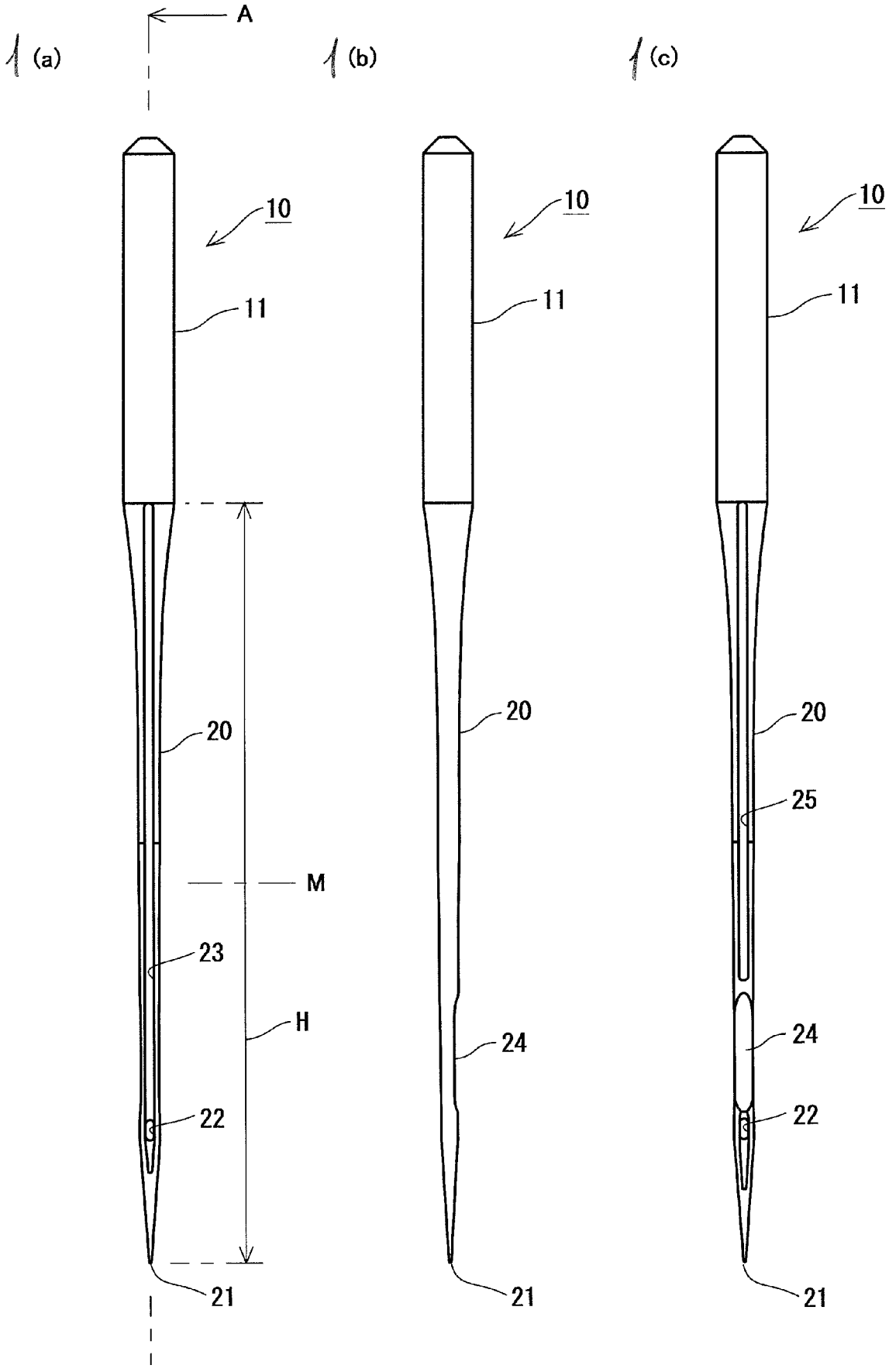
2. A covering chain stitch sewing machine needle according to Claim 1, wherein:
   when the covering chain stitch sewing machine needles attached to the covering chain stitch sewing machine are moved to bottom dead centers respectively, the step portion in a covering chain stitch sewing machine needle attached at a highest position among the covering chain stitch sewing machine needles is formed at a position at which the step portion does not penetrate the fabric, and the step portion in a covering chain stitch sewing machine needle attached at a lowest position among the covering chain stitch sewing machine needles is formed at a position at which the step portion penetrates the fabric.

3. A sewing method using a covering chain stitch sewing machine performing sewing in such a manner that covering chain stitch sewing machine needles arranged in parallel and at different heights in a direction perpendicular to a fabric feeding direction move up and down so as to form loops under a fabric, and the loops are then scooped by a looper, wherein:

   each of the covering chain stitch sewing machine needles includes a shank portion that is held when the covering chain stitch sewing machine needle is attached to the sewing machine, and a needle shaft portion that has a thread hole formed at a front end portion of the needle shaft portion and that can be inserted into and extracted from the fabric;
   in the needle shaft portion, a front groove extending from an opening edge of the thread hole toward the shank portion is formed, and a scarf portion having a shape formed by recessing the contour of the needle shaft portion is formed on a back side of the front groove; and
   the front groove that has a step portion on the shank portion side with respect to the scarf portion is formed so that a depth of the groove at the step portion increases from a needle tip side toward the shank portion.

4. A sewing method using a covering chain stitch sewing machine according to Claim 3, wherein:

   a covering chain stitch sewing machine needle attached at a highest position among the covering chain stitch sewing machine needles is set so that the step portion of the covering chain stitch sewing machine needle is not positioned under the fabric in a state in which the covering chain stitch sewing machine needle has moved to a position of a bottom dead center; and
   a covering chain stitch sewing machine needle attached at a lowest position among the covering chain stitch sewing machine needles is set so that the step portion of the covering chain stitch sewing machine needle is positioned under the fabric in a state in which the covering chain stitch sewing machine needle has moved to another position of another bottom dead center.


1 (a)
A
10
11
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1 (b)
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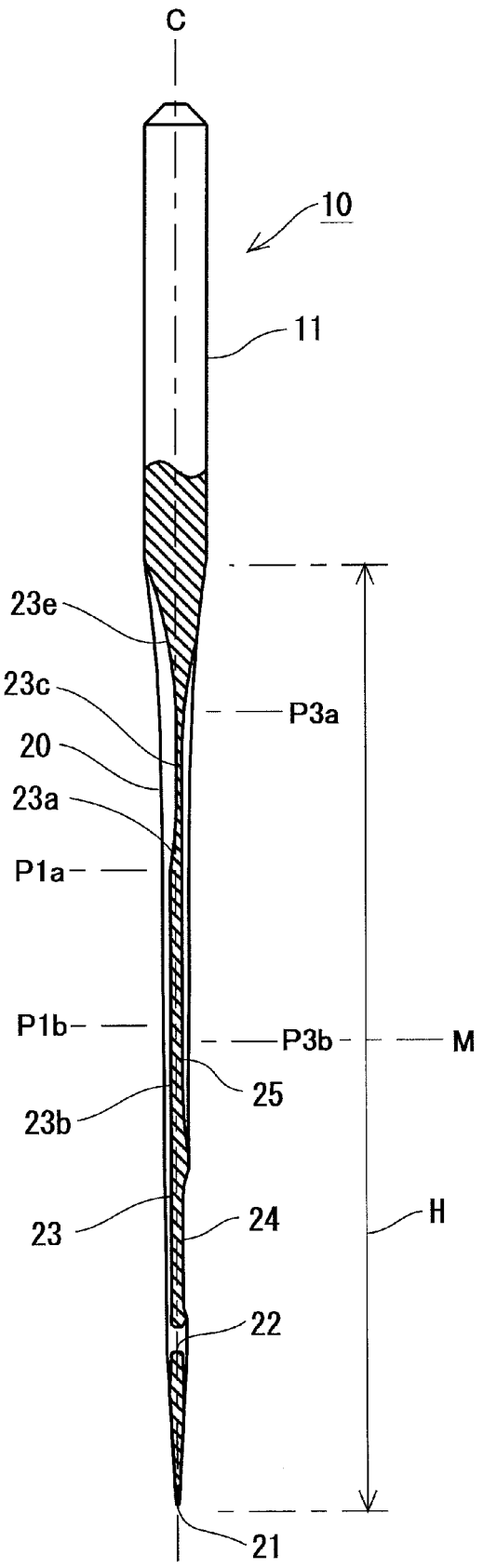
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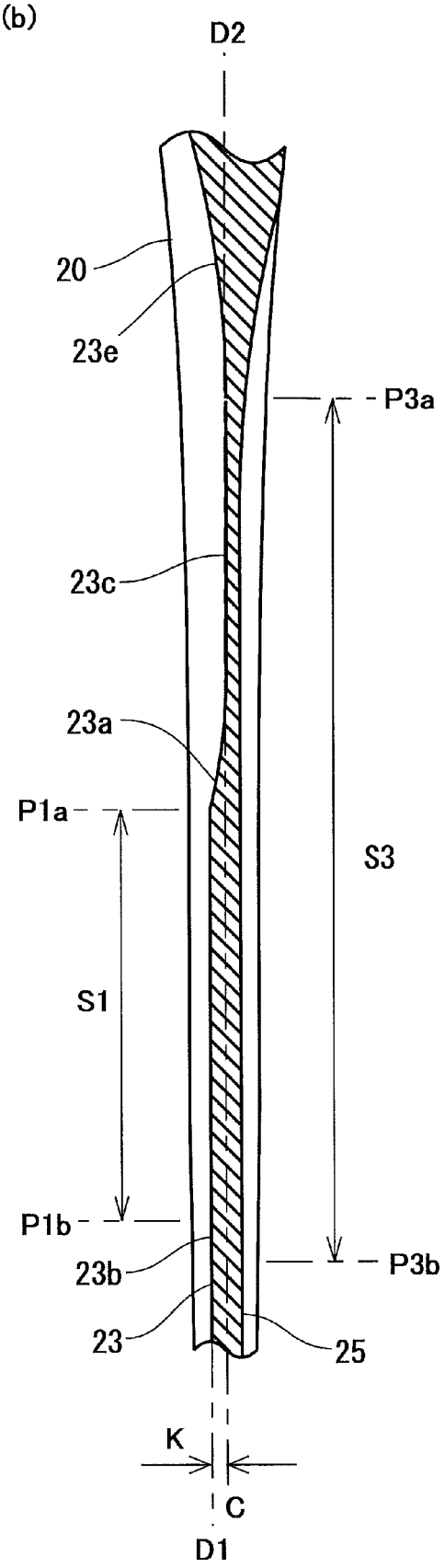
2 (b)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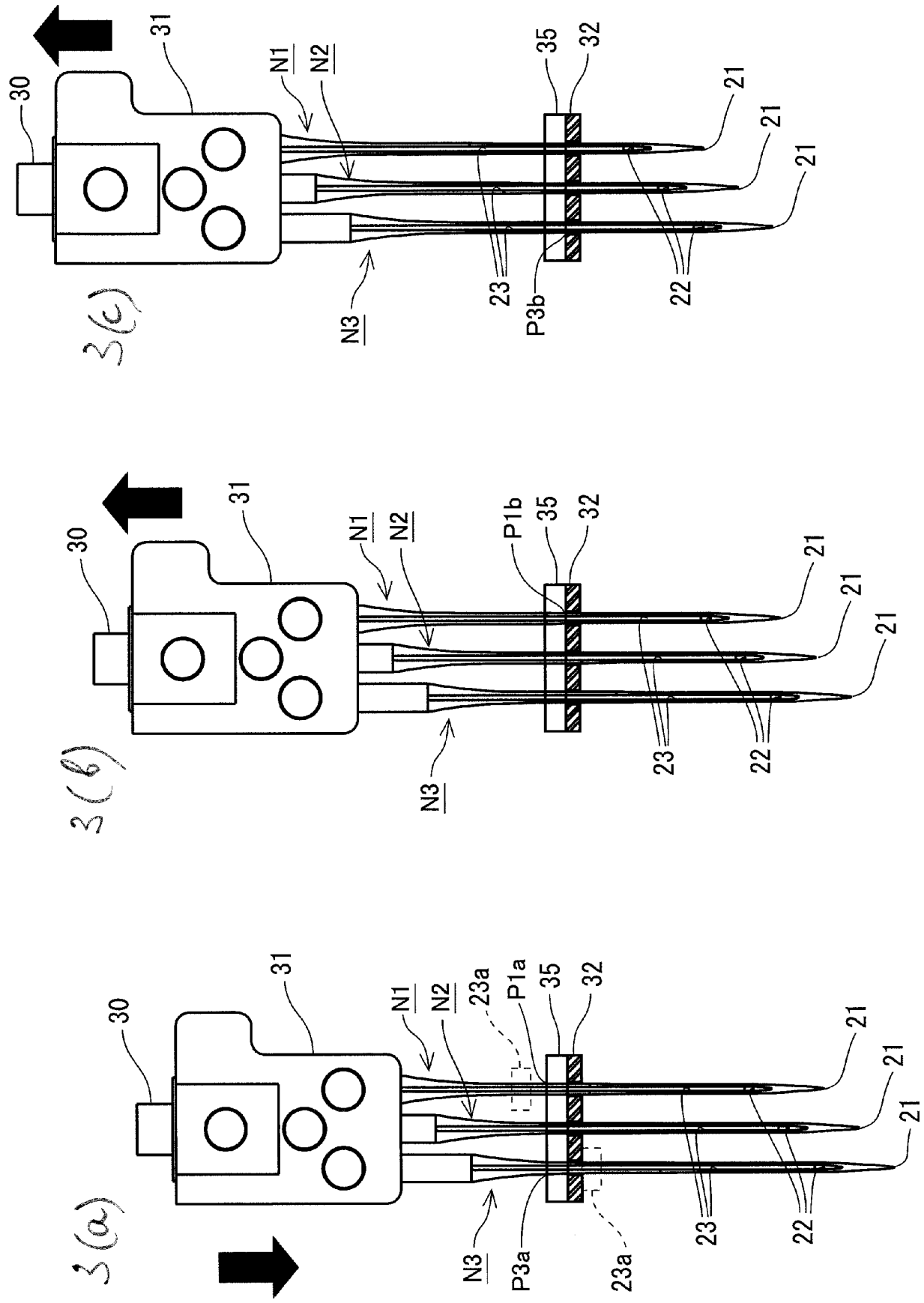
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23a
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22

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EUROPEAN SEARCH REPORT

Application Number
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D05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 July 2021	Braun, Stefanie

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