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(54) Bobbin case for use with full rotary hook in industrial sewing machine

(57) A bobbin case (4) is detachably attachable to a full rotary hook (1) forming stitches in cooperation with a sewing needle (6) of a sewing machine and houses a lower thread bobbin on which a lower thread (DT) is wound. The bobbin case (4) has an outer peripheral wall formed with a lower thread exit (19) through which the lower thread (DT) is introduced outwards and a thread tension spring (18) imparting a tension to the lower thread (DT) which has come out of the lower thread exit (19). The bobbin case (4) has a front with a lower thread guide (20) mounted at a location spaced away from the front of the bobbin case (4) and an imaginary line extended from a trajectory of vertical movement of the sewing needle (6) . The lower thread guide (20) guides the lower thread (DT) extending out of the lower thread exit (19).

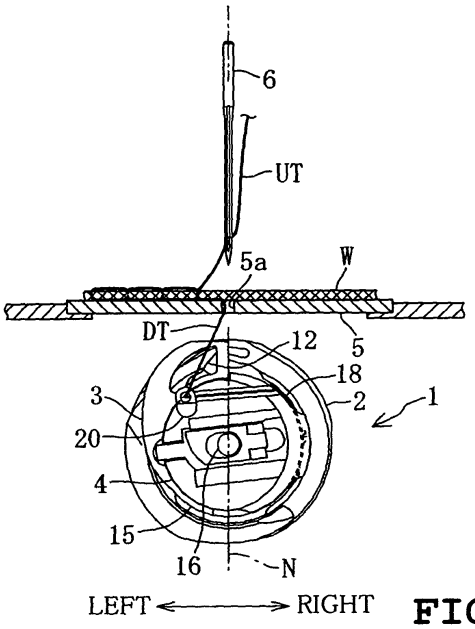

FIG.1

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Description

[0001] The present invention relates to a bobbin case which is used with a full rotary hook and can form stable well-looking stitches.

[0002] Vertical full rotary hooks have conventionally been used with industrial sewing machines although half rotary hooks have been used with less frequency. The vertical full rotary hooks generally have a simpler hook driving mechanism than the half rotary hooks. Both types of rotary hooks house a bobbin case having a lower thread bobbin on which a lower thread is wound. For example, JP-2000-261848A discloses a vertical full rotary hook comprising a rotating hook, a rotating hook bobbin case holder which is mounted in the rotating hook so as to be unrotatable, and a bobbin case attached to the holder. The bobbin case houses a lower thread bobbin and has an outer peripheral wall including a right side provided with a bobbin thread tension spring. The bobbin thread tension spring has a distal end or an upper right portion of the bobbin case formed with a lower thread exit. A lower thread wound on the lower thread bobbin is drawn from the lower thread exit through the vicinity of an upper end of the bobbin case, extending directly above a needle hole of a needle plate.

[0003] In the above-described construction, hitch stitches formed in a stitch forming direction are assumed to range from 0° to about 180° when the positive Y-direction in X-Y coordinate is represented by "0°". As a result, a sewing manner as shown in FIG. 8 results in mixture of hitch stitches and perfect stitches. One of manners of overcoming this problem can be considered to direct a lower thread wound on the lower thread bobbin from the lower thread exit directly toward the needle hole of the needle plate.

[0004] In this case, however, when the lower thread comes upward through the lower thread exit which is the distal end of the bobbin thread tension spring, the lower thread is pulled upward upon execution of cloth feed. The bobbin thread tension spring floats depending upon the strength of tension applied to the lower thread, whereupon the spring force of the bobbin thread tension spring is rendered unstable. As a result, the thread tension of the lower thread is rendered unstable such that stitches are irregular.

[0005] Therefore, an object of the present invention is to provide a bobbin case in which the mixture of perfect and hitch stitches can be prevented by a simple construction, the thread tension spring mounted on the bobbin case can normally exert the spring force thereof, and the thread tension of the lower thread can be rendered stable.

[0006] The present invention provides a bobbin case which is detachably attachable to a full rotary hook forming stitches in cooperation with a sewing needle of a sewing machine and which houses a lower thread bobbin on which a lower thread is wound, the bobbin case having an outer peripheral wall formed with a lower thread exit through which the lower thread is introduced outwards and a thread tension spring imparting a tension to the lower thread which has come out of the lower thread exit, the bobbin case having a front and characterized by a lower thread guide provided at a location spaced away both from the front of the bobbin case and from an imaginary line extended from a vertical movement trajectory of the sewing needle, the lower thread guide guiding the lower thread extending out of the lower thread exit.

[0007] The lower thread is pulled laterally at the lower thread exit by the lower thread guide even when pulled to the workpiece cloth side on the occasion of cloth feed. Accordingly, the thread tension spring provided in the lower thread exit is prevented from inadvertently floating. Consequently, since the thread tension imparted to the lower thread is rendered stable, the thread tension spring can normally exert spring force thereof and well-looking stitches can be formed.

[0008] The invention will be described, merely by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a front view of a vertical full rotary hook in accordance with a first embodiment of the present invention;
FIG. 2 is a plan view of the vertical full rotary hook;
FIG. 3 is a perspective view of the vertical full rotary hook;
FIG. 4 is a front view of a bobbin case;
FIG. 5 is a side view of the bobbin case during a sewing operation;
FIG. 6 is a partially enlarged perspective view of a lower end of sewing needle;
FIG. 7 illustrates perfect stitches and hitch stitches formed when the bobbin case of the first embodiment is used;
FIG. 8 is a plan view of a label to be sewn and workpiece cloth W on which the label is to be sewn;
FIG. 9 is a partially enlarged side view of the vertical full rotary hook and the needle plate during the sewing operation;
FIG. 10 is a side view of the bobbin case at the time of start of sewing;
FIG. 11 is a view similar to FIG. 2, showing a second embodiment of the invention;
FIG. 12 is a view similar to FIG. 7, showing the second embodiment of the invention;
FIG. 13 is a view similar to FIG. 2, showing a third embodiment of the invention;
FIG. 14 is a view similar to FIG. 2, showing a fourth embodiment of the invention; and
FIG. 15 is a view similar to FIG. 5, showing the fourth embodiment of the invention.

[0009] A first embodiment of the invention will be described with reference to FIGS. 1 to 10. Firstly, a vertical rotary hook 1 provided on a sewing machine will be described. The vertical rotary hook 1 includes an outer rotating hook 2, an inner bobbin case holder 3 which is

fitted in the rotating hook 2 thereby to be supported so as to be rotatable with respect to the rotating hook 2, and a bobbin case 4 attached to the bobbin case holder 3. The rotating hook 2 includes a rotating hook body 10 and a rotational shaft 11 secured to the body 10. A lower shaft 7 is rotated in synchronization with a main shaft (not shown) of the sewing machine. Torque is transmitted from the lower shaft 7 to the rotational shaft 11 so that the rotating hook 2 is rotated clockwise about the rotational shaft 11 in synchronization with the vertical movement of a sewing needle 6. The rotating hook body 10 is formed with a loop seizing beak 12 directed clockwise. The bobbin case holder 3 includes a holder body 15 and a shaft 16 and is coaxially fitted in the hook body 10 so that the bobbin case holder 3 and the hook body 10 are rotatable relative to each other. The shaft 16 protrudes from the bottom of the holder body 15 so as to extend to an open end side of the holder body 15.

[0010] The bobbin case 4 is formed into a cylindrical shape and has a closed front. The bobbin case 4 is attached to the bobbin case holder 3 so as to be prevented from relative rotation. The bobbin case 4 houses a lower thread bobbin (not shown) on which a lower thread DT is wound. When torque developed by the lower shaft 7 is transmitted to the vertical full rotary hook 1, the rotating hook 2 is rotated clockwise in synchronization with the vertical movement of the sewing needle 6 while the bobbin case holder 3 and the bobbin case 4 are prevented from rotation. Upon rotation of the rotating hook 2, an upper thread loop UTa (see FIG. 9) of an upper thread UT is seized by the beak 12. In this case, the upper thread UT extends through a needle eye 6a of the sewing needle 6 having passed through workpiece cloth W. The seized upper thread loop UTa is moved around the bobbin case holder 3 so that the upper thread loop UTa extending through the needle eye 6a of the sewing needle 6 is entangled with the lower thread DT extending from the lower thread bobbin. Subsequently, the upper thread loop UTa is tightened up by a thread take-up lever (not shown), whereupon stitches are formed.

[0011] The bobbin case 4 has an outer peripheral wall 4a including an upper right-hand portion on which a thread tension spring 18 is provided as shown in FIG. 9. A left side of the wall 4a is referred to as "front" as viewed in FIG. 9. The thread tension spring 18 imparts thread tension to the lower thread DT coming out of the bobbin case 4. The thread tension spring 18 is constructed so that the thread tension thereof is adjustable. Accordingly, the lower thread DT passes between the thread tension spring 18 and the wall 4a, coming out of the bobbin case 4 through a lower thread exit 19 located at the distal end of the thread tension spring. More specifically, the lower thread exit 19 is formed on the right of an extended line of the vertical movement trajectory of the sewing needle 6.

[0012] A thread guide member 20 will now be described. The thread guide member 20 is secured to the front of the bobbin case 4. The thread guide member 20 is substantially elliptic as viewed in FIGS. 1 and 3 to 5 and is located on the left of the vertical movement trajectory N of the sewing needle 6 on the front of the bobbin case 4. The thread guide member 20 includes a lower half secured to the front of the bobbin case 4 and an upper half bent frontward by a predetermined angle. A right side as viewed in FIG. 5 is referred to as the front. An upper half of the thread guide member 20 is formed with a lower thread guide hole 20a into which the lower thread DT is insertable. The thread guide hole 20a serves as a lower thread guide. In this case, the lower thread guide hole 20a is located lower than the lower thread exit 19 as shown in FIG. 4. The bobbin case 4 includes a front formed with a linear guide groove 22 extending from the lower thread exit 19 toward the upper half of the thread guide member 20 as shown in FIGS. 1 and 5. The lower thread DT drawn out of the lower thread exit 19 passes through the guide groove 22 and thereafter extends through the lower thread from the rear to the front. The lower thread DT further passes through the needle hole 5a of the needle plate 5, reaching the workpiece cloth W.

[0013] More specifically, as shown in FIGS. 1 and 2, during the sewing operation, the lower thread DT extending to the workpiece cloth W passes through the needle hole 5a and further through the lower thread guide hole 20a while being directed obliquely downward and leftward. Accordingly, when the sewing needle 6 descends through the needle hole 5a below the needle plate 5, the lower thread DT extending from the needle hole 5a to the lower thread guide hole 20a or the lower thread DT entangled with the upper thread UT is necessarily located on the left of the sewing needle 6. Moreover, a thread guide groove 6b is formed in the sewing needle 6 so as to be located right below the needle eye 6a. The upper thread UT coming out of the needle eye 6a is guided leftward as viewed from the operator side. Accordingly, as shown in FIG. 7, in the case where the positive Y direction in X-Y coordinates represents 0°, perfect stitches (PS) are formed when a stitch forming direction θ (cloth feed direction and direction opposite to the cloth feed direction) is in the ranges shown as $0° \leq \theta < 200°$ and $220° < \theta < 360°$. Furthermore, hitch stitches (HS) are formed when the stitch forming direction θ is in a range shown as $200° \leq \theta \leq 220°$.

[0014] The above-described bobbin case 4 will operate as follows. As described above, the lower thread DT of the lower-thread bobbin housed in the bobbin case 4 is drawn out of the exit 19 and passes through the guide groove 22 and the lower-thread guide hole 20a of the thread guide member 20, thereafter extending through the needle hole 5a to the workpiece cloth W over the needle plate 5. The upper thread UT is drawn from a thread spool (not shown) through a thread take-up lever (not shown), extending through the needle eye 6a from the rear to the front. Accordingly, the stitch forming direction θ in which hitch stitches are formed ranges as $200° \leq \theta \leq 220°$ shifted from 180° (negative Y direction) as shown in FIG. 7.

[0015] FIG. 8 illustrates a case where an outer periphery of a rectangular label 22 is sewn into a rectangular shape and is sewn onto the workpiece cloth W. Sewing starts at left inner first stitch S1 in this rectangular sewing. Sewing is then carried out from positive feed a (arrow A designates a stitch forming direction), leftward feed b (arrow B designates a stitch forming direction), reverse feed c (arrow C designates a stitch forming direction), and rightward feed d (arrow D designates a stitch forming direction) sequentially in this order. In this case, the stitch forming direction of positive feed a is represented as 180°. The stitch forming direction of leftward feed b is represented as 90°. The stitch forming direction of reverse feed c is 0°. The stitch forming direction of leftward feed d is represented as 270°. Accordingly, the stitch forming section θ in each of the four stitch forming directions A to D is outside the range of $200° \leq \theta \leq 220°$ in which the hitch stitches are formed.

[0016] Firstly, the following describes the case where first to fifteenth stitches S1 to S15 are sewn in the stitch forming direction A. In the case of a second stitch S2 subsequent to the first stitch S1, when the sewing needle 6 is caused to stitch through the label 22 and workpiece cloth W and then lifted upward slightly from the lowermost position, the loop UTa of upper thread UT formed in front of the needle eye 6a is seized by the beak 12 while the beak 12 is moved clockwise. In this case, since the lower thread guide hole 20a of the thread guide member 20 is provided at a lower position than the lower thread exit 19, the direction of the lower thread DT moving from the guide hole 20a toward the needle plate 5 approaches to a vertical direction which is the trajectory of vertical movement of the sewing needle 6. Accordingly, the probability of the needle 6 sticking to the lower thread DT can be reduced, whereupon rejection of products can be reduced in the quality inspection.

[0017] Furthermore, the beak 12 is rotated clockwise as viewed at the front so that the upper thread loop UTa formed in front of the needle eye 6a is seized by the beak 12. In this case, since the lower thread DT is entangled with the upper thread loop UTa from the left, a perfect stitch is formed. Subsequently, stitches S3, ⋯ S14 and S15 are formed in the same manner as described above. These are perfect stitches. Moreover, the lower thread DT is laterally pulled by the guide hole 20a at the exit 19 even if pulled to the workpiece cloth side during cloth feed for every stitch. Accordingly, since thread tension applied to the lower thread DT is rendered stable, the thread tension spring 18 provided in the lower thread exit 19 is prevented from inadvertently floating. Consequently, the thread tension spring 18 can normally exert the spring force thereof, and well-looking stitches can be formed.

[0018] Next, the following describes the case where fifteenth to thirty-sixth stitches S15 to S36 are sewn in the stitch forming direction B. In the case of a sixteenth stitch S16 subsequent to the fifteenth stitch S15, when the sewing needle 6 is caused to stick through the label 22 and workpiece cloth W and then lifted upward slightly from the lowermost position, the upper thread loop UTa formed in front of the needle eye 6a is seized by the beak 12 while the beak 12 is moved clockwise. In this case, since the lower thread DT entangles the upper thread loop UTa from the left without the upper thread loop UTa intersecting the sewing needle 6, a perfect stitch is formed. Subsequently, stitches S17, ... S35 and S36 are formed in the same manner as described above. These are perfect stitches.

[0019] Subsequently, the following describes the case where thirty-sixth to fiftieth stitches S36 to S50 are sewn in the stitch forming direction C. In the case of a thirty-seventh stitch S37 subsequent to the thirty-sixth stitch S36, when the sewing needle 6 is caused to stick through the label 22 and workpiece cloth W and then lifted upward slightly from the lowermost position in the same manner as described above, the upper thread loop UTa formed in front of the needle eye 6a is seized by the beak 12 while the beak 12 is moved clockwise. In this case, since the lower thread DT entangles the upper thread loop UTa from the left without the upper thread loop UTa intersecting the sewing needle 6, a perfect stitch is formed. Subsequently, stitches S38, ... S49 and S50 are formed in the same manner as described above. These are perfect stitches.

[0020] Furthermore, the following describes the case where fiftieth to seventy-first stitches S50 to S71 are sewn in the stitch forming direction D. In the case of a fifty-first stitch S51 subsequent to the fiftieth stitch S50, when the sewing needle 6 is caused to stick through the label 22 and workpiece cloth W and then lifted upward slightly from the lowermost position in the same manner as described above, the upper thread loop UTa formed in front of the needle eye 6a is seized by the beak 12 while the beak 12 is moved clockwise. In this case, the upper thread UTa is guided by the groove 6b of the sewing needle 6. Accordingly, since the upper thread loop UTa is formed in the left front of the sewing needle 6 and entangled with the lower thread DT from the left, a perfect stitch is formed. Subsequently, stitches S52, ... S70 and S71 are formed in the same manner as described above. These are perfect stitches.

[0021] The lower thread DT extending from the lower thread exit 19 to the lower thread guide hole 20a is fitted in the guide groove 22. Accordingly, the beak 12 engages the upper thread loop UTa such that the loop UTa is enlarged. As a result, when sliding on the front of the bobbin case 4, the upper thread loop UTa can be prevented from interfering with the lower thread DT. Thus, the upper thread loop UTa can smoothly slide on the front of the bobbin case 4. Furthermore, at a first stitch, the lower thread end DTa extending from the bobbin case 4 further extends through the lower thread guide hole 20a of the thread guide member 20 and is spaced forward from the front of the bobbin case 4 by a predetermined slight distance (3 mm, for example), as shown in FIG. 10. Accordingly, since the upper thread loop UTa is necessarily en-

tangled with the lower thread DT, stitches can reliably be formed from a first one.

[0022] As obvious from the foregoing, the vertical full rotary hook 1 is provided below the needle plate 5 of the sewing machine and forms stitches in cooperation with the sewing needle 6. The bobbin case 4 in which the lower thread bobbin is housed is detachably attached to the vertical full rotary hook 1. The outer peripheral wall 4a of the bobbin case 4 is provided with the lower thread exit 19 guiding the lower thread DT wound on the lower thread bobbin out of the bobbin case 4. The thread guide member 20 is provided on the front of the bobbin case 4 for guiding the lower thread DT extending from the lower thread exit 19. Furthermore, the thread guide member 20 is provided with the lower thread guide hole 20a which engages the lower thread DT with the thread guide member 20. Consequently, even if the lower thread DT is pulled to the workpiece cloth W side upon cloth feed, the lower thread DT at the lower thread exit 19 is pulled laterally by the lower thread guide hole 20a. Accordingly, the thread tension spring 18 provided at the lower thread exit 19 can be prevented from inadvertently floating. Consequently, since the thread tension applied to the lower thread DT is rendered stable, the thread tension spring 18 can normally exert sufficient spring force and form well-looking stitches.

[0023] The lower thread guide hole 20a is provided at the location away from the extension line of the vertical movement trajectory N of the sewing needle 6, that is, on the left of the extension line of the vertical movement trajectory N. Consequently, the stitch forming direction in which hitch stitches are formed can be set at a location shifted on the left of the Y axis of X-Y coordinate. Furthermore, since the lower thread guide hole 20a is provided at the lower position than the lower thread exit 19, the direction of the lower thread DT moving from the guide hole 20a toward the needle plate 5 approaches to a vertical direction which is the trajectory of vertical movement of the sewing needle 6. Accordingly, the probability of the needle 6 sticking to the lower thread DT upon downward movement of the sewing needle 6 can be reduced, whereupon rejection of products can be reduced in the quality inspection. Furthermore, the lower thread guide hole 20a is located on the left of the extension line of the vertical movement trajectory N of the sewing needle 6, that is, opposite to the lower thread exit 19. Consequently, stitches can be rendered stable since the lower thread loop UTa in engagement with the beak 12 of the vertical full rotary hook 1 is entangled with the lower thread DT after having passed through the lower end of the bobbin case 4.

[0024] Furthermore, the guide groove 22 is formed in the front of the bobbin case 4 to guide the lower thread DT from the lower thread exit 19 into the lower thread guide hole 20a. Accordingly, the lower thread DT passing from the right lower thread exit 19 to the leftward lower thread guide hole 20a is fitted into the guide groove 22 but not the front of the bobbin case 4. Consequently, when the upper thread loop UTa in engagement with the beak 12 is enlarged and slides on the front of the bobbin case 4, the upper thread loop UTa can be prevented from interfering with the lower thread DT. Thus, the upper thread loop UTa can smoothly slide on the front of the bobbin case 4.

[0025] FIGS. 11 and 12 illustrate a second embodiment of the invention. Identical or similar parts in the second embodiment are labeled by the same reference symbols as those in the first embodiment. In the second embodiment, the thread guide member 20A is located at a right upper position corresponding to the lower thread exit 19 of the bobbin case 4A. In this case, however, the upper thread UT passing through the eye 6a of the sewing needle 6 is entangled on the right of the sewing needle. In this case, too, even if the lower thread DT is pulled to the workpiece cloth W side upon cloth feed, the lower thread DT at the lower thread exit 19 is pulled laterally by the lower thread guide hole 20A. Accordingly, well-looking stitches can be formed in the second embodiment in the same manner as in the first embodiment. Moreover, perfect stitches (designated by "PS") are formed when the stitch forming direction θ ranges as $0° \leq \theta < 140°$ and $160° < \theta < 360°$. In other words, the range of hitch stitches (designated by "HS") can be changed from the range of $200° \leq \theta \leq 220°$ to the range of $140° \leq \theta \leq 160°$ which is opposed to the former with respect to the y-axis.

[0026] FIG. 13 illustrates a third embodiment of the invention. Identical or similar parts in the third embodiment are labeled by the same reference symbols as those in the first embodiment. In the third embodiment, the thread guide members 20 and 20A are provided on the left and right upper portions of the bobbin case 4B respectively as shown in FIG. 13. In this case, either thread guide member 20 or 20A is selectively used on the basis of the cloth feed direction θ so that occurrence of hitch stitch is prevented. The range in which hitch stitch is formed can be changed to the left or right side with respect to the y-axis of the X-Y coordinate.

[0027] FIGS. 14 and 15 illustrate a fourth embodiment of the invention. Identical or similar parts in the fourth embodiment are labeled by the same reference symbols as those in the first embodiment. In the fourth embodiment, a thread guide member 24 is provided on an upper portion of the front of the bobbin case 4 so as to protrude upward as shown in FIGS. 14 and 15. The thread guide member 24 is formed with a lower thread guide hole 24a through which the lower thread DT is caused to pass. The front of the bobbin case 4 is formed with a substantially horizontal guide groove 26 which guides the lower thread DT passing from the lower thread exit 19 into the lower thread guide hole 24a. The other construction of the fourth embodiment is the same as that of the first embodiment. Consequently, the fourth embodiment can achieve the same effect as the first embodiment.

[0028] Although the thread guide members 20, 20A and 24 include the lower thread guide holes 20a and 24a as the lower thread guides in the foregoing embodiments,

any other type that can change a path of the lower thread may be provided. For example, the thread guide may be hook-shaped, instead.

Claims

1. A bobbin case which is detachably attachable to a full rotary hook (1) forming stitches in cooperation with a sewing needle (6) of a sewing machine and which houses a lower thread bobbin on which a lower thread (DT) is wound, the bobbin case having an outer peripheral wall (4a) formed with a lower thread exit (19) through which the lower thread (DT) is introduced outwards and a thread tension spring (18) imparting tension to the lower thread (DT) which has come out of the lower thread exit (19), the bobbin case having a front and **characterized by**:

   a lower thread guide (20a) provided at a location spaced away both from the front of the bobbin case and from an imaginary line extended from a vertical movement trajectory of the sewing needle (6), the lower thread guide (20a) guiding the lower thread (DT) extending out of the lower thread exit.

2. The bobbin case of claim 1, wherein the lower thread guide (20a) is located opposite to the lower thread exit (19) relative to the imaginary extended line.

3. The bobbin case of claim 2, wherein the lower thread guide (20a) is comprised of a hole (20a, 20A) into which the lower thread (DT) is insertable.

4. The bobbin case of claim 3, including an upper portion thereof provided with a protrusion protruding upward, wherein the lower thread guide (20a) is provided on the protrusion.

5. The bobbin case of any one of claims 2 to 4, wherein the front of the bobbin case is formed with a guide groove (22) guiding the lower thread (DT) from the lower thread exit (19) to the lower thread guide (20a).

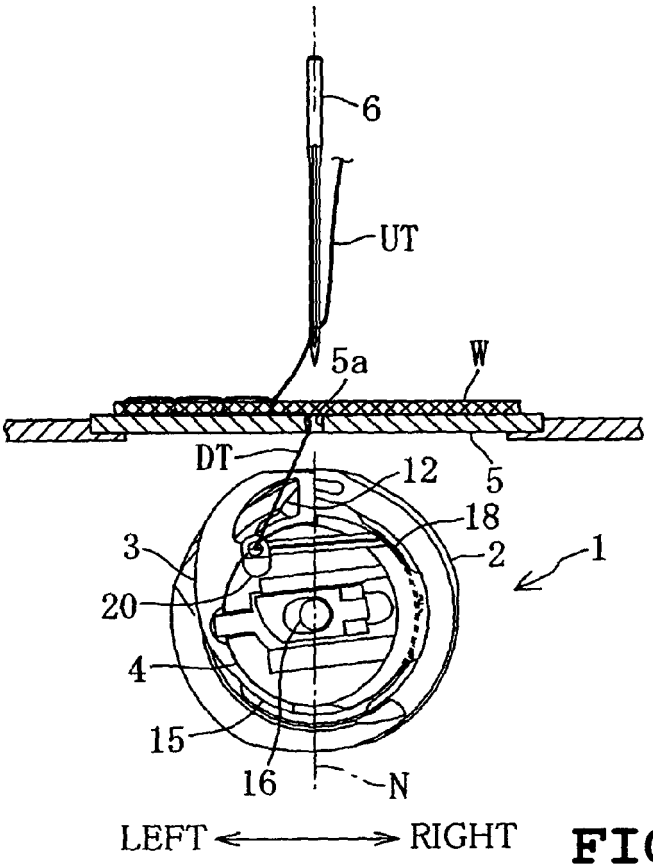
6
UT
5a
W
DT
12
5
18
3
2
1
20
4
15
16
N
LEFT
RIGHT

FIG. 1

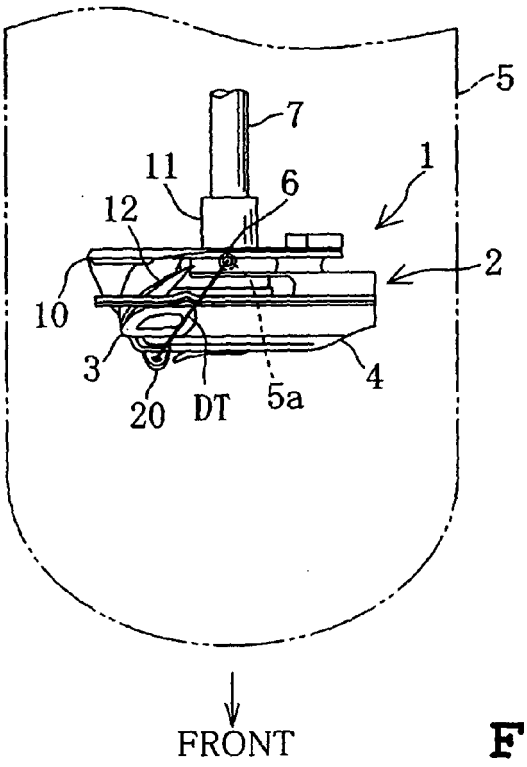
5
7
11
1
6
12
2
10
3
4
20
DT
5a
FRONT

FIG. 2

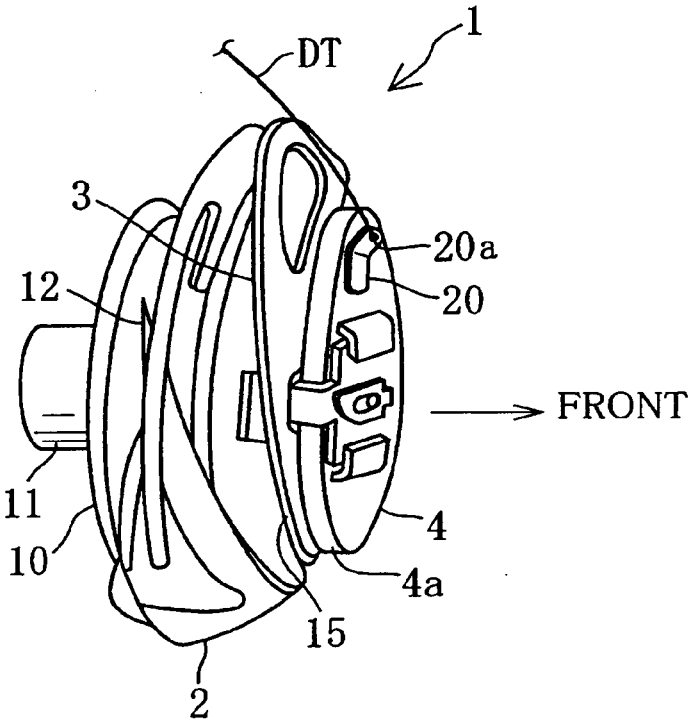

FIG. 3

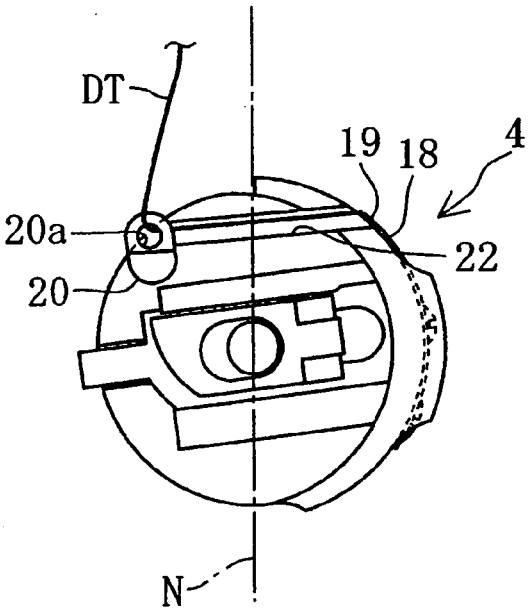

FIG. 4

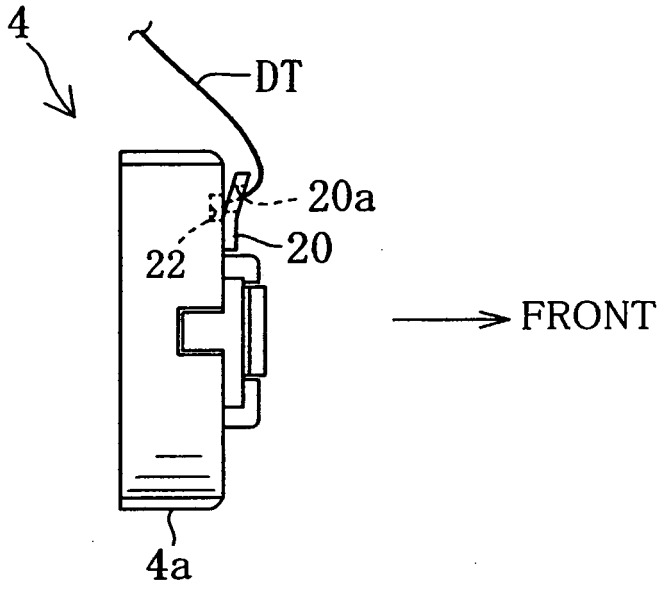

FIG. 5

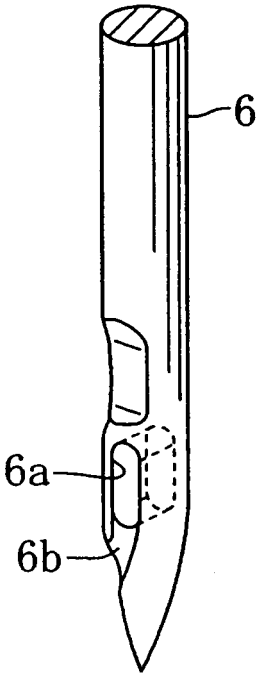

FIG. 6

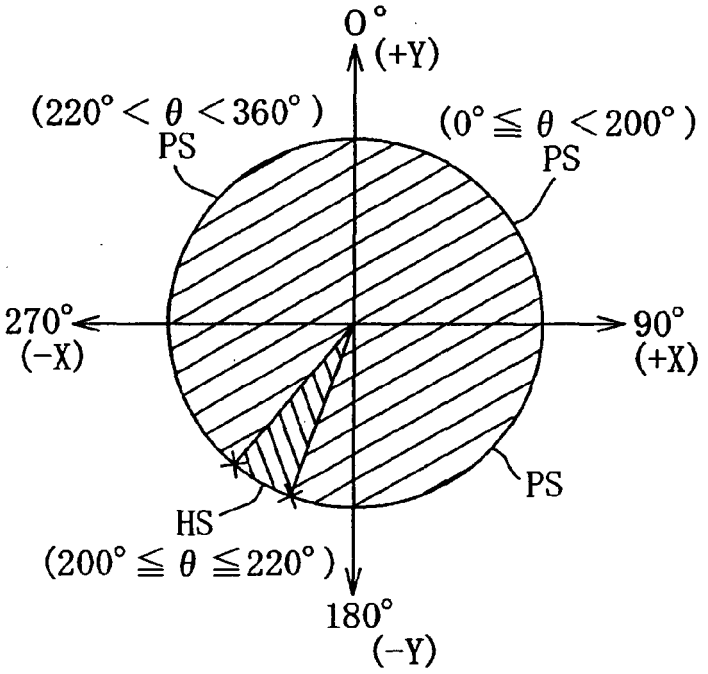
0°
(+Y)
(220° < θ < 360°)
(0° ≦ θ < 200°)
PS
PS
270°
(−X)
90°
(+X)
PS
HS
(200° ≦ θ ≦220°)
180°
(−Y)

FIG. 7

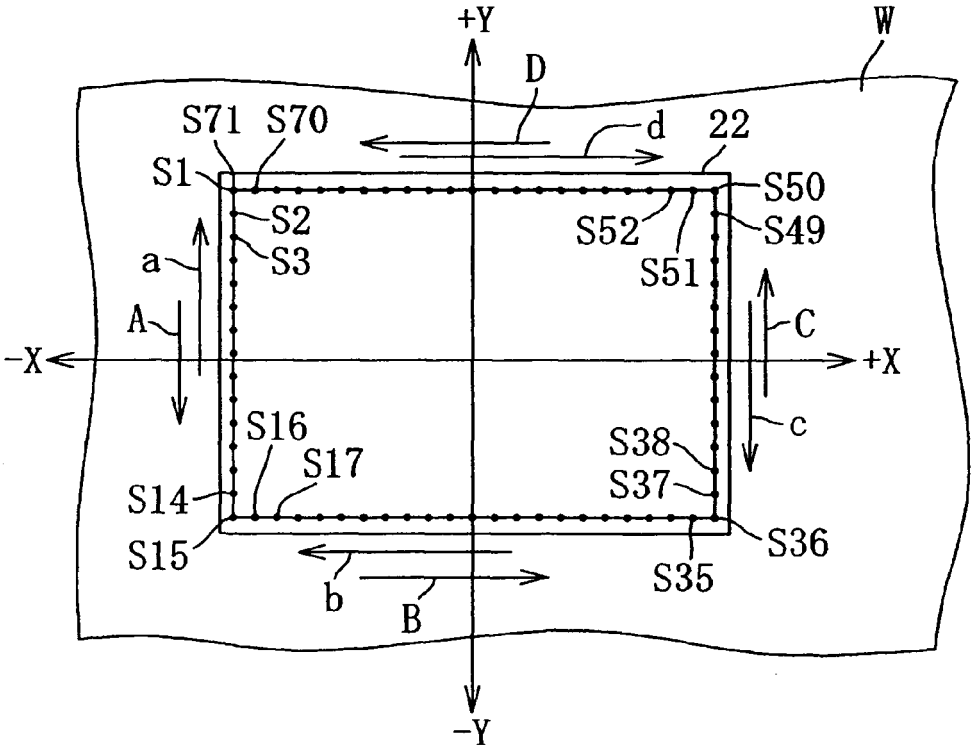
+Y
W
D
S71
S70
d
22
S1
S50
S2
S52
S49
S3
S51
a
A
C
−X
+X
S16
S38
c
S17
S37
S14
S36
S15
S35
b
B
−Y

FIG. 8

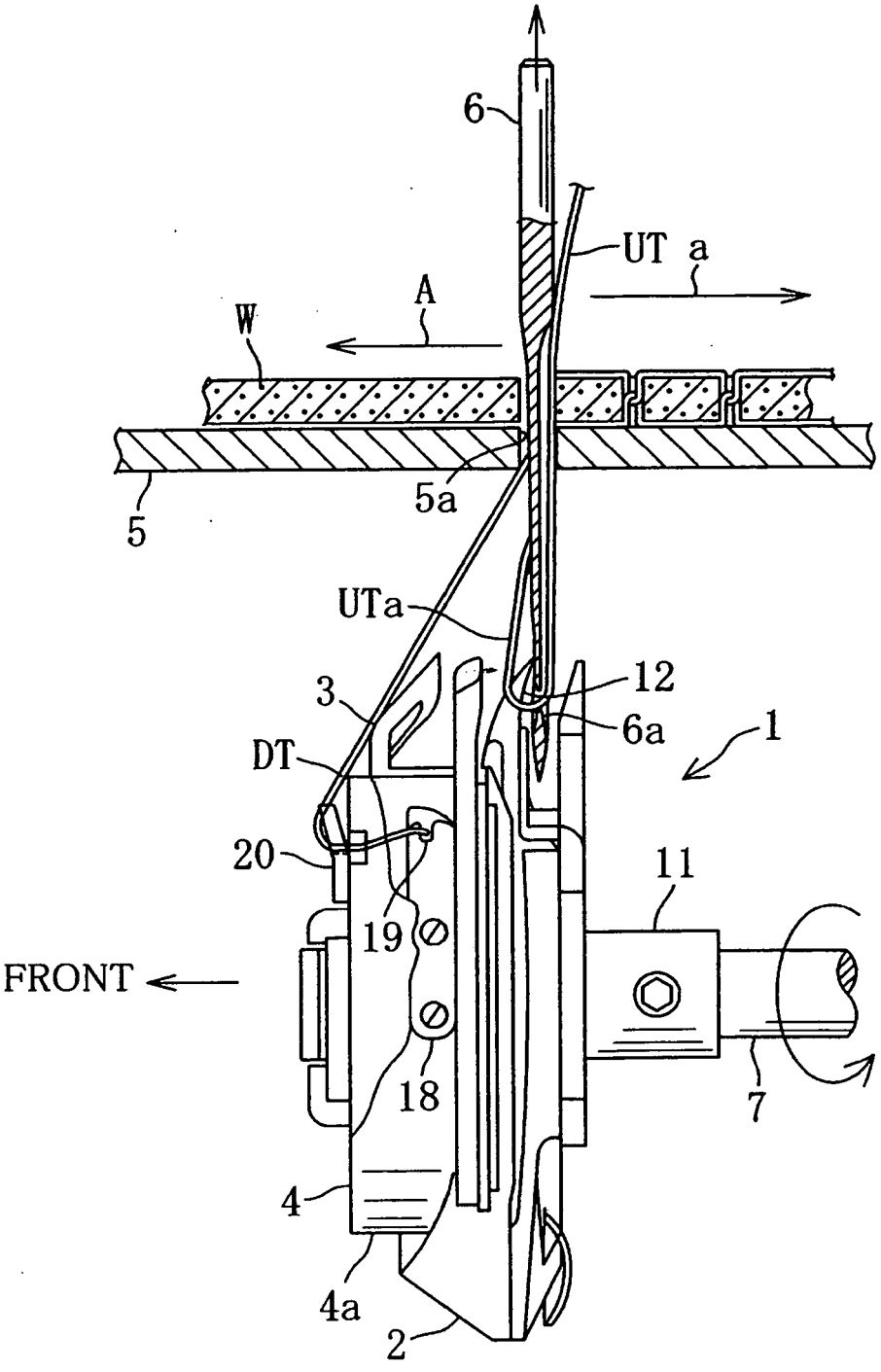

FIG. 9

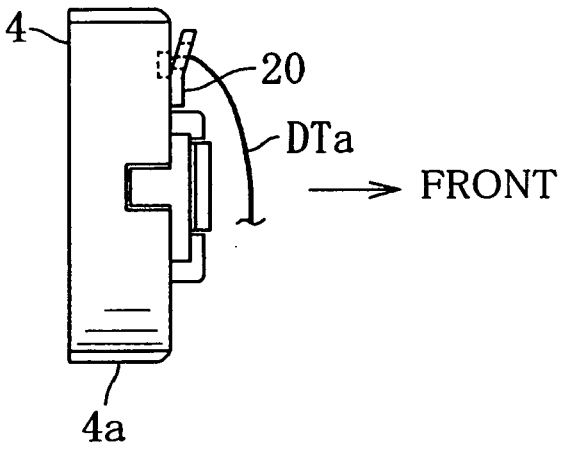

FIG.10

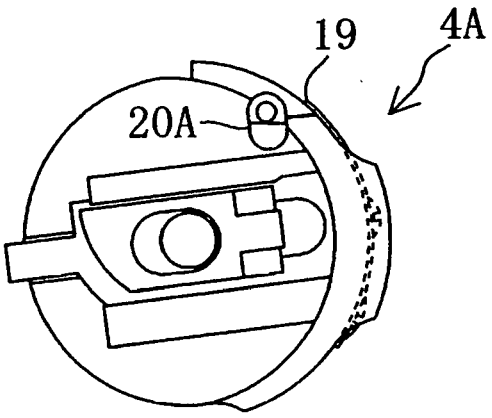

FIG.11

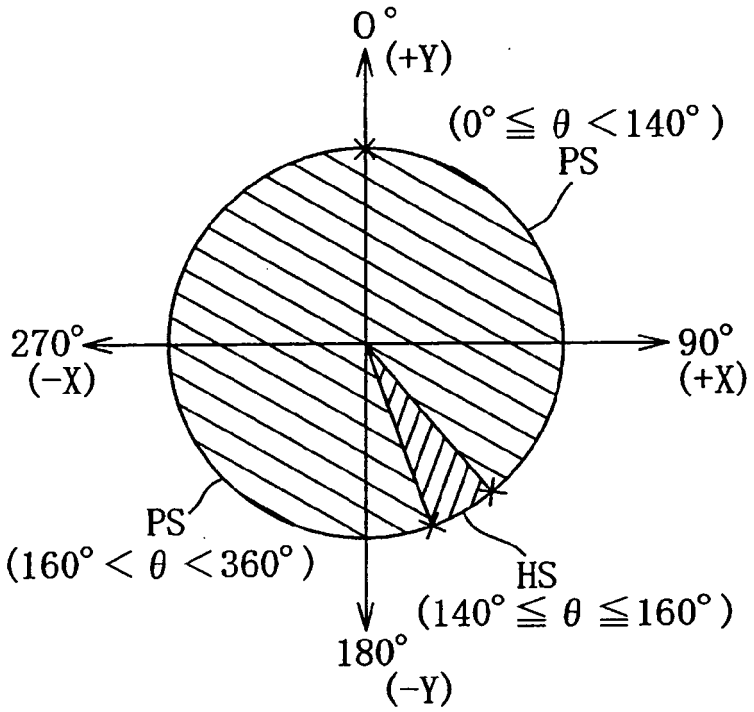

FIG.12

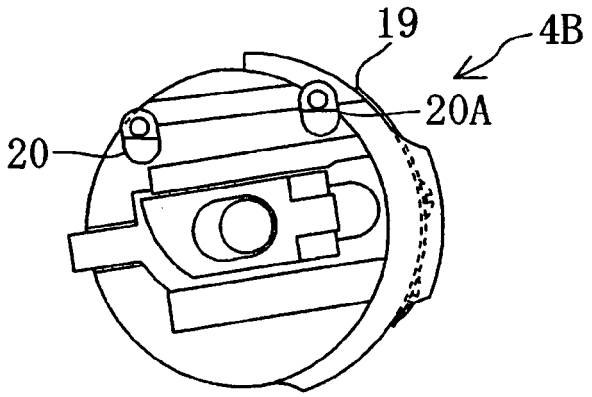

FIG.13

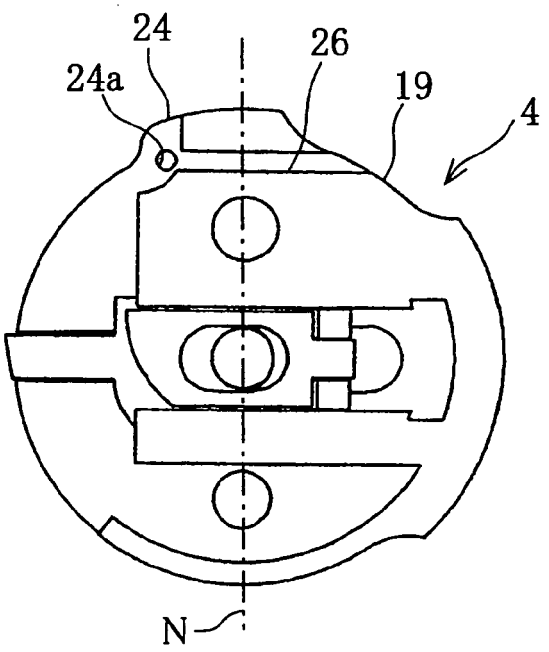

FIG.14

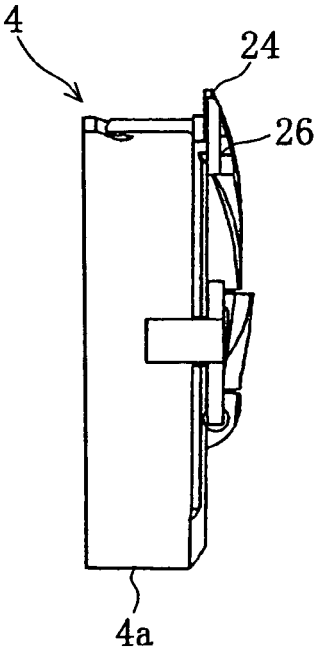

FIG.15

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EUROPEAN SEARCH REPORT

Application Number
EP 07 01 3024

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 275 675 A (KILLINGER KARL H) 30 June 1981 (1981-06-30) * figures * -----	1	INV. D05B57/26
X	US 2 098 270 A (WOOD ALFRED R) 9 November 1937 (1937-11-09) * figures * -----	1	
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TECHNICAL FIELDS SEARCHED (IPC)

D05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 October 2007	Debard, Michel

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1

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05-10-2007

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