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(54) **COMPOUND NEEDLE**

COMPOUNDNADEL

AIGUILLE COMPOUND

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Description

Technical Field

[0001] The present invention relates to a compound needle used in a knitting machine such as a flat knitting machine. In particular, the present invention relates to a guide of a slider for a needle member.

Background Art

[0002] Japanese Laid-Open Patent Publication No. 2002-294541, Japanese Laid-Open Patent Publication No. 2001-032154, and Japanese Laid-Open Patent Publication No. 62-206069 disclose compound needles. According to the disclosure of Japanese Laid-Open Patent Publication No. 2002-294541, a needle member has a fork which is branched from substantially the central position in the longitudinal direction. The fork extends toward a hook side at the front end of the needle member. A slider is guided by the lower surface of the fork and the upper surface of the needle member. A slider butt is provided in the back portion of the slider, and a pair of support portions are provided at the lower back end of the slider. The needle member is sandwiched between the support portions. The support portions are considered to be protrusions provided on the slider.

[0003] Japanese Laid-Open Patent Publication No. 2001-032154 discloses a compound needle of a similar type. Instead of providing a fork for the needle member to sandwich the slider, the upper surface of the slider is supported by a metal belt on a needle bed.

[0004] According to the disclosure of Japanese Laid-Open Patent Publication No. 62-206069, forks are provided for a needle member and a slider, respectively, and the forks engage each other to position the slider.

[0005] As in the case of Japanese Laid-Open Patent Publication No. 2002-294541, if the stitch loop is supported by the tongues at the front end of the slider, a force is generated to bounce the back end of the slider. In opposition to the force, the pair of support portions are used for preventing the back end of the slider to move upwardly. The inventor of the present application found that it is difficult to sufficiently support the force which bounces the back end of the slider by the pair of support portions provided at the lower back end of the slider. In the structure, the product life of the compound needle is short, and it is difficult to accurately limit the height of the slider butt.

Summary of the Invention

[0006] An object of the present invention is to prevent upward movement of a butt provided at the back of a slider.

[0007] Another object of the present invention is to increase the strength of a needle member, and simplify processing of the needle member.

[0008] Still another object of the present invention is to provide structure in which the slider can move back and forth easily relative to second and third forks.

[0009] According to the present invention, a compound needle comprises a needle member having a hook at its front end, and a slider slidable over the needle member, and having tongues at its front end. The needle member and the slider are movable independently for formation and transferring of knit stitches.

[0010] The needle member has a first fork, a second fork, and a third fork. The first fork protrudes from a branch portion toward the hook. The branch portion is branched upwardly from substantially the central position of a region where the slider slides. The front half of the slider is sandwiched between the first fork and the needle member such that the slider is guided by the lower surface of the first fork to limit vertical movement of the front half of the slider.

[0011] The second fork protrudes from the branch portion toward an upper back position of the needle member, and toward a butt of the slider such that the slider is guided by the lower surface of the second fork at a position where the slider has moved forward relative to the needle member.

[0012] The third fork is branched forward from a position of the needle member behind the butt of the slider, and faces the second fork such that the slider is guided by the lower surface of the third fork at a position where the slider has moved back relative to the needle member.

[0013] The second fork and the third fork limit vertical movement of the back half of the slider.

[0014] The butt is provided in the back half of the slider.

[0015] A slit vertically passes through the slider at a position ahead of the butt, and the branch portion of the needle member passes through the slit.

[0016] A first fork contact cam surface is provided on the upper surface of the front half of the slider at a position ahead of the through slit, and the first fork contact cam surface is guided by the lower surface of the first fork.

[0017] A second fork contact surface is provided on the upper surface of the back half of the slider at a position ahead of the butt of the slider, and the second fork contact surface is guided by the lower surface of the second fork.

[0018] A third fork contact surface is provided on the upper surface at the back end of the slider behind the butt of the slider, and the third fork contact surface is guided by the lower surface of the third fork.

[0019] In the specification, the front side and the back side are defined based on the longitudinal direction of the compound needle. The hook and the tongues are provided on the front side. The slider, the butt, and the third fork are provided on the back side. The upper side and the lower side are defined based on the state in which the compound needle is set on a needle bed. The slider is positioned above the needle member, and rides (slides) over the needle member. The first fork and the second fork are positioned above the slider. The slider is sandwiched between the first and second forks and

the needle member. The left-right direction and the side direction mean the direction perpendicular to both of the longitudinal direction and the vertical direction, and such directions are used, e.g., when referring to thin plates on the left and right sides of the slider of the through slit, or thin plates on the left and right sides of the skirt.

[0020] It is preferable that the back half of the slider is solid, and has substantially the same thickness from the third fork contact surface to the second fork contact surface.

[0021] Further, it is preferable that the slider is separated into two parts on the left side and the right side from a position below the second fork contact surface to the through slit, and the upper surface and the lower surface of the slider are cut at the through slit to form the through slit.

[0022] Preferably, an oblique tapered portion oriented from the upper back to the lower front is provided at the back end of the second fork;

an oblique tapered portion oriented from the upper front to the lower back is provided at the front end of the third fork;
an oblique tapered portion oriented from the upper back to the lower front is provided at the front end of the second fork contact surface; and
an oblique tapered portion oriented from the upper front to the lower back is provided at the back end of the third fork contact surface.

[0023] It is preferable that the upper surface of the needle member includes an expanded portion expanded upwardly at a position behind the hook of the needle member;

upper part of the front half of the slider forms a solid portion, and lower part of the front half of the slider forms a skirt separated into two parts; and
when the tongues close the hook, a support portion provided at the bottom of the solid portion above the skirt is supported by the expanded portion at a position on the hook side.

[0024] In particular, it is preferable that, in the front half of the slider, the bottom of the solid portion around the support portion forms a recess which is curved upwardly, and the recess is provided behind a borderline extending from the upper front to the lower back at the front end on the hook side of the solid portion.

Advantages of the Invention

[0025] Operation and advantages of the present invention will be described. When the needle member moves forward from the slider, and the hook moves forward, the front half of the slider is pressed downwardly by the lower surface of the first fork. As a result, a force which presses the slider butt at the back of the slider upwardly is generated. At this time, the third fork supports the third fork contact surface, on the upper surface at the back end of the slider. Thus, upward movement of the slider butt is prevented. Further, in a state in which the tongues close the hook, by the force from the stitch loop, a force which bounces the slider butt upwardly is generated. This force is supported by the contact between the second fork contact surface and the second fork of the needle member. Thus, bouncing of the slider butt can be prevented. Since unwanted upward movement of the slider butt is prevented, it is possible to accurately limit the height of the slider butt. Therefore, operation of the slider becomes easy. The height of the slider butt is limited by the second fork, the third fork, and the second fork contact surface and the third fork contact surface. These members can be formed with sufficient strength. Therefore, improvement in the reliability and durability of the needle spring is achieved.

[0026] The back half of the slider is formed to have substantially the same thickness from the third fork contact surface to the second fork contact surface. In the structure, the strength of this portion is increased, and improvement in the durability of the slider is achieved.

[0027] The slider is separated into two parts on the left side and the right side from a position below the second fork contact surface to the through slit, and the upper surface and the lower surface of the slider are cut at the through slit. In this manner, the slider can be fabricated easily by cutting. Further, by separating the slider at a position below the second fork contact surface into the two left and right parts, the border between the solid portion near the slider butt and the portion having the two left and right parts near the through slit becomes long. Therefore, damage due to the stress concentration to the border can be prevented.

[0028] The tapered portions oriented obliquely from the upper back to the lower front are provided at the back end of the second fork and at the front end of the second fork contact surface. In the structure, it is possible to smoothly guide the second fork contact surface under the second fork. Likewise, the tapered portions oriented obliquely from the front to the lower back are provided at the front end of the third fork and the back end of the third fork contact surface. In the structure, it is possible to smoothly guide the third fork contact surface by the lower surface of the third fork.

[0029] At the position where the hook is closed, while the tongues are held by the stitch loop, a force is applied from the stitch loop to the tongues to cause flexure in the lateral direction. Therefore, preferably, at the expanded portion of the upper surface of the needle member on the hook side, the bottom of the solid portion above the skirt is supported by the upper surface of the needle member. It should be noted that the position of the upper surface of the needle member supporting the bottom of the solid portion is referred to as the support portion. Since the distance between the tongues and the support portion is small, it is possible to improve the rigidity of the

tongues, and prevent flexure deformation or the like of the tongues. Thus, at the time of knitting using a hard knitting yarn or knitting a yarn in dense stitches, knitting operation can be performed easily.

[0030] The borderline of the solid portion of the front half of the slider, on the hook side, extending from the upper front to the lower back will be considered. The borderline is a borderline between the tongues and the skirt separated into two parts, and the solid portion. When the tongues close the hook, and part of the expanded portion near the hook contacts the recess as the support portion to support the bottom of the solid portion of the slider, the recess can be provided at a position relatively close to the tongues. Therefore, improvement in the rigidity of the tongues is achieved.

Brief Description of the Drawings

[0031]

FIG. 1 is a side view showing main parts of a needle member of a compound needle according to an embodiment.

FIG. 2 is a plan view showing a needle body in FIG. 1.

FIG. 3 is a side view showing main parts of a needle member of a compound needle according to a modified embodiment.

FIG. 4 is a plan view showing a slider of the compound needle according to the embodiment.

FIG. 5 is a side view showing the slider in FIG. 4.

FIG. 6 is an enlarged side view showing main parts in FIG. 5.

FIG. 7 is an enlarged side view showing a second fork and a third fork of the needle member and a second fork contact surface and a third fork contact surface of a slider in the compound needle according to the modified embodiment.

FIG. 8 is a side view showing a state in which the needle member has moved forward in the compound needle according to the modified embodiment.

FIG. 9 is a side view showing a state in which a hook of the needle member is closed by tongues of the slider in the compound needle according to the modified embodiment.

FIG. 10 is a side view showing a state in which the slider has moved further forward from the state in FIG. 9 in the compound needle according to the modified embodiment.

FIG. 11 is an enlarged view showing the state of the compound needle in FIG. 9.

Embodiment

[0032] Hereinafter, embodiments in the most preferred form for carrying out the present invention will be described.

[0033] An embodiment and its modified embodiment will be described with reference to FIGS. 1 to 11. FIGS. 1 and 2 show a needle member according to a first embodiment. The needle member 2 includes a main body 4 and an extension 6. A hook 8 is provided at the front end of the needle member 2. A branch portion 10 is provided near the center of the main body 4. On the upper side of the main body 4, the branch portion 10 is branched into a first fork 12 on the front side, and a second fork 14 on the back side. The lower surface of the first fork 12 on the front side of the branch portion 10 forms a guide 13 for guiding the upper surface of a slider. The lower surface of the second fork 14 on the back side of the branch portion 10 forms a guide surface 15. The needle member 2 is curved upwardly from a position near the back end of the main body 4. A third fork 16 protrudes forward from a position obliquely behind, and above the back end of the main body 4. The lower surface of the third fork 16 forms a guide surface 17. At the back end of the second fork 14, a tapered portion 18 is provided. The tapered portion 18 is tapered obliquely from the upper back to the lower front. At the front end of the third fork 16, a tapered portion 19 is provided. The tapered portion 19 is tapered obliquely from the upper front to the lower back.

[0034] In the specification, the front side and the back side are defined based on the longitudinal direction of the needle member 2 or the slider 30. The hook 8 is provided on the front side, and the third fork 16 or the like are provided on the back side. The needle member 2 is accommodated in a needle bed (not shown), and slides back and forth along the needle bed. The lower side and the upper side are defined by the lower sides and upper sides in FIGS. 1, 3, and 5. Side surfaces of the needle member 2 mean two side surfaces along the longitudinal direction in FIG. 2. It should be noted that two side surfaces shown on the upper and lower sides in FIG. 4 are left and right side surfaces of the slider 30.

[0035] In the needle member 2, a cheek 20 is provided at a position slightly backward from the hook 8 where the height is increased upwardly. The cheek 20 includes a dimple portion 21. Upper part of the dimple portion 21 (upper surface of the needle member) is swelled upwardly to form an upwardly expanded surface 22. When the hook 8 is closed by tongues 32 of the slider 30, a portion of the expanded surface 22 near the hook 8 supports the bottom of a solid portion 38 of the slider 30. As shown in FIG. 2, the dimple portion 21 is provided by dimple formation process of the needle member 2 at the portion of the cheek 20. For example, the dimple portion 21 has a rectangular shape, and is oriented obliquely from the lower back to the upper front. The front side of the dimple portion 21 is on the side of the hook 8. When the hook 8 is fully opened (FIG. 8), the tongues 32, 32 are depressed into the left and right dimple portions 21, 21 such that the tongues 32, 32 do not protrude from the side surfaces of the needle member 2. A reference numeral 23 schematically denotes a needle butt for moving the needle member 2 back and forth.

[0036] The needle member 2 shown in FIGS. 1 and 2

is considerably long. Therefore, the needle member 2 cannot be processed easily, and it is laborious to fit the needle member 2 into the slider 30. A needle member 3 shown in FIG. 3 includes a main body 5 and a needle jack 7 separately. A fitting recess 24 is provided in the main body 5, and a fitting protrusion 25 is provided in the needle jack 7. The fitting recess 24 and the fitting protrusion 25 are fitted to each other to combine the main body 5 and the needle jack 7 together. Alternatively, the fitting protrusion may be provided on the side of the needle body 5, and the fitting recess may be provided on the side of the needle jack 7. In the case of the needle member 3 in FIG. 3, since the third fork 16 is provided on the side of the needle jack 7, attachment/detachment of the slider 30 is easy, and it is possible to produce the slider 30 easily.

[0037] The difference between the needle member 2 and the needle member 3 is whether the main body and the needle jack are separated into two components or formed integrally into one piece. The needle member 2 and the needle member 3 are the same in other respects. Description about the needle member 2 is applicable to the needle member 3, and description about the needle member 3 is applicable to the needle member 2. In the embodiments, the same constituent elements are labeled with the same reference numeral.

[0038] FIGS. 4 and 5 show the slider 30. At the front end of the slider 30, a pair of left and right tongues 32, 32 are present. A slit 33 is formed between the tongues 32, 32. The tongues 32, 32 are spaced away from each other toward the left side and the right side from the slit 33 at the central position. The tongues 32, 32 are bent such that the front ends of the tongues 32, 32 contact each other. Tongues or a hook of another slider can be inserted into the slit 33. At a position slightly backward from the tongues 32, a nose 34 is present. The nose 34 is expanded upwardly for preventing backward movement of the stitch loop held by the tongues 32, beyond the nose 34. At the center of the slider 30, a through slit portion 36 is provided. At the through slit portion 36, the slider 30 is separated into the left part and the right part. A through slit 37 is formed between the left part of and the right part of the through slit portion 36. The through slit portion 36 is swelled to the left and right for generating friction with, e.g., the wall surface of the needle groove of the needle bed to prevent unwanted movement of the slider 30. A front solid portion 38 is provided on the front side of the through slit portion 36, and a back solid portion 40 is provided on the back side of the through slit portion 36. The slider 30 is solid in these solid portions 38, 40. The thickness is constant in the solid portion 38, and the thickness is constant in the solid portion 40.

[0039] A first fork contact cam surface 39 is formed on the upper surface of the solid portion 38. The first fork contact cam surface 39 contacts the guide 13 on the lower surface of the first fork 12 for limiting vertical movement of the solid portion 38. On the front side and the lower side of the solid portion 38, the slider 30 is separated into the left part and the right part to form the tongues 32, the nose 32, and a skirt 41. The skirt 41 slides on the main body 4 or 5 from a portion facing the lower side of the first fork 12 to the portion of the cheek 20. The expanded surface 22 supports the bottom surface of the solid portion 38 to prevent the front half of the slider from being depressed.

[0040] At the center of the back solid portion 40, a slider butt 42 protrudes upwardly. A second fork contact surface 44 is present on the front side of the slider butt 42. A tapered potion 45 is formed at the front end of the second fork contact surface 44. The tapered portion 45 is oriented from the upper back to the lower front. A third fork contact surface 46 is present on the back side of the slider butt 42. A tapered portion 47 is formed at the back end of the third fork contact surface 46. The tapered portion 47 is oriented from the upper front to the lower back. A borderline 48 between the solid portion 40 and the through slit portion 36 is in parallel with the second fork contact surface 44. Since the length of the borderline 48 is large, the stress applied to the borderline 48 can be distributed broadly.

[0041] FIG. 6 is an enlarged view showing an area around the solid portion 38 in the front half of the slider 30. The borderline 50 is an oblique borderline on the front side of the solid portion 38. The tongues 32 and the nose 34 are provided on the front side of the solid portion 38. An upwardly curved recess 52 is formed on the back side of the borderline 50. The front half of the recess 52 forms a support portion 53. When the tongues 32 hold a stitch loop, and the hook 8 is closed, the support portion 53 contacts the expanded surface 22 to prevent flexure deformation of the tongues 32. In the structure, the expanded surface 22 is positioned on the upper front half of the dimple portion 21. Since the distance between the support portion 53 and the tongues 32 is small, it is possible to improve the rigidity of the tongues 32.

[0042] FIG. 7 shows the relationship between the second fork 14 and the second fork contact surface 44, and the relationship between the third fork 16 and the third fork contact surface 46. When the slider 30 has moved forward, the second fork contact surface 44 is supported by the second fork 14. When the slider 30 has moved back, the third fork contact surface 46 is supported by the third fork 16. When the second fork contact surface 44 contacts the second fork 14, or the third fork contact surface 46 contacts the third fork 16, the solid portion 40 is guided by the tapered portions 18, 45 or the tapered portions 19, 47. Further, the solid portion 40 is solid having the constant thickness in the wide range extending from the third fork contact surface 46 to the second fork contact surface 44. Therefore, the strength of the solid portion 40 is high. Further, the stress applied to the border between the solid portion 40 and the through slit portion 36 is distributed by making the borderline 48 longer.

[0043] FIGS. 8 to 10 show three states of the compound needle. A reference numeral 60 denotes a metal band on the needle bed side. The metal band 60 contacts

the upper surface of the first fork 12 or the upper surface of the second fork 14 to prevent the compound needle from floating above the needle groove of the needle bed.

[0044] FIG. 8 shows a state in which the hook 8 has moved forward to the front end position, and the slider 30 has moved back to the back end position with respect to the needle member. At this time, the guide 13 at the lower surface of the first fork 12 applies a force to push the first fork contact cam surface 39 downwardly, and the force is operated to move the slider butt 42 upwardly. In the meanwhile, the third fork contact surface 46 contacts the third fork 16 to prevent the slider butt 42 from moving upwardly. At this time, the tongues 32 are depressed into the left and right dimple portions 21 of the needle main body 2, and do not protrude to the sides of the needle main body 2. Therefore, the stitch on the hook 8 can be transferred to the tongues 32 easily.

[0045] As shown in FIG. 9, in a state in which the tongues 32 close the hook 8, by the force from a stitch loop held by the tongues 32 or the like, a force which bounces the slider butt 42 upwardly is generated. This force is supported by the second fork contact surface 44 and the second fork 14 to prevent the unwanted upward movement of the slider butt 42. This mechanism is also applicable to a case of FIG. 10 in which the tongues 32 have moved further forward. FIG. 10 shows a state in which the slider 30 has moved forward to the front end position with respect to the needle member 3.

[0046] FIG. 11 is an enlarged view showing the state of FIG. 9. A stitch loop 62 is held by the tongues 32. Since tension is applied to the knitted fabric, e.g., by racking operation of the needle bed or drawing the knitted fabric downwardly, a force in the left-right direction is applied to the tongues 32. Further, a force is applied from the stitch loop 62 to the tongues 32 downwardly. At the tongues 32, the slider 30 is separated into the left part and the right part. Therefore, the rigidity of the tongues 32 is low. For example, this is required for moving the stitch loop by inserting tongues or a hook of another compound needle into the gap between the tongues 32, 32. The support portion 53 is positioned slightly backward from the oblique borderline 50 at the front of the solid portion 38. The support portion 53 contacts the expanded surface 22 on the side of the needle member 3. Thus, the bottom surface of the solid portion 38 is supported. In this manner, the distance between the support portion 53 and the tongues 32 is reduced, and flexure deformation of the tongues 32 is prevented.

[0047] In the embodiments, the following advantages are obtained.

(1) It is possible to limit vertical movement of the slider by the first to third fork, the first fork contact cam surface, and the second and third fork contact surfaces. In particular, it is possible to limit the force to move the slider butt upwardly by the second fork and the third fork or the like, and accurately limit the height of the slider butt.

(2) Since the portion, ranging from the third fork to the slider butt and to the second fork, is formed to have the constant thickness, the strength of this portion is high.

(3) When a force is applied from the stitch loop to the tongues, the slider is supported at a position near the tongues. Therefore, flexure deformation of the tongues is small. Thus, at the time of knitting using a hard knitting yarn or knitting a yarn in dense stitches, knitting operation can be performed stably.

Brief Description of the Symbols

[0048]

2, 3	Needle Member
4, 5	Main Body
6	Extension
8	Hook
10	Branch Portion
12	First Fork
14	Second Fork
13	Guide
14	Second Fork
16	Third Fork
15, 17	Guide Surface
18, 19	Tapered Portion
20	Cheek
21	Dimple Portion
22	Expanded Surface
23	Needle Butt
24	Fitting Recess
25	Fitting Protrusion
30	Slider
32 .	Tongue
33	Slit
34	Nose
36	Through Slit Portion
37	Through Slit
38,40	Solid Portion
39	First Fork Contact Cam Surface
41	Skirt
42	Slider Butt
44	Second Fork Contact Surface
46	Third Fork Contact Surface
45,47	Tapered Portion
48,50	Borderline
52	Recess
53	Support Portion
60	Metal Band
62	Stitch Loop

Claims

1. A compound needle comprising: a needle member (2) having a hook (8) at a front end of the needle

member (2) and a slider (30) slidable over the needle member (2) and having tongues (32) at a front end of the slider (30), the needle member (2) and the slider (30) being movable independently for formation and transferring of knit stitches, **characterized in that**

the needle member (2) comprises first folk (12), a second fork (14) and third fork (16);

the first fork (12) protrudes from a branch portion (10) toward the hook (8), the branch portion (10) is branched upwardly from a substantially central position of a region of the needle member (2) where the slider (30) slides, and a front half of the slider (30) is sandwiched between the first fork (12) and the needle member (2) such that the slider (30) is guided by the lower surface of the first fork (12) to limit vertical movement of the front half of the slider (30),
the second fork (14) protrudes from the branch portion (10) toward an upper back position of the needle member (2), and toward a butt (42) of the slider (30) such that the slider (30) is guided by the lower surface of the second fork (14) at a position where the slider (30) has moved forward relative to the needle member (2),
the third fork (16) is branched forward from a position behind the butt (42) of the slider of the needle member (2), and faces the second fork (14) such that the slider (30) is guided by the lower surface of the third fork (16) at a position where the slider (30) has moved back relative to the needle member (2), and
the second fork (14) and the third fork (16) limit vertical movement of the back half of the slider (30), and that

the slider (30) comprises the butt (42), a slit (33), a first fork contact cam surface (39), a second fork contact surface (44) and a third fork contact surface (46),

the butt (42) is provided in the back half of the slider (30),
the slit (33) vertically passes through the slider (30) at a position ahead of the butt (42), and the branch portion (10) of the needle member (2) passes through the slit (33),
the first fork contact cam surface (39) is provided on the upper surface of the front half of the slider (30) at a position ahead of the slit (33) to be guided by the lower surface of the first fork (12),
the second fork contact surface (44) is provided on the upper surface of the back half of the slider (30) at a position ahead of the butt (42) of the slider (30) to be guided by the lower surface of the second fork (14); and
the third fork contact surface (46) is provided on the upper surface at the back end of the slider (30) behind the butt (42) of the slider (30) to be guided by the lower surface of the third fork (16).

2. The compound needle of claim 1, **characterized in that** the back half of the slider (30) is solid and has substantially the same thickness from the third fork contact surface (46) to the second fork contact surface (44).

3. The compound needle of claim 1, **characterized in that** the slider (30) is separated into two parts on the left side and the right side from a position below the second fork contact surface (44) to the slit (33), and the upper surface and the lower surface of the slider (30) are cut at the slit (33) to form the slit (33).

4. The compound needle of claim 1, **characterized in that** an oblique tapered portion (18) oriented from the upper back to the lower front is provided at a back end of the second fork (14);

an oblique tapered portion (19) oriented from the upper front to the lower back is provided at a front end of the third fork (16);
an oblique tapered portion oriented from the upper back to the lower front is provided at a front end of the second fork contact surface (44); and
an oblique tapered portion (47) oriented from the upper front to the lower back is provided at a back end of the third fork contact surface (46).

5. The compound needle of claim 1, **characterized in that** the upper surface of the needle member (2) includes an expanded portion (22) expanded upwardly at a position behind the hook of the needle member (2);

an upper part of the front half of the slider (30) forms a solid portion (38), and a lower part of the front half of the slider (30) forms a skirt (41) separated into two parts; and
when the tongues (32) close the hook (8), a support portion (53) provided at the bottom of the solid portion above the skirt (41) is supported by a hook side position of the expanded portion (22)

6. The compound needle of claim 5, **characterized in that**, in the front half of the slider (30), the bottom of the solid portion (38) around the support portion (53) forms a recess (52) which is curved upwardly, and

the recess (52) is provided behind a borderline (50) extending from the upper front to the lower back at the front end on the hook side of the solid portion (38).

Patentansprüche

1. Compound- bzw. Schiebernadel umfassend: ein Nadelglied (2) mit einem Haken (8) an einem vorderen Ende des Nadelglieds (2); und einen Gleiter (30), der über dem Nadelglied (2) gleitet und Zungen (32) an einem vorderen Ende des Gleiters (30) aufweist, wobei das Nadelglied (2) und der Gleiter (30) zum Bilden und Umhängen von Strickmaschen unabhängig voneinander bewegbar sind, **dadurch gekennzeichnet, dass** das Nadelglied (2) eine erste Gabelung (12), eine zweite Gabelung (14) und eine dritte Gabelung (16) aufweist,

   die erste Gabelung (12) von einem Abzweigbereich (10) zum Haken (8) hin vorsteht, wobei der Abzweigbereich (10) von einer im Wesentlichen mittleren Position eines Bereichs des Nadelglieds (2) nach oben abzweigt, wo der Gleiter (30) gleitet, und wobei eine vordere Hälfte des Gleiters (30) zwischen der ersten Gabelung (12) und dem Nadelglied (2) so dazwischen angeordnet ist, dass der Gleiter (30) durch die untere Fläche der ersten Gabelung (12) geführt wird, um die vertikale Bewegung der vorderen Hälfte des Gleiters (30) zu begrenzen,
   die zweite Gabelung (14) von dem Abzweigbereich (10) zu einer oberen hinteren Position des Nadelglieds (2) hin und zu einem Anschlag (42) des Gleiters (30) so vorsteht, dass der Gleiter (30) durch die untere Fläche der zweiten Gabelung (14) zu einer Position geführt wird, wo der Gleiter (30) relativ zum Nadelglied (2) vorwärts bewegt ist,
   die dritte Gabelung (16) von einer Position hinter dem Anschlag (42) des Gleiters (30) des Nadelglieds (2) nach vorn abzweigt und der zweiten Gabelung (14) so gegenüber liegt, dass der Gleiter (30) durch die untere Fläche der dritten Gabelung (16) zu einer Position geführt wird, wo der Gleiter (30) sich bezüglich des Nadelglieds (2) nach rückwärts bewegt hat; und
   die zweite Gabelung (14) und die dritte Gabelung (16) die vertikale Bewegung der hinteren Hälfte des Gleiters (30) begrenzt, und dass
   der Gleiter (30) den Anschlag (42), einen Schlitz (33), eine erste Gabelungs-Kontaktnockenfläche (39), eine zweite Gabelungs-Kontaktfläche (44) und eine dritte Gabelungs-Kontaktfläche (46) umfasst,
   der Anschlag (42) in der hinteren Hälfte des Gleiters (30) vorgesehen ist;
   der Schlitz (33) vertikal durch den Gleiter (30) an einer Position vor dem Anschlag (42) hindurch geht, und der Abzweigbereich (10) des Nadelglieds (2) durch den Schlitz (33) hindurchgeht;
   die erste Gabelungs-Kontaktnockenfläche (39) auf der oberen Fläche der vorderen Hälfte des Gleiters (30) an einer Stelle vor dem Schlitz (33) vorgesehen ist, um von der unteren Fläche der ersten Gabelung (12) geführt zu werden;
   die zweite Gabelungs-Kontaktfläche (44) auf der oberen Fläche der hinteren Hälfte des Gleiters (30) an einer Position vor dem Anschlag (42) des Gleiters (30) vorgesehen ist, um von der unteren Fläche der zweiten Gabelung (14) geführt zu werden; und
   die dritte Gabelungs-Kontaktfläche (46) auf der oberen Fläche am hinteren Ende des Gleiters (30) hinter dem Anschlag (42) des Gleiters (30) vorgesehen ist, um von der unteren Fläche der dritten Gabelung (16) geführt zu werden.

2. Compound- bzw. Schiebernadel nach Anspruch 1, **dadurch gekennzeichnet, dass** die hintere Hälfte des Gleiters (30) fest ist und von der dritten Gabelungs-Kontaktfläche (46) zur zweiten Gabelungs-Kontaktfläche (44) im Wesentlichen dieselbe Dicke aufweist.

3. Compound- bzw. Schiebernadel nach Anspruch 1, **dadurch gekennzeichnet, dass** der Gleiter (30) in zwei Teile auf der linken Seite und der rechten Seite von einer Position unterhalb der zweiten Gabelungs-Kontaktfläche (44) zum Schlitz (33) geteilt ist, und die obere Fläche sowie die untere Fläche des Gleiters (30) am Schlitz (33) ausgeschnitten sind, um den Schlitz (33) zu bilden.

4. Compound- bzw. Schiebernadel nach Anspruch 1, **dadurch gekennzeichnet, dass** ein schräg verjüngter Bereich (18), der von oben hinten nach unten vorn gerichtet ist, an einem hinteren Ende der zweiten Gabelung (14) vorgesehen ist;

   ein schräg verjüngter Bereich (19), der von oben vorn nach unten hinten gerichtet ist, an einem vorderen Ende der dritten Gabelung (16) vorgesehen ist;
   ein schräg verjüngter Bereich, der von oben hinten nach unten vorn gerichtet ist, an einem vorderen Ende der zweiten Gabelungs-Kontaktfläche (44) vorgesehen ist, und
   ein schräg, verjüngter Bereich (47), der von oben vorn nach unten hinten gerichtet ist, an einem hinteren Ende der dritten Gabelungs-Kontakfläche (46) vorgesehen ist.

5. Compound- bzw. Schiebernadel nach Anspruch 1, **dadurch gekennzeichnet, dass** die obere Fläche

des Nadelglieds (2) einen vorstehenden Bereich (22) aufweist, der an einer Position hinter dem Haken des Nadelglieds (2) nach oben vorsteht;

ein oberer Teil der vorderen Hälfte des Gleiters (30) einen festen Abschnitt (38), und ein unterer Teil der vorderen Hälfte des Gleiters (30) eine in zwei Teile getrennte Randleiste (41) bildet; und,
wenn die Zungen (32) den Haken (8) verschließen, ein Unterstützungsbereich (53), der am Boden des festen Bereichs über der Randleiste (41) vorgesehen ist, von einer Nadelseitenposition des vorstehenden Bereichs (22) unterstützt wird.

6. Compound- bzw. Schiebernadel nach Anspruch 5, **dadurch gekennzeichnet, dass** in der vorderen Hälfte des Gleiters (30) der Boden des festen Abschnitts (38) um den Unterstützungsbereich (53) herum eine Ausnehmung (52) bildet, die nach unten gekrümmt ist, und die Ausnehmung (52) hinter einer Grenzlinie (50) vorgesehen ist, die sich von oben vorn nach unten hinten am vorderen Ende auf der Hakenseite des festen Abschnitts (38) erstreckt.

Revendications

1. Aiguille composite comprenant un élément d'aiguille (2) comportant un crochet (8) à une extrémité avant de l'élément d'aiguille (2) et un élément coulissant (30) pouvant coulisser sur l'élément d'aiguille (2) et comportant des langues (32) à une extrémité de l'élément coulissant (30), l'élément d'aiguille (2) et l'élément coulissant (30) étant mobiles indépendamment pour la formation et le transfert de mailles, **caractérisée en ce que** :

l'élément d'aiguille (2) comprend une première fourche (12), une deuxième fourche (14) et une troisième fourche (16) ;
la première fourche (12) fait saillie à partir d'une partie de branche (10) vers le crochet (8), la partie de branche (10) est divisée vers le haut à partir d'une position sensiblement centrale d'une région de l'élément d'aiguille (2) dans laquelle l'élément coulissant (30) glisse, une moitié avant de l'élément coulissant (30) est prise en sandwich entre la première fourche (12) et l'élément d'aiguille (2) de sorte que l'élément coulissant (30) est guidé par la surface inférieure de la première fourche (12) pour limiter le déplacement vertical de la moitié avant de l'élément coulissant (30) ;
la deuxième fourche (14) fait saillie à partir de la partie de branchement (10) vers une position arrière supérieure de l'élément d'aiguille (2) et vers une butée (42) de l'élément coulissant (30) de sorte que l'élément coulissant (30) est guidé par la surface inférieure de la deuxième fourche (14) à une position où l'élément coulissant (30) s'est déplacé vers l'avant par rapport à l'élément d'aiguille (2) ;
la troisième fourche (16) est divisée vers l'avant à partir d'une position en arrière de la butée (42) de l'élément coulissant (30) de l'élément d'aiguille (2) et fait face à la deuxième fourche (14) de sorte que l'élément coulissant (30) est guidé par la surface inférieure de la troisième fourche (16) à une position où l'élément coulissant (30) s'est déplacé vers l'arrière par rapport à l'élément d'aiguille (2) ; et
la deuxième fourche (14) et la troisième fourche (16) limitent le déplacement vertical de la moitié arrière de l'élément coulissant (30) ;

et **en ce que** :

l'élément coulissant (30) comprend la butée (42), une fente (33), une surface de came de contact de première fourche (39), une surface de contact de deuxième fourche (44) et une surface de contact de troisième fourche (46) ;
la butée (42) est prévue dans la moitié arrière de l'élément coulissant (30) ;
la fente (33) passe verticalement à travers l'élément coulissant (30) à une position en avant de la butée (42) et la partie de branchement (10) de l'élément d'aiguille (2) passe par la fente (33) ;
la surface de came de contact de première fourche (39) est formée sur la surface supérieure de la moitié avant de l'élément coulissant (30) à une position en avant de la fente (33) à guider par la surface inférieure de la première fourche (12) ;
la surface de contact de deuxième fourche (44) est prévue sur la surface supérieure de la moitié arrière de l'élément coulissant (30) à une position en avant de la butée (42) de l'élément coulissant (30) à guider par la surface inférieure de la deuxième fourche (14) ; et
la surface de contact de troisième fourche (46) est prévue sur la surface supérieure de l'extrémité arrière de l'élément coulissant (30) derrière la butée (42) de l'élément coulissant (30) à guider par la surface inférieure de la troisième fourche (16).

2. Aiguille composite selon la revendication 1, **caractérisée en ce que** la moitié arrière de l'élément coulissant (30) est pleine et a sensiblement la même épaisseur à partir de la surface de contact de la troisième fourche (46) jusqu'à la surface de contact de la deuxième fourche (44).

3. Aiguille composite selon la revendication 1, **caractérisée en ce que** l'élément coulissant (30) est séparé en deux parties du côté gauche et du côté droit à partir d'une position située en-dessous de la surface de contact (44) de deuxième fourche vers la fente (33), et la surface supérieure et la surface inférieure de l'élément coulissant (30) sont coupées au niveau de la fente (33) pour former la fente (33).

4. Aiguille composite selon la revendication 1, **caractérisée en ce que** :

une partie conique oblique (18) orientée de la partie arrière haute vers la partie avant basse est prévue à une extrémité arrière de la deuxième fourche (14) ;
une partie conique oblique (19) orientée de la partie avant haute vers la partie arrière basse est prévue au niveau d'une extrémité avant de la troisième fourche (14) ;
une partie conique oblique orientée de la partie arrière haute vers la partie avant basse est prévue au niveau d'une extrémité avant de la surface de contact (44) de deuxième fourche ; et
une partie conique oblique (47) orientée de la partie avant haute vers la partie arrière basse est prévue au niveau d'une extrémité arrière de la surface de contact de troisième fourche (46).

5. Aiguille composite selon la revendication 1, **caractérisée en ce que** la surface supérieure de l'élément d'aiguille (2) inclut une partie en extension (22), en extension vers le haut à une position à l'arrière du crochet de l'élément d'aiguille (2) ;

une partie supérieure de la moitié avant de l'élément coulissant (30) forme une partie pleine (38) et une partie inférieure de la moitié avant de l'élément coulissant (30) forme une jupe (41) séparée en deux parties ; et
quand les langues (32) ferment le crochet (8), une partie support (53) prévue en bas de la partie pleine au-dessus de la jupe (41) est portée par une position de côté du crochet de la partie en extension (22).

6. Aiguille composite selon la revendication 5, **caractérisée en ce que**, dans la moitié avant de l'élément coulissant (30), le bas de la partie pleine (38) autour de la partie de support (53) forme un creux (52) qui est courbé vers le haut et le creux (52) est prévu entre une limite (50) s'étendant à partir de la partie avant haute vers la partie arrière basse à l'extrémité avant du côté du crochet de la partie pleine (38).

Fig. 1

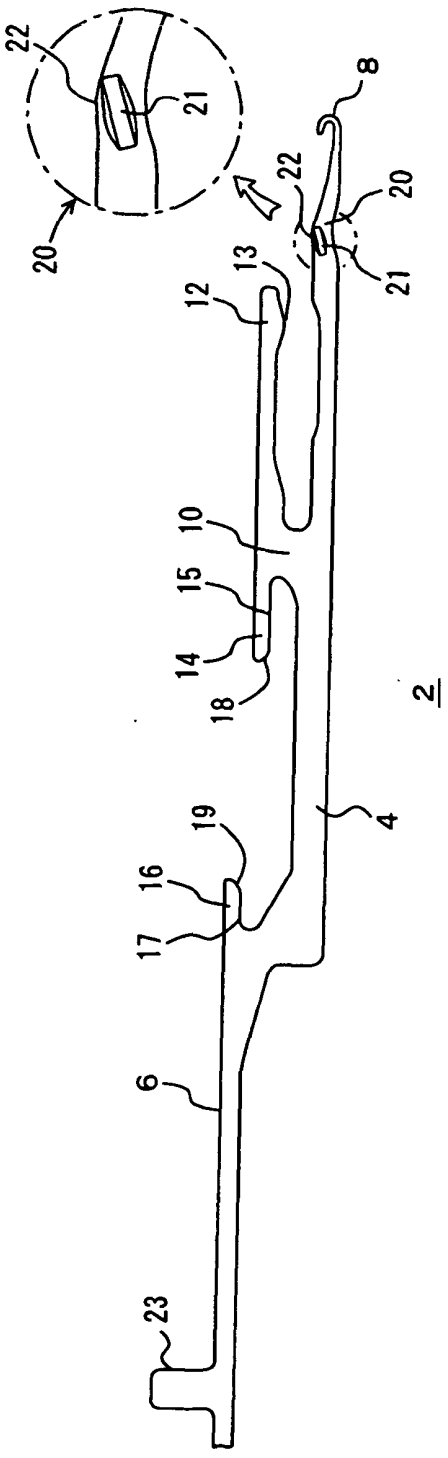

Fig. 2

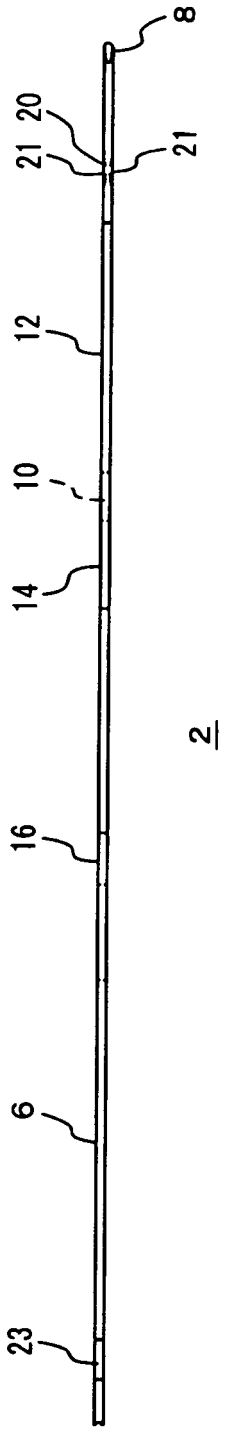

Fig. 3

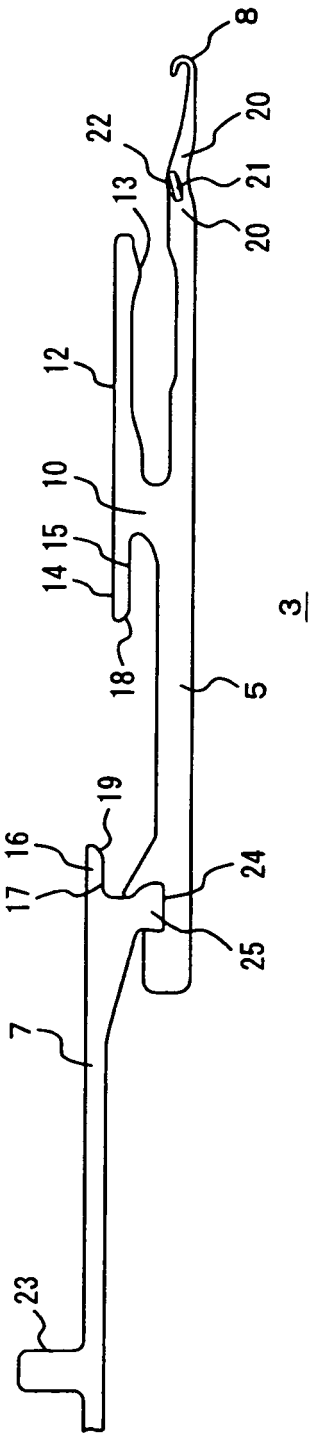

Fig. 4

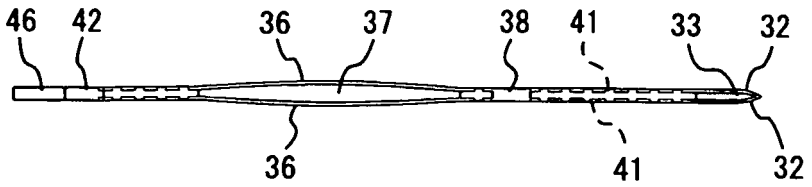
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Fig. 5

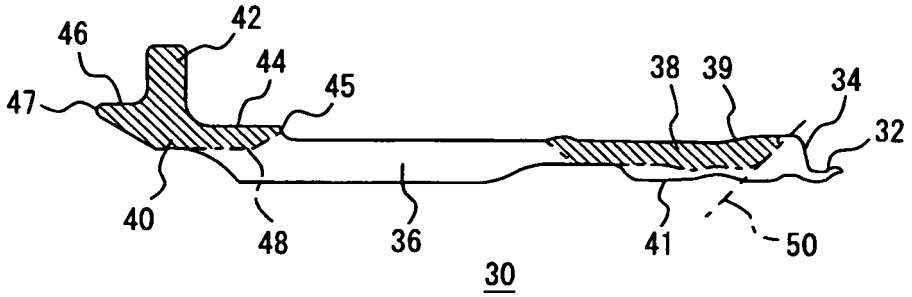
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Fig. 6

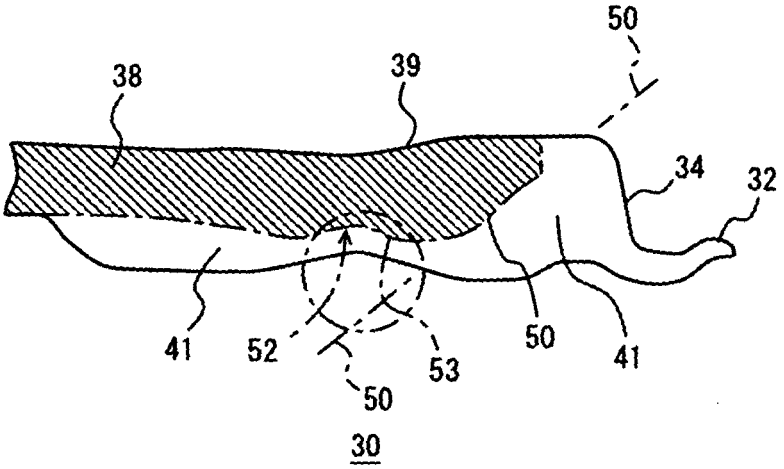
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Fig. 7

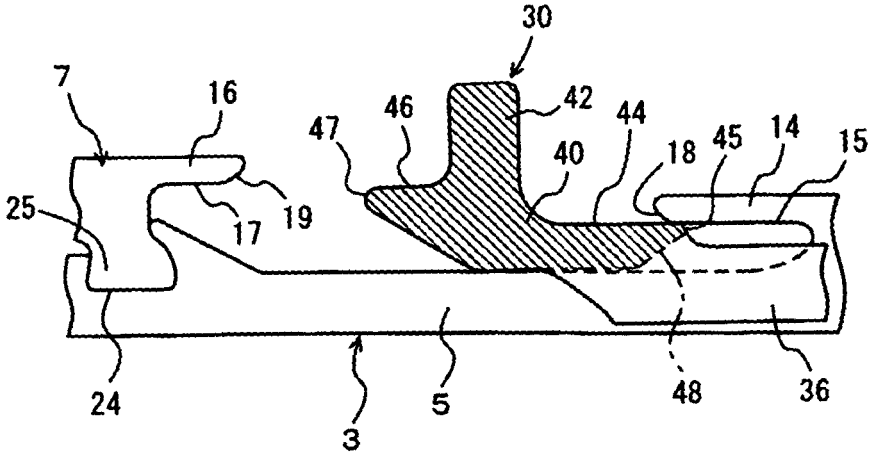
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Fig. 8

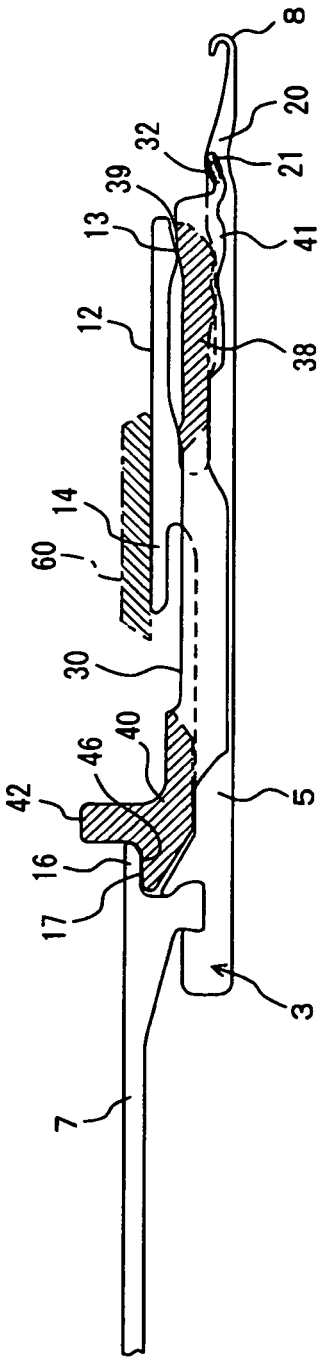


Fig. 9

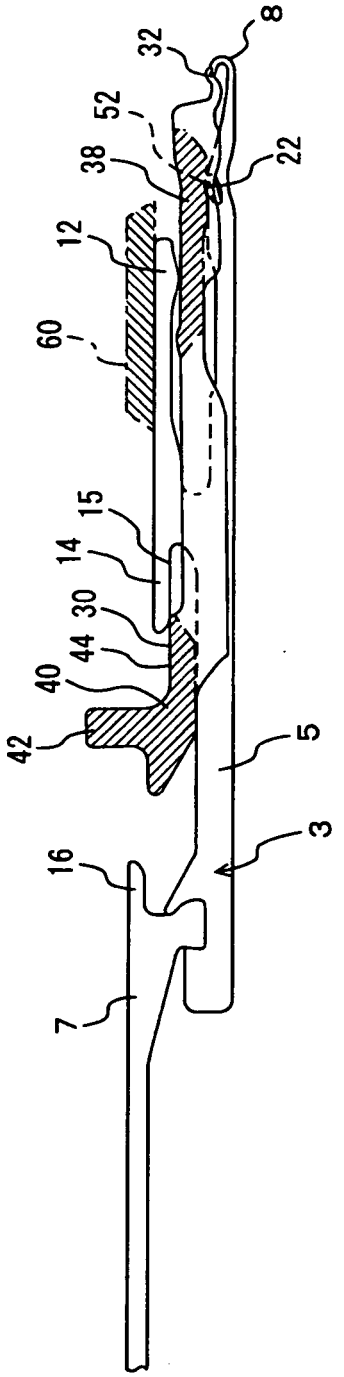


Fig. 10

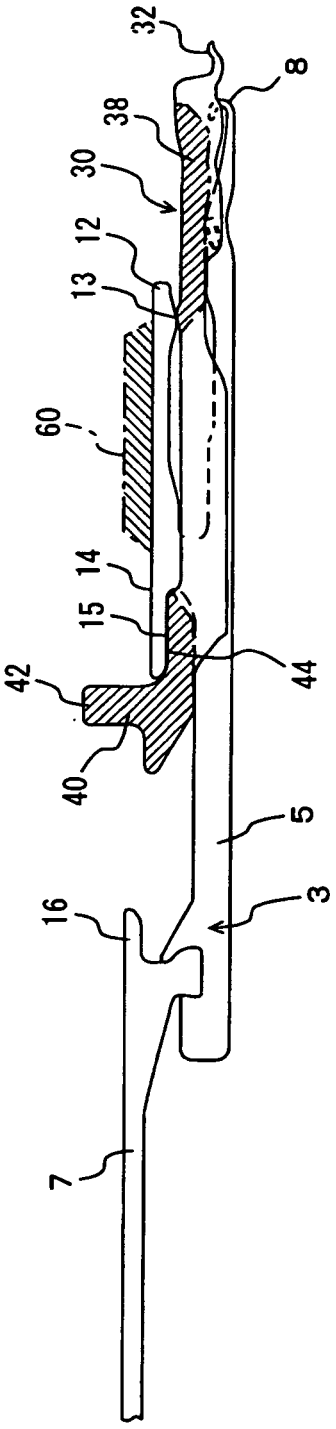
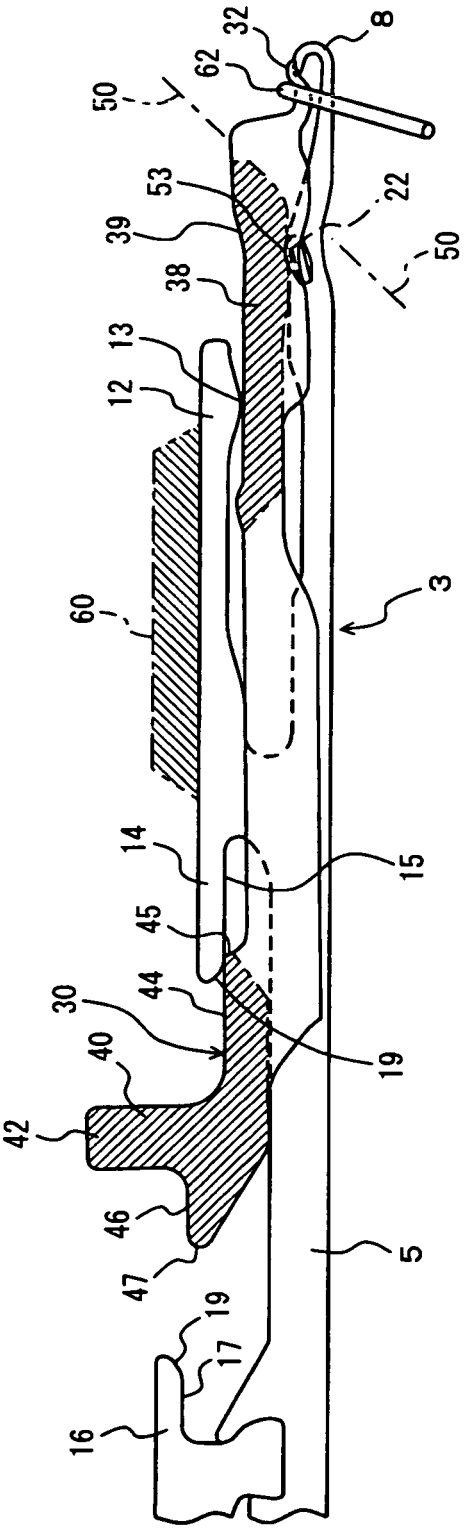


Fig. 11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REFERENCES CITED IN THE DESCRIPTION

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