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(54) Compound needle for flatbed knitting machine

(57) [Problem to be solved] The present invention provides a compound needle for a flatbed knitting machine in which positioning of an opening/closing body and a base body is easily made when the opening/closing body and the base body are coupled to each other and a large force is hardly applied to the coupling portion.

[Solution] A coupling portion 16 between blades 13, 14 as an opening/closing body 12 of a slider 11 and a base body 15 is positioned in the front-rear direction by providing a coupling groove 15b formed so as to correspond to the lengths of upper stages 13e, 14e on one side face of the base body 15, fitting the upper stages 13e, 14e into the coupling groove 15b, and making rear ends of the connecting portions 13d, 14d have in contact with an contacting portion 15c. Rear portions of the blades 13, 14 are divided into the upper stages 13e, 14e and lower stages 13c, 14c so that the lengths of the blades 13, 14 can be shortened in the front-rear direction. A force required for positioning the coupling portion 16 in the vertical direction can be made to act from the lower side easily. The lower stages 13c, 14c sag and absorb a force received by front portions of the blades 13, 14 from the bottom of the slider groove 17d so that the force is hardly applied to the coupling portion 16.

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Description

[Technical Field]

[0001] The present invention relates to a compound needle which is accommodated in a needle groove formed on a needle bed of a flatbed knitting machine and opens and closes an aperture of a hook with a slider.

[Background Art]

[0002] Conventionally, in a flatbed knitting machine, a number of needle grooves are formed on a needle bed and a knitting needle accommodated in each needle groove is driven such that a hook at a front end moves toward or away from a needle bed gap at an end of the needle bed so that a knit fabric is knitted with knitting yarns supplied to the hook on the needle bed gap. A latch needle or a compound needle is used as the knitting needle. If the compound needle which opens and closes the aperture of the hook with a slider is used, a movement stroke for opening and closing the aperture of the hook as the knitting needle can be reduced in comparison with that of the latch needle (see, Patent Literature 1, for example).

[0003] Fig. 7 illustrates a partial structure of a slider 1 used in a conventional compound needle as disclosed in Patent Literature 1 and the like. Fig. 7(a) illustrates a plan view structure of the slider 1, Fig. 7(b) illustrates a front view structure of the slider 1, Fig. 7(c) illustrates a front view structure of a base body 5 of the slider 1, Fig. 7(d) illustrates a cross-sectional structure seen from a cutting plane line D-D of Fig. 7(c), and Fig. 7(e) illustrates a structure of a coupling portion 6 of the slider 1.

[0004] It is to be noted that the compound needle including the slider 1, accommodated in a needle groove formed on a needle bed, moves in the needle groove to the right or the left direction in the drawings. The needle bed faces to a needle bed gap at the right side in the drawings. Although the needle bed is inclined downward from the needle bed gap side, the slider 1 is illustrated as a horizontal state in the drawings. In the present description, the direction in the needle groove is indicated as follows:, as for the horizontal direction, the right side in the drawings as the needle bed gap side corresponds to a front side, and the left side in the drawings away from the needle bed gap corresponds to a rear side, as for the vertical direction on the other hand, the up and down direction in the drawings corresponds to as it is.

[0005] The slider 1 is formed by an opening/closing body 2, shaded with slant lines in Fig. 7(b) and formed by two blades 3, 4, and a base body 6 coupled to the opening/closing body 2 at a coupling portion 6. The blades 3, 4 have tongue portions 3a, 4a at front portions thereof, respectively. Lower portions of the blades 3, 4 are accommodated in a slider groove formed on a needle body, which is not shown in the drawings. The blades 3, 4 moves forward and backward relatively in the slider groove so as to open and close the aperture of the hook with the tongue portions 3a, 4a. Guiding portions 3b, 4b which continue to the tongue portions 3a, 4a are formed on the blades 3, 4 (see, Patent Literature 2, for example) in order to suppress floating of the blades 3, 4 from inside of the slider groove due to guiding by side walls of the slider groove when the blades 3, 4 move backward with respect to the needle body. Tail portions 3c, 4c at rear portions of the blades 3, 4 are not formed in line symmetry with respect to a center line 1a, and the tail portion 3c of one blade 3 expands laterally such that the tail portion 3c elastically makes slide contact with a side wall of the needle groove so as to serve as a sliding resistance. Coupling butts 3d, 4d are vertically provided on front portions of the tail portions 3c, 4c. The blades 3, 4 make contact with each other remaining no space therebetween in the vicinity of the coupling butts 3d, 4d. Seceding bend portions 3e, 4e are provided at the front side with respect to the coupling butts 3d, 4d. A space is generated between the blades 3, 4 on the front side of the seceding bend portions 3e, 4e. Engaging protrusions 3f, 4f are vertically provided on positions between the seceding bend portions 3e, 4e and the guiding portions 3b, 4b. The tail portion 3c of the blade 3 expands laterally at the rear side with respect to the coupling butt 3d.

[0006] Fig. 7(c) illustrates the base body 5 in a state where a rear portion thereof is partially shortened. A sliding contact arm 5a is formed on a lower portion of the base body 5. When the slider 1 is moved relatively with respect to the needle body, a bottom of the sliding contact arm 5a makes slide contact with a sliding contact face provided on an upper face of a tail portion of the needle body. A coupling groove 5b is formed on one side face of the sliding contact arm 5a and the tail portions 3c, 4c of the blades 3, 4 are fitted into the coupling groove 5b. A through-hole 5c is formed on an upper portion of the coupling groove 5b and the coupling butts 3d, 4d of the blades 3, 4 are fitted into the through-hole 5c. Butts 5d, 5e are vertically provided on a rear half portion of the base body 5 and can receive a driving force from a cam mounted on a carriage which moves while facing to the needle bed. An engaging concave 5f is formed on a front portion of the base body 5. The engaging protrusions 3f, 4f of the blades 3, 4 are engaged in the engaging concave 5f so as to prevent the blades 3, 4 from swinging.

[0007] As illustrated in Fig. 4(e), on the coupling portion 6 between the blades 3, 4 and the base body 5, the blades 3, 4 and the base body 5 are assembled so as to be fixed to each other as follows. That is, the coupling butts 3d, 4d are fitted into the through-hole 5c in a state where the tail portions 3c, 4c are accommodated in the coupling groove 5b of the sliding contact arm 5a. Further, fixing portions 6a, 6b, 6c are formed with swaging tools or the like so that the blades 3, 4 and the base body 5 are assembled each other in an fixed state.

[Citation List]

[Patent Literature]

[0008]

[Patent Literature1] Japanese Patent No. 2946323
[Patent Literature 2] Japanese Patent No. 3577038

[Disclosure of the Invention]

[Technical Problem]

[0009] The blades 3, 4 as illustrated in Fig. 7 have generally linear shapes from the tongue portions 3a, 4a at the front portions to the tail portions 3c, 4d at the rear portions. Therefore, the blades 3, 4 are undesirably long in the front-rear direction. Further, although the two blades 3, 4 and the base body 5 are required to be coupled to each other with high accuracy on the coupling portion 6, the coupling groove 5b and the through-hole 5c into which the tail portions 3c, 4c and the coupling butts 3d, 4d are fitted, respectively, are formed to be slightly larger than the tail portions 3c, 4c and the coupling butts 3d, 4d. Therefore, after the tail portions 3c, 4c and the coupling butts 3d, 4d are fitted into the coupling groove 5b and the through-hole 5c, respectively, operations for positioning and fixing the tail portions 3c, 4c and the coupling groove 5b, and the coupling butts 3d, 4d and the through-hole 5c to each other are needed to be performed. The positioning is performed by making upper faces of the tail portions 3c, 4c abut against an upper wall face of the coupling groove 5b, for example.

[0010] However, an upward force for positioning cannot be applied to the tail portions 3c, 4c from the positions just under thereof in a state where lower faces of the tail portions 3c, 4c are accommodated in the coupling groove 5b. The upward force for positioning is need to be applied, for example, from frontward positions to the seceding bend portions 3e, 4e, apart a side direction, so that it is difficult to realize the positioning with high accuracy. When the blades 3, 4 are relatively moved with respect to the needle body, the front portions of the blades 3, 4 rocked while concavity and convesity formed on a bottom of a slider groove serve as cams. A large bending moment is applied to the coupling portion 6 with the rocking and there arises a risk that the blades 3, 4 and the base body 5 are decoupled. In order to prevent such risk from arising, the blades 3, 4 and the base body 5 need to be firmly fixed to each other with swaging tools or the like on the fixing portions 6a, 6b, 6c.

[0011] An object of the invention is to provide a compound needle for a flatbed knitting machine in which positioning of an opening/closing body and a base body is easily made when the opening/closing body and the base body are coupled to each other and a large force is hardly applied to the coupling portion.

[Technical Solution]

[0012] The present invention provides a compound needle for a flatbed knitting machine,
assembled with a needle body, which is accommodated in a needle groove formed on a needle bed of the flatbed knitting machine and has a hook at a front portion thereof, and a slider, which has a tongue portion at a front portion thereof for opening and closing the aperture of the hook and is movable relatively with respect to the needle body, the slider provided with an opening/closing body, which is arranged in a lower portion of the needle groove and has the tongue portion at the front portion thereof, and a base body, which is arranged in an upper portion of the needle groove and has a front portion to be coupled to a rear portion of the opening/closing body,
characterized in that
the opening/closing body of the slider has a rear portion formed into two stages of an upper stage and a lower stage, the lower stage is continuous to the tongue portion side at the front portion thereof and the upper stage extends to the front side over the upper side of the lower stage,
the base body of the slider has a coupling groove, on a side surface at one lateral side, having a length corresponding to that of the upper stage formed at the rear portion of the opening/closing body, and
coupling of the opening/closing body and the base body for the slider is performed by fitting the upper stage of the rear portion of the opening/closing body into the coupling groove of the base body.

[0013] In the compound needle according to the present invention,
said upper stage of said opening/closing body of said slider has an offset such that a position of the upper stage is displaced to one lateral side of said base body of the slider with respect to said lower stage.

[0014] In the compound needle according to the present invention,
said upper stage of said opening/closing body of said slider has a resistance portion, which makes slide contact with a side wall of said needle groove and generates sliding resistance when the slider slides in the needle groove, on one lateral side of the base body of the slider.

[0015] In the compound needle according to the present invention,
said opening/closing body of said slider is formed to be divided into two blades.

[Advantageous Effects]

[0016] According to the present invention, a rear portion of an opening/closing body of a slider is formed into upper and lower two stages. The lower stage is formed to be continuous to a tongue side at a front portion and the upper stage is formed to extend to the front side at the upper side of the lower stage. The upper stage of the opening/closing body is fitted into a groove formed on a

side face of a base body at one lateral side so that the opening/closing body and the base body are coupled to each other. The upper stage fitted into the groove can be easily positioned from the position just under the upper stage by applying an upward force to the lower stage. Even if a front portion of the opening/closing body receives the upward force from a bottom of a slider groove of a needle body and rocks in a state where the opening/closing body and the base body are coupled to each other, the lower stage sags and absorbs the force, so that a large force can be prevented from being applied to the coupling portion.

[0017] Further, according to the present invention, the upper stage of the opening/closing body of the slider has an offset such that a position of the upper stage is displaced to one lateral side of the base body, and the coupling groove formed on the side face of the base body can be made shallower, so that strength of the base body can be easily kept.

[0018] Further, according to the present invention, a resistance portion which generates sliding resistance is provided on the upper stage at the rear portion of the opening/closing body fitted into the groove of the base body of the slider, so that another part or the like is not required to be used in order to obtain sliding resistance and a structure of a compound needle can be simplified.

[0019] Further, according to the present invention, even if the opening/closing body of the slider is formed to be divided into two blades, the opening/closing body and the base body can be assembled with high accuracy and coupled to each other.

[Brief Description of Drawings]

[0020]

[Fig. 1] Figs. 1 are partial front views illustrating a structure of a compound needle 10 and a slider 11 as an embodiment of the present invention.

[Fig. 2] Fig. 2 are a partial plan view and a partial front view illustrating a base body 15 used in the slider 11 of Figs. 1, and a plan view, a front view and a left end view illustrating blades 13, 14.

[Fig. 3] Figs. 3 are a partial plan view illustrating the slider 11 of Figs. 1 and a cross-sectional view seen from a cutting plane line B-B of the partial plan view.

[Fig. 4] Figs. 4 are a partial plan view and a partial front view illustrating a structure of a slider 21 used to the compound needle as another embodiment of the present invention.

[Fig. 5] Figs. 5 are plan views and front views of base body 25, blade 23, 24, and sliding resistance flap 29 used for the slider 21 in Fig. 4.

[Fig. 6] Figs. 6 are partial front views illustrating a structure of a part of a coupling portion between the base body 25, and the blades 23, 34 as well as the sliding resistance flap 29.

[Fig. 7] Figs. 7 are a partial plan view and a partial front view illustrating a slider 1 which is conventionally used in a compound needle, a front view and a cross-sectional view illustrating a base body 5, and a partial front view illustrating a structure of a coupling portion 6.

[Description of Embodiments]

[0021] Hereinafter, Figs. 1 illustrate a structure of a compound needle 10 and a slider 11 as an embodiment of the present invention. Figs. 2 illustrate structures of a base body 15 and blades 13, 14 used in the slider 11 of Figs. 1. Figs. 3 illustrate structures of the blades 13, 14 used in the slider 11 in Figs. 1 on a coupling portion 16. Figs. 4 illustrate a structure of a slider 21 used for a compound needle as another embodiment. Figs. 5 illustrate structures of a base body 25, blades 23, 24 and a sliding resistance flap 29 used for the slider 21. Figs. 6 illustrate a structure of a coupling portion 26 for the base body 25, blades 23, 24 and the sliding resistance flap 29.

[0022] In description with reference to Figs. 1 through Figs. 6, parts which are described previously or parts corresponding to those described with reference to Figs. 7 are denoted with the same reference numerals and description is not repeated in some case. Further, parts which are not illustrated in the drawing to be referred are described while the reference numerals which have been described before are added to the parts in some case. In Figs. 1 and Fig. 4(a), an opening/closing body 12, 22 of the slider 11, 21 is shaded with slant lines as in Fig. 7(b).

[Example 1]

[0023] Fig, 1(a) illustrates a structure of a main part as a compound needle 10 and Fig. 1(b) illustrates a structure of a slider 11. The compound needle 10 is accommodated in a needle groove formed on a needle bed of a flatbed knitting machine, which is omitted to be illustrated, and the slider 11 has the opening/closing body 12, which is formed by two blades 13, 14 made of metal plates having elasticity, or the like. A hook 17a at a front portion of a needle body 17 has an aperture which is opened and closed by tongue portions 13a, 14a of the slider 11. The base body 15 can be moved relatively with respect to the needle body 17 while a bottom of a sliding contact arm 15a is made into slide contact with an upper face of a tail portion 17b of the needle body 17. A coupling concave 17c is also provided on the tail portion 17b and a convex portion 18a at a front portion of a needle jack 18 is fitted into the coupling concave 17c so that the needle body 17 and the needle jack 18 are coupled to each other. A driving butt and the like are provided at a rear portion of

the needle jack 18 but illustration thereof is omitted.

[0024] In the compound needle 10, the front portion of the needle jack 18 is made thinner so that a coupling portion between the needle body 17 and the needle jack 18 is held to occupy a part of space in the needle groove with respect to the thickness direction at one lateral side, and a sliding contact face with the bottom of the sliding contact arm 15a of the base body 15 is ensured at the other lateral side. Such structure that the coupling portion between the needle body 17 and the needle jack 18 is arranged to be side by side with the sliding contact portion between the slider 11 and the needle body 17 in the thickness direction, makes it possible to shorten the entire length required as the compound needle 10. The sliding contact portion between the slider 11 and the needle body 17 may not be arranged to be side by side with the coupling portion between the needle body 17 and the needle jack 18 in the thickness direction, but alternatively, the sliding contact portion and the coupling portion can be arranged so as to be separated from each other at the front and rear positions such that the sliding contact portion is arranged at the front side with respect to the coupling portion.

[0025] The blades 13, 14 close the aperture of the hook 17a by making front ends of the tongue portions 13a, 14a at front portions thereof abut against a front end of a hooked portion of the hook 17a. The tongue portions 13a, 14a formed on the front portions of the two blades 13, 14 can be separated into both sides of the hook 17a so as to advance to the needle bed gap beyond the hook 17a. Lower portions of the blades 13, 14 are accommodated in a slider groove 17d formed on an upper face of the needle body 17. Guiding portions 13b, 14b of the blades 13, 14 as illustrated in Fig. 1(b) have the same functions as those of the guiding portions 3b, 4b in Fig. 4. As illustrated in Fig. 1(a), if the blades 13, 14 are moved backward at the most level in the slider groove 17d, the guiding portions 13b, 14b are guided until the guiding portions 13b, 14b are pressed to the lower side by a guiding portion presser 17e formed on a side wall of the slider groove 17d.

[0026] Rear portions of the blades 13, 14 include lower stages 13c, 14c which continue approximately linearly to the tongue portions 13a, 14a and the guiding portions 13b, 14b at the front portions of the blades 13, 14. Further, the rear portions of the blades 13, 14 are folded back in an approximately U shape to form two-stage shapes. That is to say, the rear ends of the lower stages 13c, 14c are connected to upper stages 13e, 14e extended to the front side through connecting portions 13d, 14d. The blades 13, 14 can be shortened in the front-rear direction by forming the rear portions of the blades 13, 14 into the two-stage shapes. The connecting portions 13d, 14d and the upper stages 13e, 14e are used for forming the coupling portion 16 for coupling to the base body 15.

[0027] The coupling portion 16 is provided not on the sliding contact arm 5a at the lower portion as in the slider 1 as illustrated in Fig. 4 but in a coupling groove 15b formed on a side face of the base body 15. The coupling groove 15b is formed such that a section having a constant depth corresponds to the lengths of the upper stages 13e, 14e. The width of the coupling groove 15b is made slightly larger than the widths of the upper stages 13e, 14e. A contacting portion 15c is provided on a lower portion of the coupling groove 15b at a rear end side, and, when the upper stages 13e, 14e are fitted into the coupling groove 15b, rear ends of the connecting portions 13d, 14d have in contact with the contacting surface 15c so as to determine the position in the front-rear direction. The upper stages 13e, 14e and the coupling groove 15b are positioned in the vertical direction by making upper faces of the upper stages 13e, 14e have in contact with an upper side wall of the coupling groove 15b. An upward force required for the positioning can be provided to directly act on the lower stages 13c, 14c which are positioned just under the upper stages 13e, 14e so as to easily position the upper stages 13e, 14e and the coupling groove 15b. Even if the front portions of the blades 13, 14 receive the upward force from the bottom of the slider groove 17d of the needle body 17 when the front portions of the blades 13, 14 rock with the movement of the blades 13, 14 in the front-rear direction, the lower stages 13c, 14c sag and absorb the force so that the coupling portion 16 can be suppressed from receiving a large force. Fixing portions 16a, 16b are formed by swaging or the like on a lower portion and an upper portion of the coupling groove 15b in a state where the blades 13, 14 are positioned with respect to the coupling groove 15b of the base body 15, so that the coupling portion 16 is fixed.

[0028] Although butts to be driven are provided on a rear portion of the base body 15 as in the butts 5d, 5e of the base body 5 in Fig. 4, a butt corresponding to the butt 5d is not illustrated and only a butt 15e corresponding to the butt 5e is illustrated. An engaging concave 15f, which engages with engaging protrusions 13f, 14f of the blades 13, 14 so as to prevent the blades 13, 14 from swinging, is provided on the front portion of the base body 15.

[0029] Into the coupling groove 15b of the base body 15 as illustrated in Fig. 2(a), the upper stage 14e of the blade 14 as illustrated in Fig. 2(b) and the upper stage 13e of the blade 13 as illustrated in Fig. 2(c) are fitted. In order to easily position them at the time of the fitting, contacting portions 13g, 13h; 14g, 14h which slightly protrude from front and rear ends are provided on upper faces of the upper stages 13e, 14e, respectively. To provide the contacting portions 13g, 13h; 14g, 14h, positioning by having the contacting portions 13g, 13h; 14g, 14h in contact with an upper wall face of the coupling groove 15b at the front and rear two points can be easily made.

[0030] As illustrated in Fig. 2(b), on the blade 14 of which upper stage 14e is fitted into the back side of the coupling groove 15b, an offset is provided on the connecting portion 14d so that the upper stage 14e is positioned at one lateral side of a center in the width direction of the needle groove with respect to the lower stage 14c

positioned at the other lateral side thereof in the width direction of the needle groove. Thus, the coupling groove 15b can be made shallower and deterioration in the strength of the base body 15 due to the portion on which the coupling groove 15b is formed can be prevented from occurring.

[0031] As illustrated in Fig. 2(c), on the blade 13 of which upper stage 13e is fitted into the front side of the coupling groove 15b, although an offset as provided on the blade 14 is not provided, a middle portion of the upper stage 13e is curved so as to expand to the front side. Thus, the middle portion of the upper stage 13e is made to have in contact with a side wall of the needle groove. When the slider 11 is slidingly moved with respect to the needle groove, the upper stage 13e has in slide contact with the side wall of the needle groove so as to function as a resistance portion which generates sliding resistance. Since the upper stage 13e of the blade 13 has the resistance portion, another part or the like is not required to be used in order to obtain the sliding resistance so that a structure of the compound needle 10 can be simplified. Further, if the resistance portion is provided on the upper stage 13e, the sliding resistance received when the slider 11 is moved in the front-rear direction upon reception of a driving force by the butts provided on the upper portion of the base body 15 can be applied in a state where a difference in the vertical direction between the butts and the resistance portion is small. Therefore, a rotating moment generated when the butts are driven in the front-rear direction can be made smaller in comparison with a case where the sliding resistance is applied by the sliding contact arm 5a on the lower portion of the base body 5 as illustrated in Fig. 4.

[0032] When the resistance portion is formed as a member separated from the blades 13, 14, the resistance portion is not required to be provided by curving the upper stage 13e of the blade 13. Further, in such case, it is sufficient that the upper stages 13e, 14e have lengths required for the coupling portion 16, and the upper stages 13e, 14e can be shorten. In addition, if the upper stage 13e is not curved, positions of the fixing portions 16a, 16b can be changed. If the resistance portion formed as a separate member is provided at a position extended from the upper stages 13e, 14e in the front-rear direction, the difference in the vertical direction between the butts and the resistance portion can be made smaller in the same manner as the present embodiment. The resistance portion formed as the separate member can be provided on the sliding contact arm 5a of the base body 5 or the like as in the case of Fig. 4.

[0033] Fig. 3 illustrates the offset provided on the connecting portion 14d of the blade 14 together with a center line 11a in the width direction of the slider 11. The upper stages 13e, 14e of the blades 13, 14 fitted into the coupling groove 15b of the base body 15 as illustrated in Fig. 3(a) have in contact with each other remaining no space therebetween at a position of the cutting plane line B-B as illustrated in Fig. 3(b). On the blade 13 at one lateral side, the lower stage 13c and the upper stage 13e takes the same position in the width direction on at least the connecting portion 13d. On the blade 14 at the other lateral side, the offset is provided on the connecting portion 14d such that the lower stage 14c and the upper stage 14e take different positions in the width direction. The lower stages 13c, 14c are arranged at both sides of the center line 11a in line symmetry with a space therebetween. It is to be noted that the offset is not necessarily required to be provided on the connecting portion 14d of the blade 14 if the coupling groove 15b provided on the base body 15 is made deeper and a spacer is sandwiched between the upper stages 13e, 14e.

[0034] In the present embodiment as described above, the opening/closing body 12 is formed by two blades 13, 14. Therefore, the tongue portions 13a, 14a can be advanced to the needle bed gap with respect to the hook 17a so as to be used for stitch transferring or the like. However, in a case where an opening/closing body 12 is formed by a single member and a tongue portion is used only for opening and closing an aperture of a hook 17a, if the present invention is applied to a coupling between the opening/closing body 12 and a base body 15, a length in a front-rear direction is shortened and positioning is easily performed, even if the front portion of the opening/closing body 12 receives a force from the bottom of the slider groove when the front portion of the opening/closing body 12 is moved forward and backward, the force can be made to be hardly applied to the coupling portion 16.

[Example 2]

[0035] Hereinafter, it is provided a description for another embodiment of the present invention illustrated in Figs. 4 through Figs. 6, with mainly different parts from those of the embodiment in Figs. 1 through Figs. 3 and basically similar description might be omitted. Further, similar parts are attached by the same reference signs with respect to the part of the signs below the first digit.

[0036] In a slider 21, illustrated in Figs. 4, used in a compound needle as another embodiment of the present invention, a opening/closing body 22 is formed with two blade 23, 24 and a sliding resistance flap 29 made from an elastic metal plate or the like. Connecting portions 23d, 24d of the blades 23, 24 are provided with no offset. The length of the upper stages 23e, 24e are shortened than those of the upper stages 13d, 14e, so that a coupling portion 26 could be shorten in length. A coupling groove 25b which is provided on the base body 25 might be made longer than or equal to the length of the upper stage 24e, corresponding to the shortened length of the coupling portion 26. At front part of the coupling groove 25b, there is provided an accommodating groove 25j, which has a depth shallower than that of the coupling groove 25b and a length long enough to accommodate the sliding resistance flap 29.

[0037] Figs. 5 illustrate parts used for the slider 21 in

Figs. 4 as the base body 25 in (a), the blade 24 in (b), the sliding resistance flap 29 in (c) and the blade 23 in (d) respectively. The sliding resistance flap 29 has a resistance portion 29a bending to a lateral direction and a supporting portion 29b. The supporting portion 29b is clipped between the blades 23, 24 while the opening/closing body 22 is formed.

[0038] Figs. 6 illustrate structures of the coupling portion 26, which is formed by piling the base body 25, the blades 23, 24 and the sliding resistance flap 29. where a coupling state in which the coupling portion has been formed is in (a), and a non-coupling state in which the coupling portion has not been formed is in (b), respectively. In addition, on a lower portion at the vicinity of the front end of the upper stages 23e, 24e, contacting portions 23g, 24g are provided to protrude slightly.

[0039] Even in the non-coupling state, contacting portions 23h, 24h and contacting portions 23i, 24i provided on near position to the connecting portion 23d, 24d and on front position are able to have in contact with contacting portion 25h, 25i respectively. However, the upper stages 23e, 24e incline so as to drop by a smaller angle than one degree, and the contacting portions 23g, 24g protrude downward under a lower wall surface. In order to fit the upper stages 23e, 24e into the coupling groove 25b, it might be possible to lift up slightly the contacting portions 23g, 24g to be deformed elastically.

[0040] In the coupling state, the slightly deformed upper stages 23e, 24e are fitted into the coupling groove 25b, the contacting portions 23g, 24g have in contact with the contacting portion 25g on the lower wall surface of the coupling groove 25b. The contact between the contacting portions 23h, 24h, the contacting portions 23i, 24i of the lower stages 23c, 24c and the contacting portions 25h, 25i of the base body 25 are held. With respect to the front-rear direction, a distance from the position of the contacting portions 23g, 24g to the contacting portions 23h, 24h and that to the contacting portions 23i, 24i are nearly equal. The blades 23, 24 are determined stably to position in the vertical direction by supporting from the three contacting portions 25g, 25h, 25i. The positioning is stable, so that, when the fixing portions 26a, 26b are swaged in the coupling portion 26 to fix the blades 23, 24 and the sliding resistance flap 29, it is able to be prevented from a situation like that the tongue portions 23a, 24a side drop by rotation of the blades 23, 24.

[Reference Signs List]

[0041]

10 Compound needle
11, 21 Slider
12, 22 Opening/closing body
13, 14, 23, 24 Blade
13a, 14a, 23a, 24a Tongue portion
13c, 14c, 23c, 24c Lower stage
13d, 14d, 23d, 24d Connecting portion
13e, 14e, 23e, 24e Upper stage
13g, 13h, 14g, 14h, 23g, 23h, 23i, 24g, 24h, 24i, 25g, 25h, 25i Contacting portion
15, 25 Base body
15b, 25b Coupling groove
15c, 25c Contacting surface
16, 26 Coupling portion
16a, 16b, 26a, 26b Fixing portion
17 Needle body
17a Hook
17d Slider groove
25j Accommodating groove
29 Sliding resistance flap

Claims

1. A compound needle (10) for a flatbed knitting machine,
assembled with a needle body (17), which is accommodated in a needle groove formed on a needle bed of the flatbed knitting machine and has a hook (17a) at a front portion thereof, and a slider (11), which has a tongue portion (13a, 14a) at a front portion thereof for opening and closing the aperture of the hook (17a) and is movable relatively with respect to the needle body (17),
the slider (11) provided with an opening/closing body (12), which is arranged in a lower portion of the needle groove and has the tongue portion (13a, 14a) at the front portion thereof, and a base body (15), which is arranged in an upper portion of the needle groove and has a front portion to be coupled to a rear portion of the opening/closing body (12), **characterized in that**
the opening/closing body (12) of the slider (11) has a rear portion formed into two stages of an upper stage (13e, 14e) and a lower stage (13c, 14c), the lower stage (13c, 14c) continues to the tongue portion (13a, 14a) side at the front portion thereof and the upper stage (13e, 14e) extends to the front side over the upper side of the lower stage (13c, 14c),
the base body (15) of the slider (11) has a coupling groove (15b), on a side surface at one lateral side, having a length corresponding to that of the upper stage (13e, 14e) formed at the rear portion of the opening/closing body (12), and
coupling of the opening/closing body (12) and the base body (15) for the slider (11) is performed by fitting the upper stage (13e, 14e) of the rear portion of the opening/closing body (12) into the coupling groove (15b) of the

2. The compound needle (10) for the flatbed knitting machine according to claim 1, wherein
said upper stage (13e, 14e) of said opening/closing body (12) of said slider (11) has an offset such that a position of the upper stage (13e, 14e) is displaced

to one lateral side of said base body (15) of the slider (11) with respect to said lower stage (13c, 14c).

3. The compound needle (10) for the flatbed knitting machine according to claim 1 or 2, wherein
said upper stage (13e, 14e) of said opening/closing body (12) of said slider (11) has a resistance portion, which makes slide contact with a side wall of said needle groove and generates sliding resistance when the slider (11) slides in the needle groove, on one lateral side of the base body (15) of the slider (11).

4. The compound needle (10) for the flatbed knitting machine according to any one of claims 1 through 3, wherein
said opening/closing body (12) of said slider (11) is formed to be divided into two blades (13, 14).

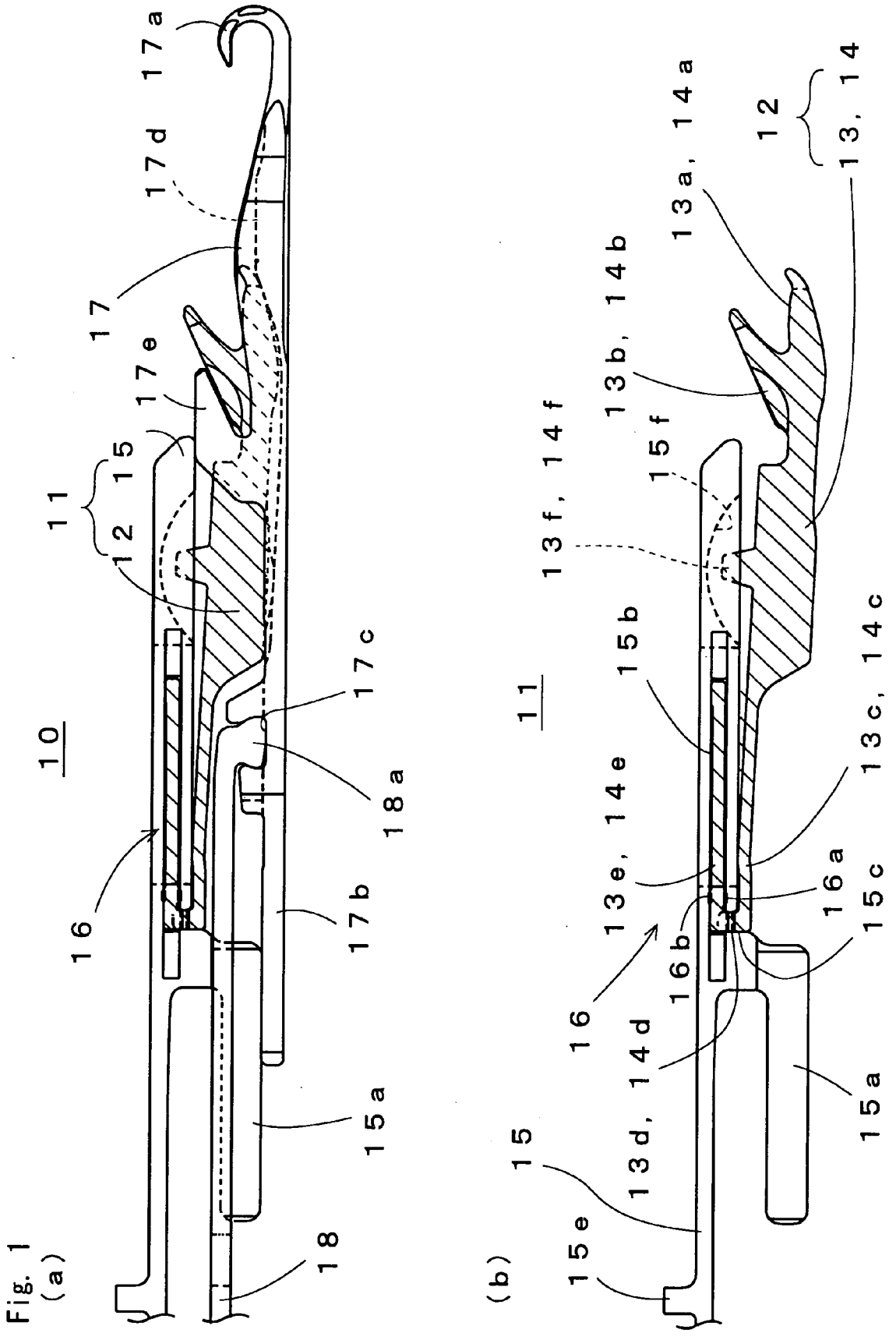


Fig. 1
(a)
10
11
12
15
17
17a
17d
17e
16
17b
17c
18a
15a
18
(b)
11
12
13, 14
13a, 14a
13b, 14b
13f, 14f
15f
15b
13e, 14e
13c, 14c
16a
15c
16
16b
13d, 14d
15
15e
15a

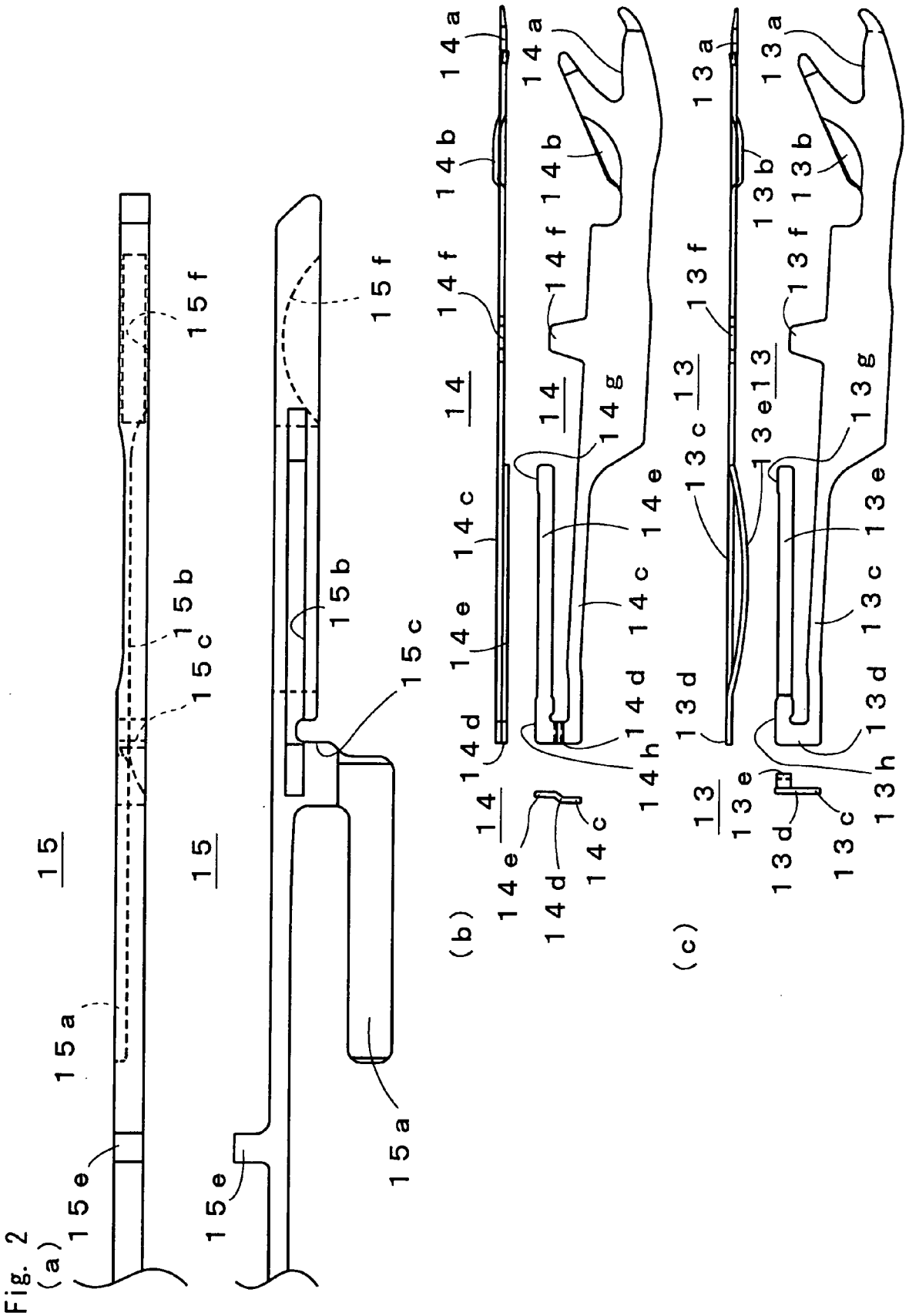
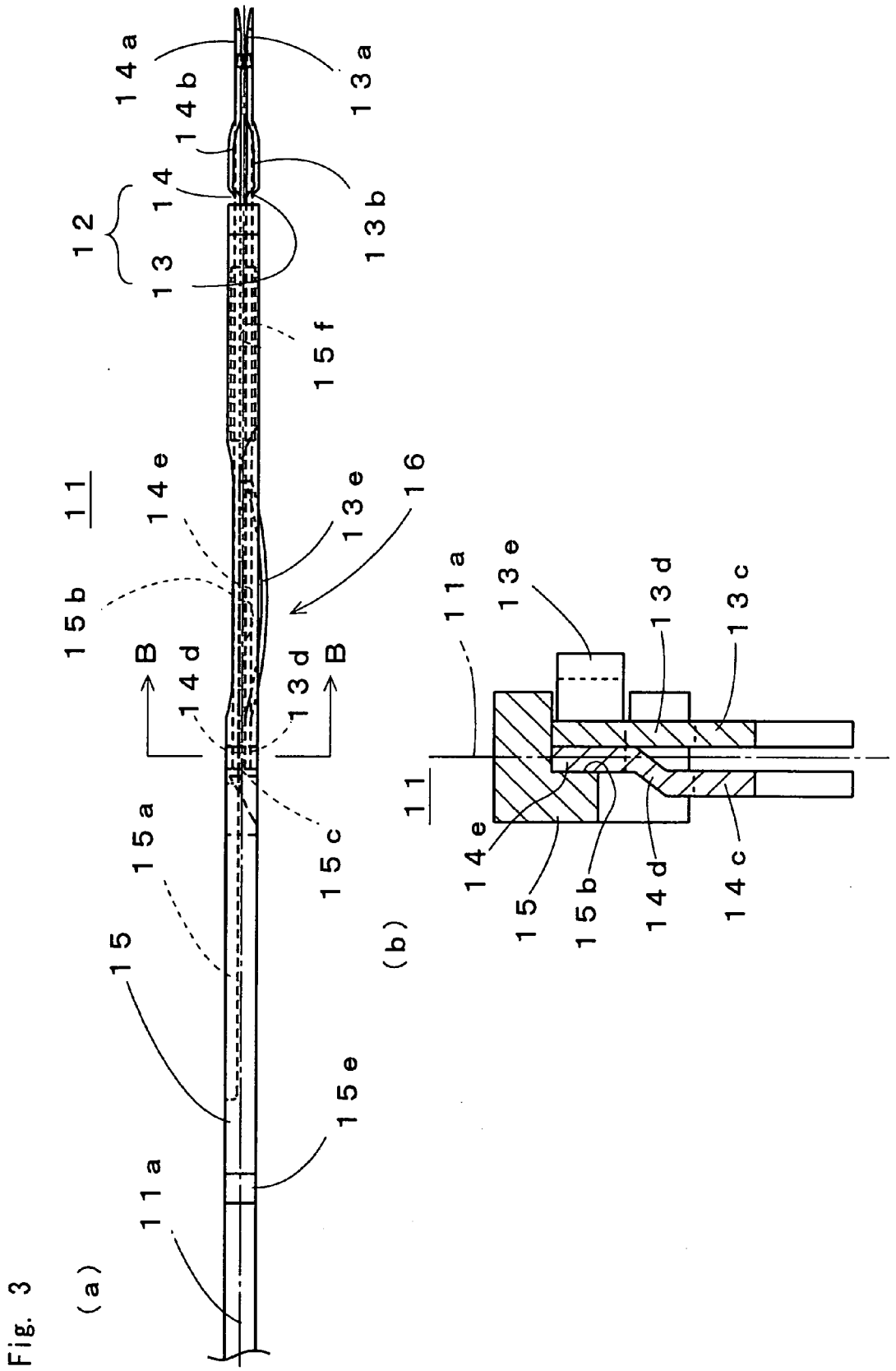


Fig. 2
(a)
15
15a
15e
15f
15b
15c
15
15e
15f
15b
15c
15a
(b)
14
14a
14b
14f
14c
14e
14d
14g
14h
14
14e
14d
14c
14a
14b
14f
14g
14c
14e
14d
14h
(c)
13
13a
13b
13f
13c
13e
13d
13h
13
13e
13d
13c
13a
13b
13f
13e
13g
13c
13e
13d
13h

Fig. 3


(a)
(b)
11
11a
12
13
13a
13b
13c
13d
13e
14
14a
14b
14c
14d
14e
15
15a
15b
15c
15e
15f
16
B
B

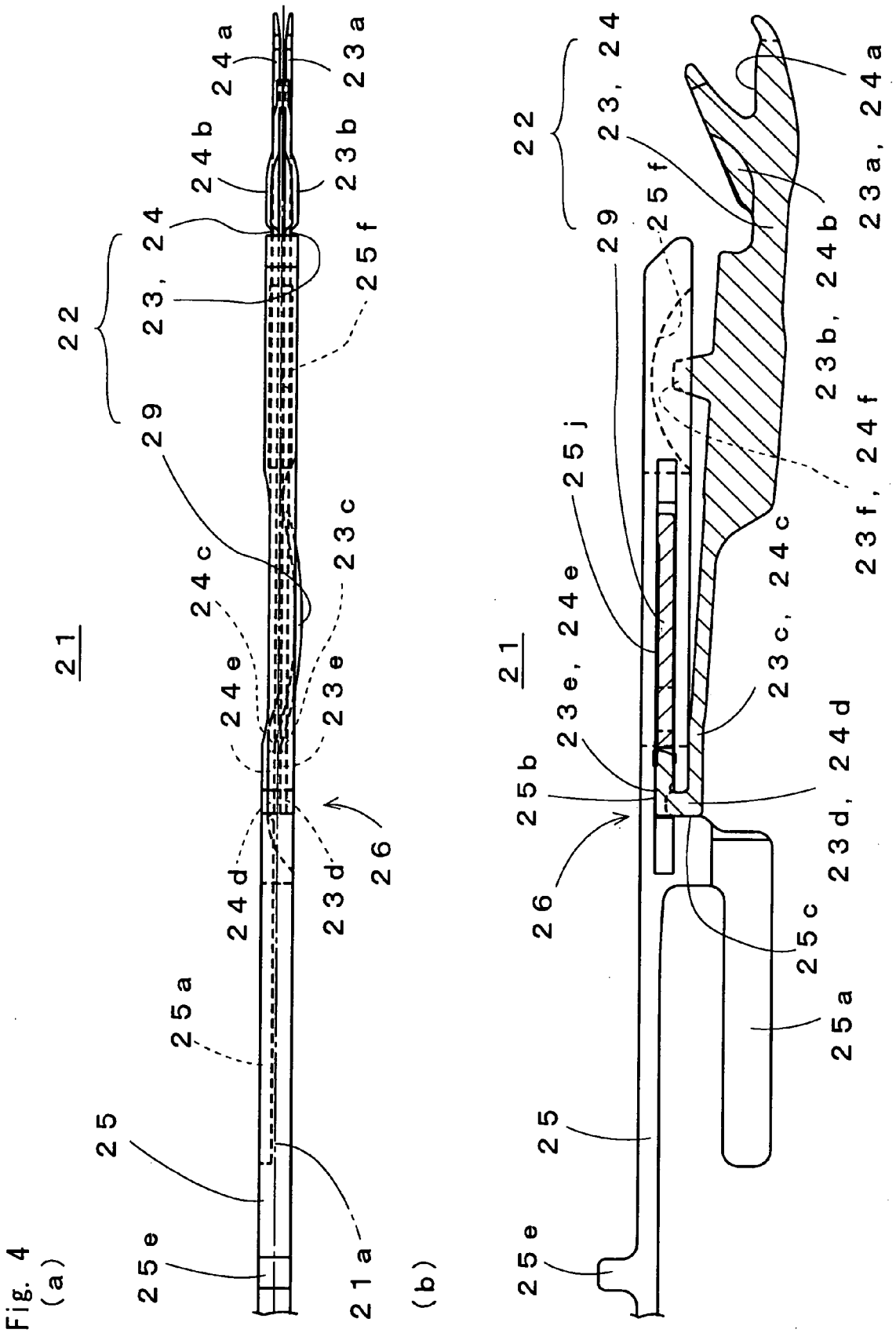


Fig. 4
(a)
22
23, 24
29
21
24a
24b
24c
24d
24e
23a
23b
23c
23d
23e
25f
26
25
25a
25e
21a
(b)
22
23, 24
29
21
25f
25j
23e, 24e
25b
26
23a, 24a
23b, 24b
23f, 24f
23c, 24c
23d, 24d
25c
25a
25
25e

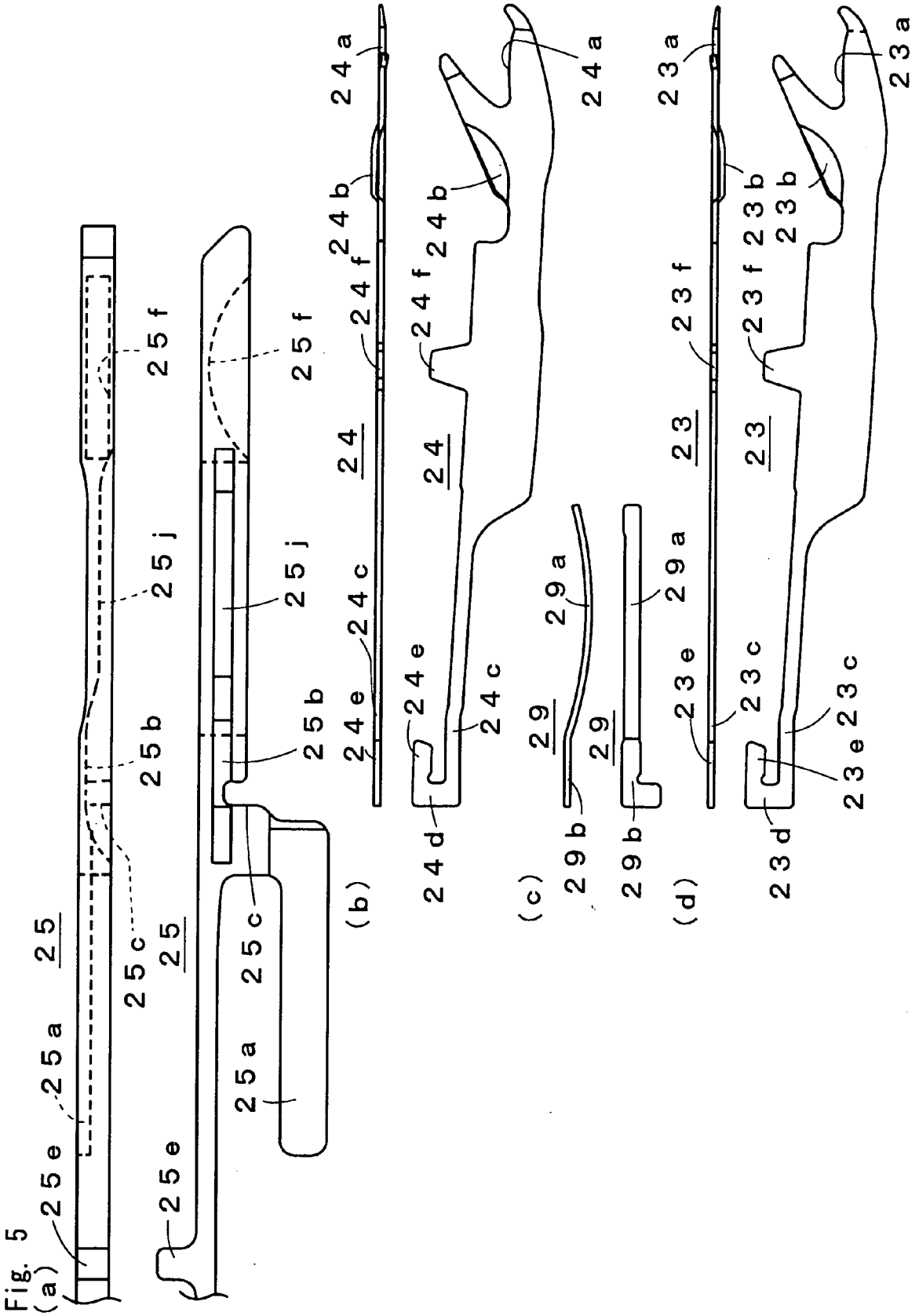
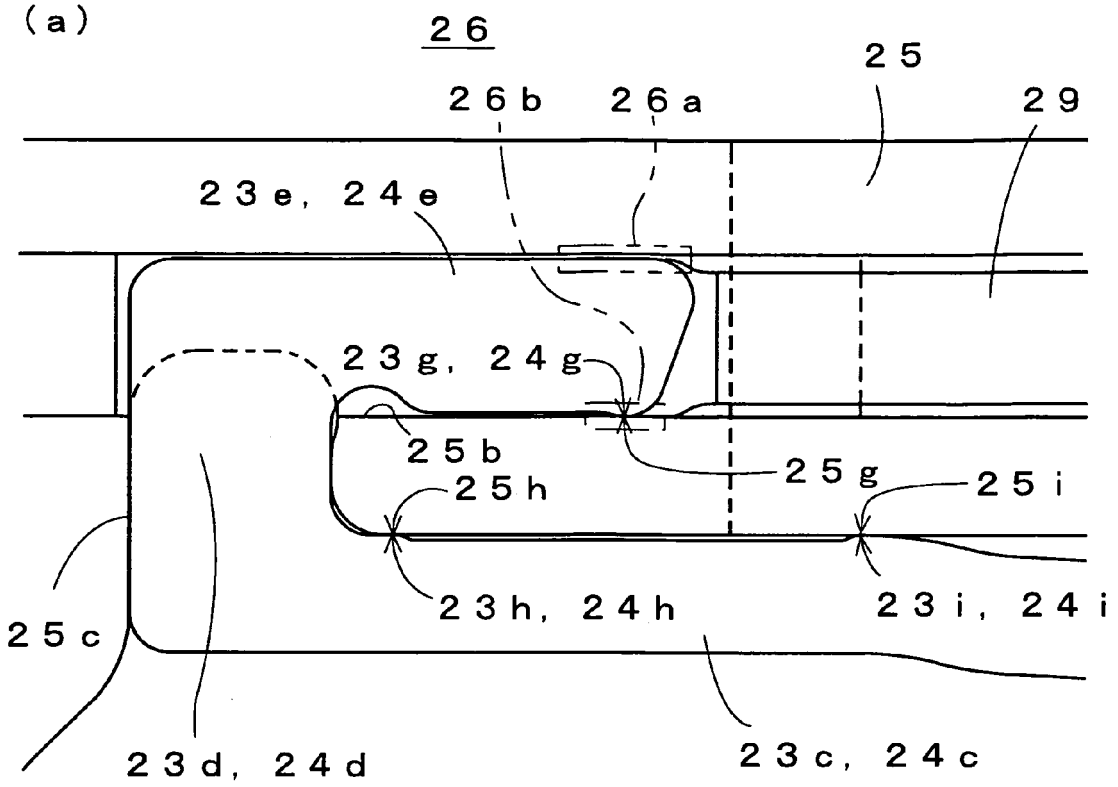


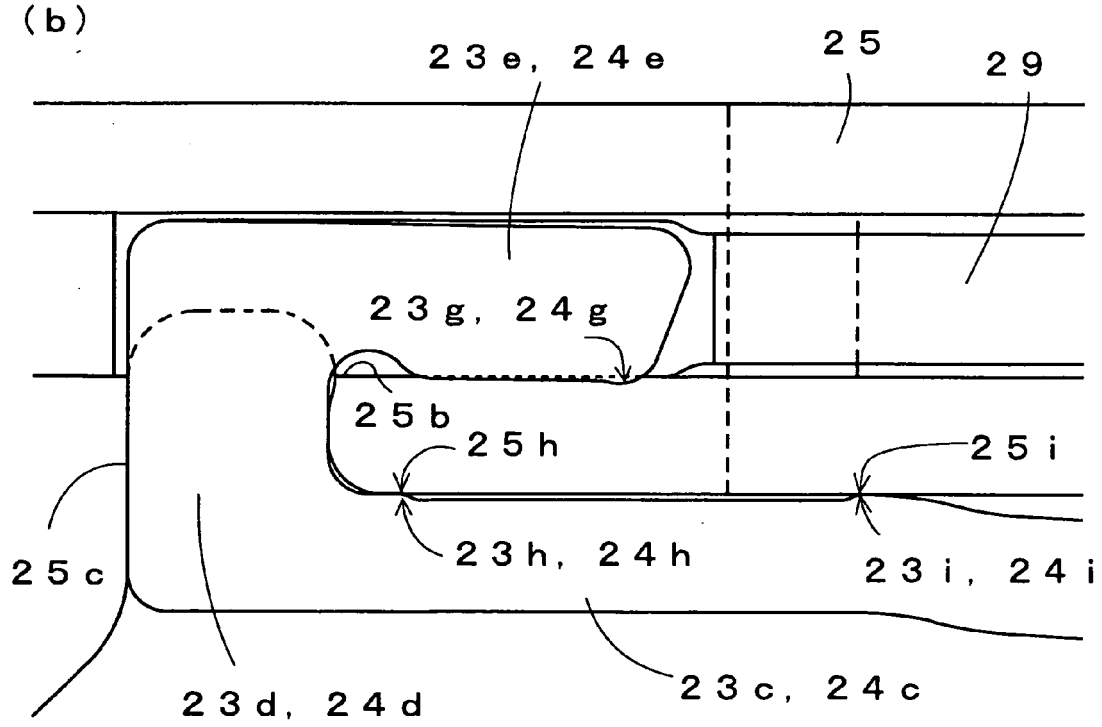
Fig. 5
(a)
25
25a
25e
25c
25b
25j
25f
(b)
24
24a
24b
24f
24c
24e
24d
(c)
29
29a
29b
(d)
23
23a
23b
23f
23c
23e
23d

Fig. 6

(a)


26
26b
26a
25
29
23e, 24e
23g, 24g
25b
25g
25h
25i
25c
23h, 24h
23i, 24i
23d, 24d
23c, 24c

(b)


23e, 24e
25
29
23g, 24g
25b
25h
25i
25c
23h, 24h
23i, 24i
23d, 24d
23c, 24c

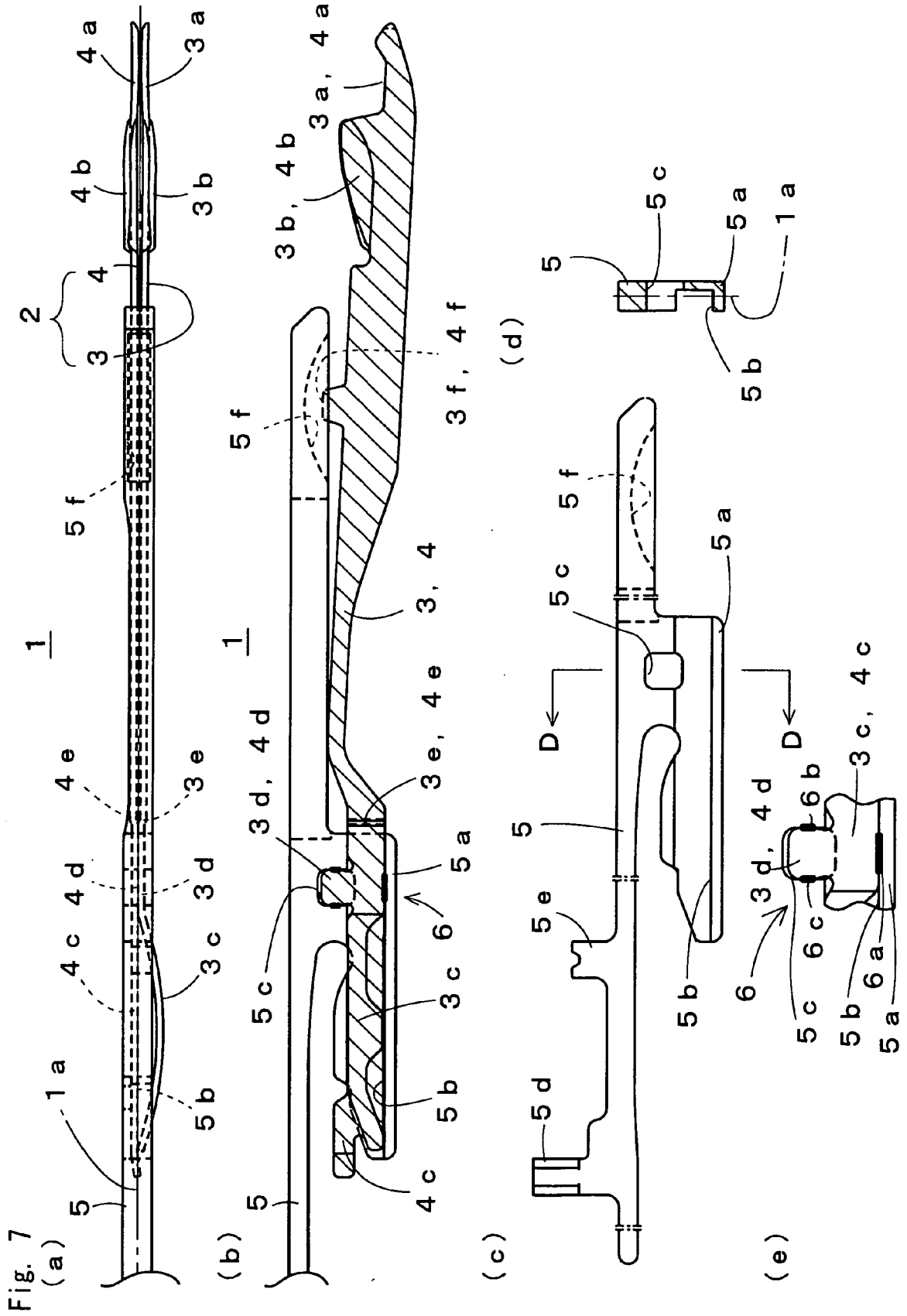


Fig. 7
(a)
(b)
(c)
(d)
(e)
1
2
3
4
5
1a
3a
3b
3c
3d
3e
3f
4a
4b
4c
4d
4e
4f
5a
5b
5c
5d
5e
5f
6
6a
6b
6c
D

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP 3577038 B **[0008]**