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Description

Description

5 [Technical Field]

[0001] The present invention relates to a flatbed knitting machine provided with a set up equipment of a fabric and a knitting method using such a flatbed knitting machine.

10 [Background Art]

[0002] Conventionally, in a flatbed knitting machine, a set up equipment, which is provided under a needle bed gap between needle beds and includes a set up bed having set up needles and being moved in an elevation manner, is used when knitting of a fabric is started on the needle beds (for example, see Patent Literatures 1 and 2). When knitting of the fabric is started, a set up part of the fabric is formed in the needle bed gap and the set up bed is elevated to cause the set up needles to advance to the needle bed gap and capture the set up part. The fabric is knitted while the captured set up part is held with the set up needles and the set up bed is lowered. In such a manner, the set up equipment applies predetermined tension to the fabric, so that the fabric is made easy to be knitted.

[0003] Patent Literature 1 discloses a set up equipment, which is provided with one set up comb (set up bed) and set up needles, capable of switching to hold and release the set up part based on whether hooks provided on upper ends of sliders are separated from or are stored in projections provided on upper ends of needle bodies. Patent Literature 2 discloses a set up equipment, which is provided with a plurality of set up beds, set up needles in different sections in the knitting width direction and capable of starting to knit a part of the fabric in advance, and then, starting to knit another part thereof.

[0004] Fig. 8 schematically shows a knitting method with which a flatbed knitting machine starts integral knitting of a short-sleeved knitwear 1 as an example of a fabric product capable of being knitted without seam. The knitwear 1 is knitted in such a manner that knitting is started from a hem 2 side to knit a body 3 into a cylinder form. Knitting of sleeves 4, 5 that are shorter than the body 3 is started by adding waste knittings 6, 7 previously. The respective sleeves 4, 5 are also knitted into cylinder forms at both sides of the body 3 and the sleeves 4, 5 are joined to the body 3 while being gathered thereto. The flatbed knitting machine is provided with the set up equipment in Patent Literature 1 and pulldown equipment 8 (for example, see Patent Literature 3) that pulls down the fabric drooping to the lower side of the needle bed gap from both sides in the front-back direction. The pulldown equipment 8 can be opened and closed in a divided manner into a plurality of sections in the knitting width direction. The pulldown equipment 8 is opened in sections in which the set up bed is provided at the upper side for pulling down the set up part. When the set up bed is lowered and passes through the pulldown equipment 8, the set up parts for the body 3 and the waste knittings 6, 7 are released from the set up needles, the pulldown equipment 8 is closed, and pulling-down by the pulldown equipment 8 is performed. When the sleeves 4, 5 are gathered, the pulldown equipment 8 in sections for pulling down the waste knittings 6, 7 is opened so as to make the sleeves 4, 5 be easy to be moved to the body 3 side.

[0005] Fig. 9 shows the case in which the set up equipment for the flatbed knitting machine can start partial knitting of the fabric as disclosed in Patent Literature 2. In this case, partial set up beds 10 that correspond to parts of sections of the needle beds and on which set up needles 9 are arranged in parallel are used for pulling down set up parts when knitting of the sleeves 4, 5 is started. As shown in Fig. 9(1), after knitting of the body 3 as a part of the same fabric on needle beds 13 is started in advance, the sleeves 4, 5 as remaining parts thereof are knitted on the partial set up beds 10, so that the waste knittings 6, 7 as shown in Fig. 8 are not required. As shown in Fig. 9(2), if the short sleeves 4, 5 are started to be gathered before passing through the pulldown equipment 8, upper parts of the sleeves 4, 5 are gathered to the body 3 side in a state where the set up parts for the sleeves 4, 5 are held by the set up needles 9 at the time of the gathering, and the integrated knitwear 1 as shown in Fig. 9(3) is formed without seam. The pulldown equipment 8 is opened in sections overlapping with positions at which the partial set up beds 10 are present and is closed in sections in which the body 3 is pulled down. The closed sections of the pulldown equipment 8 are indicated by being hatched.

50 [Citation List]

[Patent Literature]

55 **[0006]**

Patent Literature 1: JP H2-210046 A

Patent Literature 2: JP S47-49789 B

[Summary of Invention]

5 [Technical Problem]

[0007] When knitting of the short-sleeved knitwear 1 is started, the waste knittings 6, 7 are required in Fig. 8 or a situation in which the sleeves 4, 5 are not lowered before the partial set up beds 10 pass through the pulldown equipment 8 as shown in Fig. 9(2) can occur when the sleeves 4, 5 are gathered to the body 3 side in Fig. 9. In this situation, the sleeves 4, 5 are gathered to the body 3 side by racking of the needle beds in a state where the set up needles 9 on the partial set up beds 10 hold the set up parts for the sleeves 4, 5 and remain still, so that tension applied to knitting yarns is increased, resulting in a risk of extension or breakage of the knitting yarns. Accordingly, it is not effective only to provide the set up needles 9 for set up in different sections in the knitting width direction on the plurality of set up beds in the above-mentioned situation.

[0008] An object of the present invention is to provide a flatbed knitting machine provided with a set up equipment capable of preventing tension which is applied to knitting yarns from being increased, even when a knitting fabric is gathered in the knitting width direction while a set up part is captured and pulled down with set up needles.

[Solution of Problem]

[0009] The present invention is a flatbed knitting machine under needle beds having as a set up equipment which provided with:

a set up bed on which set up needles capable of switching to hold or to release a set up part of a fabric are arranged in parallel in a knitting width direction;
a longitudinal driving mechanism moving the set up bed in an elevation manner; and
a hold release mechanism to drive switching to hold or to release the set up part with the set up needles,

characterized in that

at least one set up bed has a functioning plate part on which the set up needles are arranged in parallel and which is movable in the knitting width direction, and
the set up equipment further is provided with a transversal driving mechanism to drive the functioning plate part in the knitting width direction relatively to the set up bed.

[0010] In the present invention

said set up equipment is further provided with two combinations of said functioning plate part and said transversal driving mechanism.

[0011] In the present invention

said set up equipment is provided with a set up bed having a functioning plate part which is not moved in the knitting width direction in addition to said set up bed having a functioning plate part which is moved in the knitting width direction, and

said longitudinal driving mechanism moves one of the set up beds in the elevation manner.

[0012] In the present invention

said hold release mechanism is provided with:

a driving source that performs driving of switching to hold or to release said set up part on said set up needle; and
a transmission part, which is provided on said set up bed having said functioning plate part to move in said knitting width direction, transmits driving force from the driving source to said set up needles, and has a groove extending in the knitting width direction and a projecting part which is engaged with the groove.

[0013] In the present invention

said transversal driving mechanism drives said functioning plate part which is moved in said knitting width direction in the same direction as a direction of a fabric which is moved by racking of said needle beds.

[0014] In the present invention

a pulldown equipment being provided under said needle beds, being separated into a plurality of sections, which are distanced from each other in the knitting width direction, and being capable of switching a state close and open in such a divided manner that pieces of the sections make contact with the fabric to pull down a knitted fabric in the closed state, and enable said functioning plate part to pass through the pieces in the opened state, and
the pulldown equipment make a section, overlapping with a position at which the functioning plate part moves in said

knitting width direction, into the opened state, when said set up part is pulled down with the set up needles arranged in parallel on the functioning plate part.

[0015] In the present invention the flatbed knitting machine further comprising:

at least two centering members, being provided on said functioning plate part, which is movable in the knitting width direction, at an interval in the knitting width direction, being movable in an extension direction of said set up needles relatively to the functioning plate part, abutting against rear surfaces of said needle beds to stop when the functioning plate part is elevated, and guiding the functioning plate part so as to cause the set up needles to project from a center of a needle bed gap; and
springs that bias the centering members in the extension direction of the set up needles relatively to the functioning plate part.

[0016] The present invention is a knitting method in which knitting of a body at an intermediate position and sleeves at both sides of the body in a knitting width direction is started as independent cylindrical fabrics from a hem side and a knitwear is integrally knitted without seam by gathering and joining the sleeves to the body using a flatbed knitting machine which is provided, under needle beds as a set up equipment, with:

a set up bed on which set up needles, capable of switching to hold and release a set up part of a fabric, are arranged in parallel in the knitting width direction;
a longitudinal driving mechanism moves the set up bed in an elevation manner; and
a hold release mechanism drives switching to hold and release the set up part with the set up needles,

characterized in that
the set up equipment is provided with at least:

two functioning plate parts on which the set up needles are arranged in parallel and which are movable in the knitting width direction, and
two transversal driving mechanisms which move the functioning plate parts in the knitting width direction relatively to the set up bed, and

after knitting of the body of the knitwear is started, both sleeves are knitted in such a manner that when the sleeves are gathered and joined to the body side while holding set up parts with the set up needles on the two functioning plate parts and lowering the set up bed, the two functioning plate parts are moved to the body side by the respective transversal driving mechanisms in the same direction as a direction of movement of the sleeves by racking of the needle beds.

[Advantageous Effects of Invention]

[0017] According to the present invention, a transversal driving mechanism can move a functioning plate part in the same direction as that of a fabric which is knitted while a set up part is captured and pulled down with set up needles even when the fabric is gathered in the knitting width direction. This movement can prevent tension which is applied to knitting yarns from being increased, thereby preventing extension or breakage of the knitting yarns. Furthermore, a position of the functioning plate part can be freely changed so that, after knitting of a part of the fabric is started in advance, knitting of a different part of the fabric can be started later by moving the functioning plate part.

[0018] In addition, according to the present invention, two functioning plate parts can be driven by transversal driving mechanisms individually to freely set respective positions of the functioning plate parts. As in the case in which knitting of both sleeves of a knitwear is started after knitting of a body is started, when the fabric is divided into two sections, knitting thereof is started later, and the fabric is gathered on needle beds, the functioning plate parts can be moved in the same direction as that of the fabric while following the fabric. Moreover, a section in which the set up part of the fabric is held and pulled down with the set up needles can be also enlarged by making the two functioning plate parts adjacent to each other.

[0019] In addition, according to the present invention, after the set up part of the fabric, which is started to be knitted in advance, is pulled down using the set up needles on the functioning plate part which is not moved in the knitting width direction, the set up part of a remaining part of the fabric can be held and pulled down by moving the functioning plate part to a position of the remaining part of the fabric.

[0020] In addition, according to the present invention, a transmission part for driving to hold and release the set up part with the set up needles from the outside of the moving functioning plate part, has a groove extending in the knitting width direction and a projecting part that is engaged with the groove. The groove and the projecting part are moved in a sliding manner. so that, even when the functioning plate part is moved in the knitting width direction, the transmission

part can transmit driving force for switching to the set up needles arranged in parallel on the functioning plate part reliably.

[0021] In addition, according to the present invention, even when gathering of the fabric by racking of the needle beds is performed while the set up part is held and pulled down with the set up needles after knitting of the fabric is started, the transversal driving mechanism moves the functioning plate part in the same direction as that of the movement of the fabric that is gathered, thereby preventing extension or breakage of the knitting yarns.

[0022] In addition, according to the present invention, when a set up part of a following part of a fabric is held and pulled down with the set up needles arranged in parallel on the functioning plate part which is moved in the knitting width direction, while a fabric knitted in advance is pulled down by making the pulldown equipment be in a closed state, and a position which is moved in the same direction as that of the fabric while the following part is pulled down overlaps with a section of the pulldown equipment in the closed state, the functioning plate part can be moved in the knitting width direction by making the section be in an opened state.

[0023] In addition, according to the present invention, the set up needles project from the center of the needle bed gap guided by the functioning plate part with the centering members, so that it is possible to capture and pull down the set up part of the fabric with the set up needles reliably.

[0024] Moreover, according to the present invention, the functioning plate parts on which the set up needles holding and pulling down the set up parts for sleeves are arranged in parallel are moved to the body side in accordance with the sleeves which are moved by racking of the needle beds, so that, even in the case of the short-sleeved knitwear, after knitting of the body is started, knitting of the sleeves can be started without waste knitting and the sleeves can be gathered to the body side and joined thereto while pulling down the sleeves with the set up needles.

[Brief Description of Drawings]

[0025]

[Fig. 1] Fig. 1 is a simplified front view showing a schematic structure of a set up equipment 12 provided in a flatbed knitting machine 11 as an example of the present invention.

[Fig. 2] Fig. 2 is a front view partially showing a structure of a set up bed 14 of the set up equipment 12 in Fig. 1.

[Fig. 3] Fig. 3 is a simplified cross-sectional side view of the flatbed knitting machine 11 in Fig. 1.

[Fig. 4] Fig. 4 is a partial front view showing a structure and operations of a transmission part 30 of the set up bed 14 in Fig. 2.

[Fig. 5] Fig. 5 is a cross-sectional side view showing structures and operations of a set up needle 9 and the transmission part 30 in Fig. 4.

[Fig. 6] Fig. 6 is a simplified front view showing a method of knitting a knitwear 1 which is started to be knitted by the flatbed knitting machine 11 in Fig. 1.

[Fig. 7] Fig. 7 is a simplified front view showing a method of knitting a knitwear 41 that is started to be knitted by the flatbed knitting machine 11 in Fig. 1.

[Fig. 8] Fig. 8 is a simplified front view showing a conventional knitting method in which knitting of a short-sleeved knitwear 1 is started by adding waste knittings 6, 7.

[Fig. 9] Fig. 9 is a simplified front view showing a conventional knitting method in which knitting of a body 3 is started in advance and knitting of sleeves 4, 5 is started later.

[Fig. 10] Fig. 10 is a partial front view and a right side view showing a combination of a centering member 60 and a spring 61 that are provided at one side of a functioning plate part 16 in Fig. 2.

[Fig. 11] Fig. 11 is a front view and a right side view showing shapes of an abutment block 62 and an elevating material 63 configuring the centering member 60 in Fig. 10.

[Fig. 12] Fig. 12 is a cross-sectional right side view showing a guiding state by the centering members 60 in Fig. 10 when the functioning plate part 16 is elevated.

[Fig. 13] Fig. 13 is a simplified partial front view and a cross-sectional right side view showing a structure in which a centering member 66 is provided at the center of a functioning plate part 19 of the entire width.

[Description of Embodiments]

[0026] Hereinafter, a structure and operations of a flatbed knitting machine 11 as an example of the present invention will be described with reference to Fig. 1 to Fig. 5 and Fig. 10 to Fig. 13. Parts that are not shown in the drawing as a description target are referred by using reference characters as shown in other drawings in some cases. Fig. 6 and Fig. 7 show an example of a fabric that is started to be knitted by the flatbed knitting machine 11. The same reference characters denote corresponding parts in Fig. 8 and Fig. 9 and overlapped description is omitted in some cases.

[Example 1]

[0027] Fig. 1 shows a schematic structure of a set up equipment 12 which is included in a flatbed knitting machine 11 as an example of the present invention. The flatbed knitting machine 11 knits a fabric on front and back needle beds 13. The set up equipment 12 is provided under a needle bed gap between the front and back needle beds 13. The set up equipment 12 in the example includes a set up bed 14 and longitudinal driving mechanisms 15. The set up bed 14 includes functioning plate parts 16 on which set up needles 9 capable of switching to hold and release set up parts of the fabric are arranged in parallel in the knitting width direction. The functioning plate parts 16 can be moved in the knitting width direction relatively to the set up bed 14. The longitudinal driving mechanisms 15 move the set up bed 14 in an elevation manner. The set up bed 14 further includes transversal driving mechanisms 17 which drives the functioning plate parts 16 in the knitting width direction.

[0028] Fig. 2 shows a structure about a right side part of the set up bed 14 of the set up equipment 12 in Fig. 1 while parts thereof in the knitting width direction and the up-down direction between parallel two-dot chain lines are foreshortened. A left side part of the set up bed 14 is symmetrical to the right side part with respect to a center of the flatbed knitting machine 11 in the knitting width direction. The set up needles 9 corresponding to partial sections of the entire knitting width of the needle beds 13 are arranged in parallel on upper parts of the functioning plate parts 16. Each functioning plate part 16 can be moved along a transversal movement guide 14a in the transverse direction in the drawing as the knitting width direction. Each transversal driving mechanism 17 drives the movement in the transverse direction includes a motor 17a, a worm gear 17b, a driven gear 17c, pulleys 17d and 17e, and a belt 17f. The worm gear 17b mounted on an output axis of the motor 17a as a driving source is engaged with the driven gear 17c. The belt 17f is hung over between the pulley 17d mounted coaxially with the driven gear 17c and the pulley 17e opposing the pulley 17d with an interval therebetween in the knitting width direction and a lower part of the functioning plate part 16 is connected to the belt 17f with a connecting member 17g interposed therebetween. The functioning plate part 16 can be also moved using a ball screw, a rack and a pinion, or the like as the transversal driving mechanism 17.

[0029] The set up equipment 12 in Fig. 1 includes two equivalent combinations of the functioning plate part 16 and the transversal driving mechanism 17 on the set up bed 14 and further includes another set up bed 18 at the back side of the set up bed 14. The set up bed 14 may include only one or equal to or more than three functioning plate parts 16. When only one functioning plate part 16 is provided on the set up bed 14, it can be made movable over the entire knitting width. The set up bed 18 includes a functioning plate part 19 on which the set up needles 9 are arranged in parallel in a range corresponding to the entire width of the needle beds 13 and which is not moved in the knitting width direction. On the functioning plate part 19, the set up needles 9 may be arranged in parallel in a narrower range than the entire width. On the other hand, when the plurality of functioning plate parts 16 which are moved are included, ranges in which the set up needles 9 are arranged in parallel thereon may be made different. A set up bed including the functioning plate part 16 which moves and the functioning plate part 19 which does not move may be provided other than the set up beds 14, 18. Furthermore, the set up bed 18 may be provided at the front side or the back side of the set up bed 14.

[0030] Lower parts of the set up beds 14, 18 are accommodated in holders 20 provided under the needle beds 13 at both sides in the knitting width direction at an interval in the front-back direction of the flatbed knitting machine 11. The holders 20 are moved in the front-back direction by selecting mechanisms 21. The selecting mechanisms 21 switch to move any one of the set up beds 14, 18 to a position at which the longitudinal driving mechanisms 15 are provided. The selecting mechanisms 21 may be configured in any form as long as they can select any one of the set up beds 14, 18 and the selecting mechanisms 21 may be provided on the longitudinal driving mechanisms 15. The longitudinal driving mechanisms 15 include elevating brackets 15b which are elevated by being guided with elevating guides 15a. The longitudinal driving mechanisms 15 convey the set up bed 14 or the set up bed 18 selected by the selecting mechanisms 21 with the elevating brackets 15b and move it in an elevation manner such that the set up needles 9 capture and hold a set up part in the needle bed gap. The respective set up beds 14, 18 may have structures equivalent to the elevating guides 15a and the elevating brackets 15b and any of them may be elevated as disclosed in JP H9-31805 A, for example. Alternatively, as disclosed in Patent Literature 2, the respective set up beds 14, 18 may have structures equivalent to the elevating guides 15a and structures equivalent to the elevating brackets 15b may select and elevate any one of the set up beds 14, 18.

[0031] A hold release mechanism 22 that is installed under the needle beds 13 performs switching to hold and release the set up part of the fabric with the set up needles 9. The hold release mechanism 22 performs driving in the knitting width direction with a rocking lever 22b of a driving source 22a which is fixed not to move in the elevating direction and the knitting width direction. The rocking of the lever 22b by a stepping motor, a solenoid, or the like causes free ends thereof at the upper side to be moved in the knitting width direction as the right-left direction in the drawing relatively to a base end thereof at the lower side. Movement of the free ends of the lever 22b in the knitting width direction is transmitted to driven parts 22e, 22f of the set up beds 14, 18 through wires 22c, 22d, respectively. Even when the set up bed 14, 18 which is selected by the selecting mechanisms 21 is elevated by the longitudinal driving mechanisms 15, the wire 22c, 22d is flexibly deformed and a state in which the set up needles 9 can be driven by the driving source 22a is maintained.

[0032] As shown in Fig. 2, a transmission part 30, which transmits the driving force generated from the driving source 22a and received on the driven part 22e to the set up needles 9 on each functioning plate part 16, is provided on the set up bed 14. The transmission part 30 is provided with a transversal movement member 30a, a groove cam 30b, a cam follower 30c, a connecting plate 30d, and a longitudinal movement member 30e to convert driving on the driven part 22e in the knitting width direction to driving in the elevating direction. A projecting part 30f extending in the knitting width direction is provided on the upper end of the longitudinal movement member 30e. The projecting part 30f is engaged with a groove 16a that is provided on a lower part of the functioning plate part 16 and extends in the knitting width direction so as to oppose the projecting part 30f.

[0033] Centering members 60 are provided at both sides of each functioning plate part 16. The centering members 60 are elevated by being biased by springs 61 when the functioning plate part 16 is elevated. The elevation of the centering members 60 stops when the centering members 60 abut against the rear surfaces of the needle beds 13 in the vicinity of the needle bed gap 13a. The needle beds 13 have needle grooves to accommodate knitting needles on the surfaces thereof. Even when the centering members 60 is stopped to elevate, the functioning plate part 16 continues to elevate while compressing the springs 61. During the elevation, the centering members 60 guide the functioning plate part 16. The guiding causes the set up needles 9 to project from the center of the needle bed gap 13a. When rigidity of the set up bed 14 is lowered due to decrease in weight, it is preferable that the centering members 60 should be provided. Hereinafter, illustration of the centering members 60 is omitted in Fig. 3 to Fig. 7.

[0034] Fig. 3 shows the simplified side structure of the flatbed knitting machine 11 in Fig. 1 in a state in which the set up bed 14 is selected and the set up needles 9 on the functioning plate parts 16 are elevated to the needle bed gap 13a between the needle beds 13. Although not shown in the drawing, the set up parts of the fabric are formed in the needle bed gap 13a. When the set up needles 9 are switched into the states capable of holding the set up parts and the set up bed 14 is lowered by the longitudinal driving mechanisms 15, the set up needles 9 capture the set up parts, are lowered while holding the captured set up parts, and pull down the knitted fabric to a position under the needle bed gap 13a. Sub rollers 31, pieces of pulldown equipment 8, and discharge rollers 32 are provided at both sides of the fabric which is pulled down and these are made into opened states in which intervals therebetween in the front-back direction are enlarged when the functioning plate parts 16 are elevated. The sub rollers 31, the pieces of pulldown equipment 8, and the discharge rollers 32 are made into closed states in which the intervals therebetween in the front-back direction are narrowed and can pull down the fabric when the functioning plate parts 16 are lowered and the set up needles 9 pass therethrough. When the pieces of pulldown equipment 8 are made into the closed state of making contact with the fabric, capturing members 8a provided with downward needles on surfaces thereof and pressure plates 8b can nip the fabric therebetween to pull down it. The drawing shows the opened state in which they are distanced from each other. Note that the closed state of the capturing members 8a is also shown with dashed lines. The pieces of pulldown equipment 8 are provided with the capturing members 8a and the pressure plates 8b in a divided manner into a plurality of sections in the knitting width direction, and opening and closing thereof can be respectively switched in the plurality of sections. The pieces of pulldown equipment 8 are made into the opened state in sections overlapping with positions at which the functioning plate parts 16 are moved in the knitting width direction until the functioning plate parts 16 pass through to positions lower than the pieces of pulldown equipment 8 when the set up needles 9 arranged in parallel on the functioning plate parts 16 of the set up bed 14 pull down the set up parts. It should be noted that after the set up equipment 12 pulls down the set up parts, the fabric can be pulled down even by lowering equipment to nip the fabric between rollers and lowering the fabric, as long as the rollers can be opened and closed, and can be rotationally driven, in a divided manner into different sections.

[0035] Fig. 4 shows the partial front structure and operations of the transmission part 30 of the set up bed 14 in Fig. 2. Fig. 5 shows the partial side structures and operations of the set up needle 9 and the transmission part 30 in Fig. 4. Fig. 5(a) shows a state in which a main part of the transmission part 30 is distanced to the front side from the functioning plate part 16. As will be described below, holding and releasing of the set up parts with the set up needles 9 can be driven from the outside of the functioning plate parts 16 which are moved in the knitting width direction so that increase in the thickness of the functioning plate parts 16 can be prevented so as not to inhibit elevation into narrow spaces from the vicinity of the needle bed gap 13a to lower parts.

[0036] When the transversal movement member 30a of the transmission part 30 is moved rightward by being driven by the wire 22c of the hold release mechanism 22 as shown in Fig. 4(a), the groove cam 30b is also moved rightward. The cam follower 30c which is fitted into the groove cam 30b is lowered because the groove cam 30b is inclined downward to the left. The connecting plate 30d supporting the cam follower 30c is also lowered and the longitudinal movement member 30e, on which the connecting plate 30d is mounted, is also lowered. As shown in Figs. 5(b), 5(c), each set up needle 9 has the structure in which a needle body 36 which is fixed to the functioning plate part 16 is combined with a slider 35 capable of being moved in an elevation manner relatively to the functioning plate part 16. A hook 35a capable of capturing the set up part is provided on the upper end of the slider 35 and a hook storage projection 36a is provided on the upper end of the needle body 36. Meanwhile, holding and releasing of such set up part with the above-mentioned set up needles 9 are performed in the same manner as those disclosed in Patent Literature 1. It should be noted that

as the set up needles 9, for example, those as disclosed in JP H5-71051 A can be also used. Furthermore, each set up needle may not have the hook on the front end thereof as long as the set up needle is configured to switch between a state for holding the set up part and a state for releasing it, and is not limited to have the above-mentioned structure.

[0037] When a driving member 16b of the functioning plate part 16 is lowered through the groove 16a that is engaged with the projecting part 30f on the upper end of the longitudinal movement member 30e, as shown in Fig. 5(b), the slider 35 of each set up needle 9 is driven so as to be lowered, and the hook 35a is out of the hook storage projection 36a of the needle body 36 and becomes capable of capturing the set up part. When the transversal movement member 30a is moved leftward as shown in Fig. 4(b), the slider 35 is driven so as to be elevated as shown in Fig. 5(c) through the groove cam 30b, the cam follower 30c, the connecting plate 30d, and the longitudinal movement member 30e. The hook 35a of the slider 35 is elevated to the position of the hook storage projection 36a of the needle body 36 and is made into a state of being stored therein. The set up part captured and held on the hook 35a is separated and released from the hook 35a along the inclination of the hook storage projection 36a. Engagement between the groove 16a and the projecting part 30f causes an engagement part thereof to be moved in a sliding manner even when the functioning plate part 16 is moved in the knitting width direction, so that relative driving between the slider 35 and the needle body 36 of each set up needle 9 in the elevating direction can be performed even when the functioning plate part 16 is moved to any position. It should be noted that a part corresponding to the groove 16a may be provided in the longitudinal movement member 30e whereas a part corresponding to the projecting part 30f may be provided on the functioning plate part 16. Furthermore, when the projecting part is provided at the moving side, not the projecting part continuous in the knitting width direction but pins that are provided at an interval in the knitting width direction may be employed. Moreover, the connecting plate 30d and the longitudinal movement member 30e may be integrated with each other.

[0038] In the present example, the set up beds 14, 18 are driven simultaneously by the driving source 22a and the lever 22b of the hold release mechanism 22 which is installed in a lower part in a still state, so that holding and releasing with the set up needles 9 on the functioning plate parts 16 and 19 are switched simultaneously. Although the holding and releasing with the set up needles 9 on the set up bed 14, 18 which is not selected by the selecting mechanisms 21 is also switched, the set up needles 9 capture no set up part and therefore give no influence. It should be noted that the driving source 22a and the lever 22b can be also realized by other mechanisms such as a crank and a cam. Furthermore, the driving source 22a and the lever 22b can be mounted on any one of the set up beds 14, 18. The driving source 22a may be provided on each of the set up beds 14, 18 to directly drive the transversal movement member 30a. Alternatively, a part corresponding to the driving source 22a may be directly mounted on the functioning plate parts 16, 19.

[0039] Fig. 6 shows a method of knitting a knitwear 1 as an example in which the set up needles 9 of the set up equipment 12 in the flatbed knitting machine 11 in Fig. 1 capture the set up parts of the fabric and move them downward. The pieces of pulldown equipment 8, which are shown with hatched lines, are in the closed states of the capturing members 8a and the pressure plates 8b, whereas the pieces of pulldown equipment 8, which are not hatched, are in the opened states thereof. Fig. 6(1) shows a state in which the set up bed 14 is elevated and set up parts for sleeves 4, 5 are pulled down with the set up needles 9 on the functioning plate parts 16 while a body 3 of the knitwear 1 is pulled down by the pieces of pulldown equipment 8. For the body 3, the pieces of pulldown equipment 8 are made into the opened states and a set up part is pulled down in advance from the side of a hem 2 with the set up needles 9 arranged in parallel on the functioning plate part 19 of the set up bed 18. When the set up bed 18 is lowered relative to the pieces of pulldown equipment 8, the set up part is released from the set up needles 9, the pieces of pulldown equipment 8 are made into the closed states, and the fabric is pulled down by the pieces of pulldown equipment 8. It should be noted that when the functioning plate parts 16 are elevated, the pieces of pulldown equipment 8 in the sections in which the functioning plate parts 16 pass through them are made into the opened states. When the body 3 and the sleeves 4, 5 are knitted in parallel, the body 3 and the sleeves 4, 5 are required to be spaced from each other for yarn feeding. Thus, knitting of both sleeves 4, 5 of the short-sleeved knitwear 1 is started at positions distanced from the body 3 in the knitting width direction and the set up parts therefor are pulled down using the functioning plate parts 16 which are moved in the knitting width direction. Waste knitting is not required even when the sleeve lengths of the sleeves 4, 5 are short.

[0040] As shown in Fig. 6(2) and Fig. 6(3), when the sleeves 4, 5 are gathered to the body 3 side and are joined thereto in the vicinity of sides openings to be integrated without seam, the functioning plate parts 16 are moved to the body 3 side in the same direction as that of the fabric by the transversal driving mechanisms 17 while following the fabric which is moved by racking of the needle beds 13. The movement amounts of the functioning plate parts 16 are preferably set to be equivalent to the movement amount of the fabric. Although the directions in which the sleeves 4, 5 are gathered to the body 3 side are different from each other such that the sleeve 4 is gathered rightward and the sleeve 5 is gathered leftward, the functioning plate parts 16 can be moved rightward and leftward simultaneously because the transversal driving mechanisms 17 are respectively provided for the two functioning plate parts 16. It should be noted that even when only one transversal movement member 17 is provided, the two functioning plate parts 16 can be moved independently by driving the functioning plate parts 16 through clutches.

[0041] When the set up parts are pulled down with the set up needles 9 arranged in parallel on the functioning plates part 16 of the set up bed 14, the capturing members 8a and the pressures plate 8b of the pieces of pulldown equipment

8 are made into the opened states in the sections overlapping with the positions at which the functioning plate parts 16 are moved in the knitting width direction. Thus, knitting can be performed in such a manner that the set up parts of the fabric for the following parts are held and pulled down with the set up needles 9 on the functioning plate parts 16 which are moved in the knitting width direction while the body 3 that has been started to be knitted in advance is pulled down by making the pieces of pulldown equipment 8 be into the closed states. When the following parts are moved by the functioning plate parts 16, if they are overlapped with the sections of the pieces of pulldown equipment 8 in the closed states, interference therebetween can be avoided by making the pieces of pulldown equipment 8 in the sections be into the opened states. Even when the functioning plate parts 16 are moved to the body 3 side and make contact with the lateral sides of the body 3, the body 3 can be flexibly recessed. As shown in Fig. 6(4), when the sleeves 4, 5 are overlapped with the positions of the pieces of pulldown equipment 8, the sleeves 4, 5 can be pulled down by the pieces of pulldown equipment 8 together with the body 3 by causing the set up needles 9 to release the set up parts.

[0042] Fig. 7 shows a method of knitting a long-sleeved knitwear 41 as another example in which a set up part of the fabric is captured and is moved downward with the set up needles 9 of the set up equipment 12 of the flatbed knitting machine 11 in Fig. 1. The knitwear 41 is knitted in such a manner that a right sleeve 42 is knitted into a cylinder form from a sleeve opening, and then, knitting of a body 43 is started in a state of being arranged in sideways and being closed the right lateral side. The body 43 is knitted in such a manner that front and back fabrics are separately knitted on the front and back needle beds 13, are closed at the shoulder side, and are opened at the hem side. The front and back fabrics of the body 43 are subjected to closing processing at the left lateral side and knitting thereof is finished. As for the body 43, a left upper part, which is to be closed, remains open while knitting of a left sleeve 44 is started as a cylindrical fabric, and knitting is finished at a sleeve opening as the leading end. The set up part of the right sleeve 42 can be pulled down by one of the functioning plate parts 16 of the set up bed 14 whereas the set up part of the body 43 can be pulled down by moving the functioning plate part 16 used for pulling down the set up part of the right sleeve 42 and aligning the two functioning plate parts 16. In the case in which the sleeve length of the right sleeve 42 is long, even when the knitting width of the body 43 is larger than the knitting width capable of being handled by one functioning plate part 16, it can be handled by aligning the two functioning plate parts 16. It should be noted that the set up part for the right sleeve 42 can be also captured using some of the set up needles 9 on the functioning plate part 19 corresponding to the entire width. The functioning plate part 16 which can be moved in the knitting width direction is capable of pulling down the set up part of the fabric any number of times by changing the position thereof, so that a fabric with steps on a set up part or a set up part of a fabric having a large width can be also sequentially pulled down by repeatedly moving the functioning plate part 16.

[0043] As described above, extension or breakage of the knitting yarns can be prevented with the simple structure in which the functioning plate parts 16 to be moved in the knitting width direction are moved in the same direction as that of the fabric in accordance with the movement of the fabric on the needle beds 13 while the set up parts of the fabric are pulled down by the functioning plate parts 16. Furthermore, after the set up part of the fabric that is knitted in advance is held and pulled down by elevating the functioning plate part 19 of the set up bed 18, the set up parts of the remaining parts of the fabric can be held and pulled down by moving and elevating the functioning plate parts 16 of the set up bed 14 to the positions of the remaining parts of the fabric, thereby eliminating the necessity of the waste knitting.

[0044] Fig. 10 shows a combination of the centering member 60 and the spring 61 provided at the right side of the functioning plate part 16 in Fig. 2. The same centering member 60 is also provided at the left side of the functioning plate part 16. The centering member 60 is formed by combining an upper abutment block 62 and a lower elevating material 63. The abutment block 62 in the present example has inclined abutting parts 62a, 62b on an upper part. The abutting parts 62a, 62b may have any shapes as long as they restrict deviation in accordance with the shapes of the rear surfaces of the needle beds 13 at the time of abutment. The elevating material 63 is connected to the abutment block 62 on an upper connecting part 63a. The connection between the abutment block 62 and the connecting part 63a is fixed by fitting a pin 60a in a pressure manner.

[0045] As shown in Fig. 10(a), an elevating groove 16c is formed at the right side in the functioning plate part 16 on which the set up needles 9 are arranged in parallel. The elevating groove 16c accommodates therein the elevating material 63 in a state in which the elevating material 63 is movable in an elevation manner in the extension direction of the set up needles 9. A spring accommodation recess 16d is formed in the functioning plate part 16 at a position under the elevating groove 16c. The spring accommodation recess 16d accommodates therein the spring 61 and is covered by a cover member 61a. The spring 61 is a coil spring which can be deformed in a compression manner. A biasing part 63b on a lower part of the elevating material 63 is inserted into an upper part of the spring 61 so that the spring 61 can bias the elevating material 63 in the extension direction of the set up needles 9.

[0046] As shown in Fig. 10(b), a part of the elevating material 63, which is accommodated in the elevating groove 16c, is covered by metal bands 16e, 16f. The metal bands 16e, 16f prevent the elevating material 63 from passing through the elevating groove 16c to the left side at which the elevating groove 16c opens. The centering member 60 is set to have the width in the transverse direction in Fig. 10(b), which is equal to or smaller than the functioning plate part 16. Such centering member 60 can smoothly pass through between the front and back pieces of pulldown equipment 8 in

the opened states shown in Fig. 3 together with the elevation of the functioning plate part 16.

[0047] Figs. 11 shows the shape of the abutment block 62 configuring the centering member 60 in Fig. 10 with Fig. 11(a) and shows the shape of the elevating material 63 with Fig. 11(b), respectively. The abutment block 62 is preferably formed by molding resin. The elevating material 63 is preferably formed by performing punching processing or cutting processing on a metal plate. Only the elevating material 63 can be used as the centering member by adding parts equivalent to the abutting parts 62a, 62b to an outer shape of the connecting part 63a of the elevating material 63.

[0048] Fig. 12 shows a guiding state when the functioning plate part 16 is elevated by the centering members 60 in Fig. 10. When the set up bed 14 in Fig. 2 is elevated, the abutting parts 62a, 62b provided on the centering members 60 at the lateral sides of each functioning plate part 16 abut against the rear surfaces of the needle beds 13. It should be noted that when sinkers 65 are fixed to the needle beds 13 at the needle bed gap 13a side for use, the abutting parts 62a, 62b can be made to abut against fixing pieces 65a of the sinkers 65 extending along the lower surfaces of the needle beds 13. When the sinkers 65 having the fixing pieces 65a are not used, it is sufficient that the abutting parts 62a, 62b are made to abut against substrates of the needle beds 13.

[0049] Until the abutting parts 62a, 62b abut against the rear surfaces of the needle beds 13 as shown in Fig. 12(a), when the functioning plate part 16 is elevated, the centering members 60 are also elevated by being biased through the springs 61. When the abutting parts 62a, 62b abut against the rear surfaces of the needle beds 13, elevation of the centering members 60 is stopped. The functioning plate part 16 is continuously elevated and the springs 61 are compressed. The elevating materials 63 of the centering members 60 are restricted so as not to deviate in the front-back direction by the bottom surfaces of the elevating grooves 16c and the metal bands 16e, 16f. The centering members 60 which are restricted from deviating in the front-back direction on the rear surfaces of the needle beds 13 guide the functioning plate part 16 such that the set up needles 9 project along a center line 13c from the needle bed gap 13a as shown in Fig. 12(b). Even when a position at which the functioning plate part 16 is elevated is changed in the knitting width direction owing to movement by the transversal movement member 17, the set up needles 9 can be made to project from the center of the needle bed gap 13a by being guided with the centering members 60. The set up needles 9 projecting from the center of the needle bed gap 13a can capture the set up part of the fabric reliably and pull down the set up part by lowering of the functioning plate part 16.

[0050] As shown in Fig. 13, a centering member 66 can be also provided on the set up bed 18 at the center of the functioning plate part 19 of the entire width. As shown in Fig. 13(a), an elevating groove 19c is formed in the functioning plate part 19. In the elevating groove 19c, the centering member 66 is accommodated in a state capable of elevating to the extension direction of the set up needles 9. A spring 67 is provided on a lower part of the centering member 66. The spring 67 is a coil spring which can be deformed in a compression manner like the springs 61 in Fig. 2 and biases the centering member 66 in the extension direction of the set up needles 9. As shown in Fig. 13(b), abutting parts 66a, 66b are provided on an upper part of the centering member 66. Such centering member 66 can be integrally formed by performing punching processing or cutting processing on a metal plate. That is, the centering member 66 is formed by integrating a combination of the abutment block 62 and the elevating material 63 of the centering member 60 shown in Fig. 10 by only a part corresponding to the elevating material 63. A part of the centering member 66, which is accommodated in the elevating groove 19c, is covered by metal bands 19e, 19f. The elevating groove 19c and the metal bands 19e, 19f for the centering member 66 have the same functions as those of the elevating groove 16c and the metal bands 16e, 16f for the elevating material 63 shown in Fig. 10.

[0051] The centering members 60 can be provided at both lateral sides of the functioning plate part 19 in the same manner as Fig. 2. A guiding state by the centering member 66 when the functioning plate part 19 is elevated can be made similar to that shown in Fig. 12 by making the abutting parts 66a, 66b abut against the rear surfaces of the needle beds 13. In case the functioning plate part 19 is long in the knitting width direction, it is sufficient that the centering members 66 are provided on a plurality of places at an interval in the knitting width direction. In case the centering members 66 are provided on the plurality of places, the centering members 60 at both sides may not be used. Also for the functioning plate parts 16 shown in Fig. 2, the centering member 66 and the centering members 60 may be used in combination or only the plurality of centering members 66 may be used at an interval in the knitting width direction. Furthermore, when only the single set up bed 18 is used, the centering members 60, 66 may be provided for the functioning plate part 19 of the entire width.

[Reference Signs List]

[0052]

1, 41	Knitwear
3, 43	Body
4, 5	Sleeve
8	Pulldown equipment

8a	Capturing member
9	Set up needle
11	Flatbed knitting machine
12	Set up equipment
5 13	Needle bed
13a	Needle bed gap
14, 18	Set up bed
15	Longitudinal driving mechanism
16, 19	Functioning plate part
10 16a	Groove
17	Transversal driving mechanism
21	Selecting mechanism
22	Hold release mechanism
22a	Driving source
15 30	Transmission part
30f	Projecting part
60, 66	Centering member
61, 67	Spring
62	Abutment block
20 63	Elevating material
62a, 62b, 66a, 66b	Abutting part

Claims

- 25
1. A flatbed knitting machine (11) under needle beds (13) having as a set up equipment (12) which provided with:
- a set up bed (14,18) on which set up needles (9) capable of switching to hold or to release a set up part of a fabric are arranged in parallel in a knitting width direction;
- 30 a longitudinal driving mechanism (15) moving the set up bed (14,18) in an elevation manner; and
- a hold release mechanism (22) to drive switching to hold or to release the set up part with the set up needles (9),
- characterized in that**
- at least one set up bed (14) has a functioning plate part (16) on which the set up needles (9) are arranged in parallel and which is movable in the knitting width direction, and
- 35 the set up equipment (12) further is provided with a transversal driving mechanism (17) to drive the functioning plate part (16) in the knitting width direction relatively to the set up bed (14).
2. The flatbed knitting machine (11) according to claim 1, wherein
- 40 said set up equipment (12) is further provided with two combinations of said functioning plate part (16) and said transversal driving mechanism (17).
3. The flatbed knitting machine (11) according to claim 1 or 2, wherein
- 45 said set up equipment(12) is provided with a set up bed (14) having a functioning plate part (16) which is not moved in the knitting width direction in addition to said set up bed (18) having a functioning plate part (19) which is moved in the knitting width direction, and
- said longitudinal driving mechanism (15) moves one of the set up beds (14,18) in the elevation manner.
4. The flatbed knitting machine (11) according to any one of claims 1 to 3, wherein
- 50 said hold release mechanism (22) is provided with:
- a driving source (22a) that performs driving of switching to hold or to release said set up part on said set up needle (9); and
- 55 a transmission part (30), which is provided on said set up bed (14) having said functioning plate part (16) to move in said knitting width direction, transmits driving force from the driving source (22a) to said set up needles (9), and has a groove (16a) extending in the knitting width direction and a projecting part (30f) which is engaged with the groove (16a).

5. The flatbed knitting machine (11) according to any one of claims 1 to 4, wherein said transversal driving mechanism (17) drives said functioning plate part (16) which is moved in said knitting width direction in the same direction as a direction of a fabric which is moved by racking of said needle beds (13).

6. The flatbed knitting machine (11) according to any one of claims 1 to 5, wherein a pulldown equipment (8) being provided under said needle beds (13), being separated into a plurality of sections, which are distanced from each other in the knitting width direction, and being capable of switching a state close and open in such a divided manner that pieces of the sections make contact with the fabric to pull down a knitted fabric in the closed state, and enable said functioning plate part (16,19) to pass through the pieces in the opened state, and the pulldown equipment (8) make a section, overlapping with a position at which the functioning plate part (16) moves in said knitting width direction, into the opened state, when said set up part is pulled down with the set up needles (9) arranged in parallel on the functioning plate part (16).

7. The flatbed knitting machine (11) according to any one of claims 1 to 6, further comprising:

at least two centering members (60,66), being provided on said functioning plate part (16), which is movable in the knitting width direction, at an interval in the knitting width direction, being movable in an extension direction of said set up needles (9) relatively to the functioning plate part (16), abutting against rear surfaces of said needle beds (13) to stop when the functioning plate part (16) is elevated, and guiding the functioning plate part (16) so as to cause the set up needles (9) to project from a center of a needle bed gap (13a); and springs (61,67) that bias the centering members (60,66) in the extension direction of the set up needles (9) relatively to the functioning plate part (16).

8. A knitting method in which knitting of a body (3) at an intermediate position and sleeves (4,5) at both sides of the body (3) in a knitting width direction is started as independent cylindrical fabrics from a hem (2) side and a knitwear (1) is integrally knitted without seam by gathering and joining the sleeves to the body using a flatbed knitting machine (11) which is provided, under needle beds (13) as a set up equipment (12), with:

a set up bed (14,18) on which set up needles (9), capable of switching to hold and release a set up part of a fabric, are arranged in parallel in the knitting width direction;
a longitudinal driving mechanism (15) moves the set up bed (14,18) in an elevation manner; and
a hold release mechanism (22) drives switching to hold and release the set up part with the set up needles (9),

characterized in that

the set up equipment (12) is provided with at least:

two functioning plate parts (16) on which the set up needles (9) are arranged in parallel and which are movable in the knitting width direction, and
two transversal driving mechanisms (17) which move the functioning plate parts (16) in the knitting width direction relatively to the set up bed (14), and

after knitting of the body (3) of the knitwear (1) is started, both sleeves (4,5) are knitted in such a manner that when the sleeves (4,5) are gathered and joined to the body (3) side while holding set up parts with the set up needles (9) on the two functioning plate parts (16) and lowering the set up bed (14), the two functioning plate parts (16) are moved to the body (3) side by the respective transversal driving mechanisms (17) in the same direction as a direction of movement of the sleeves (4,5) by racking of the needle beds (13).

Fig. 1

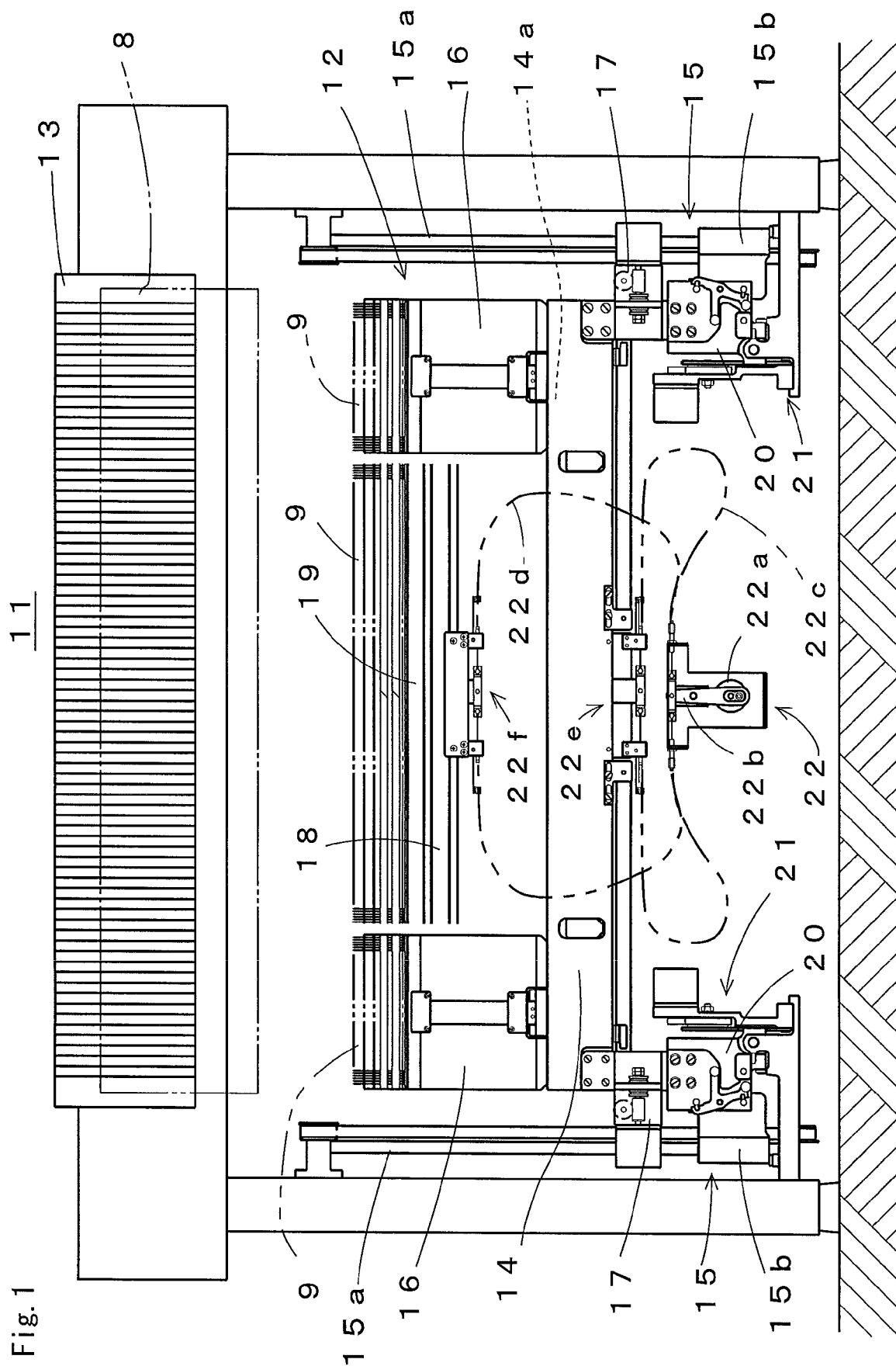


Fig. 2

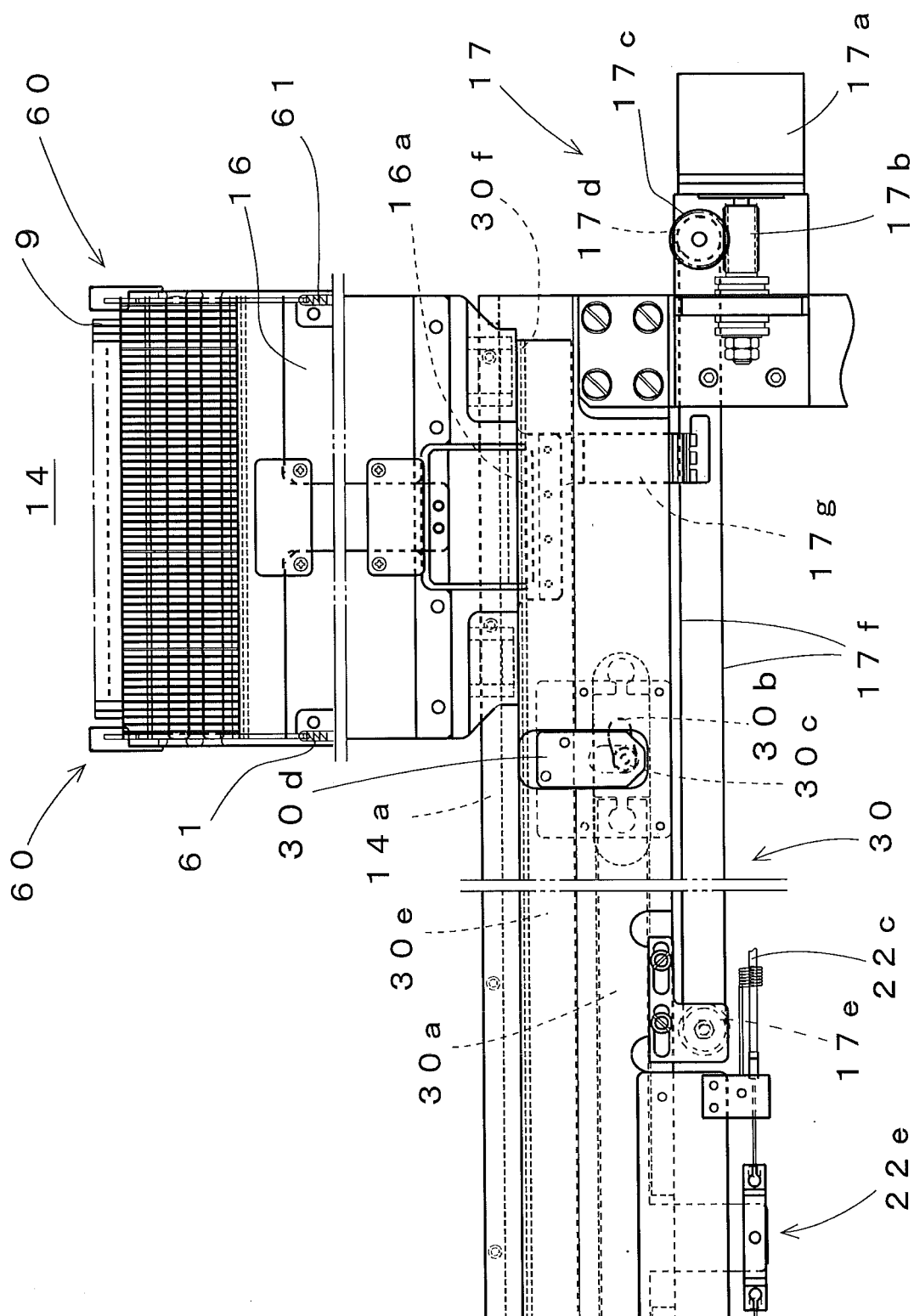


Fig. 3

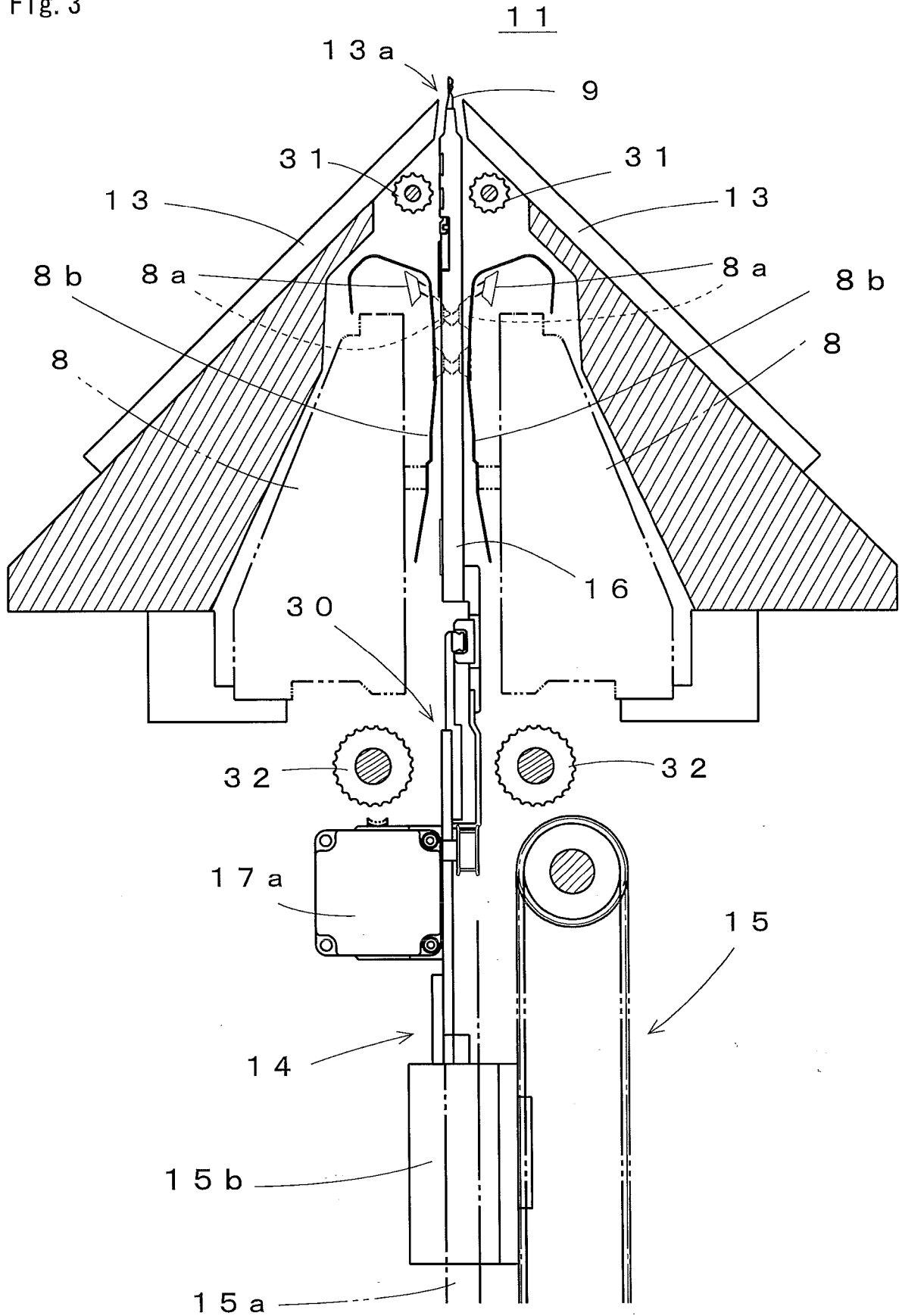
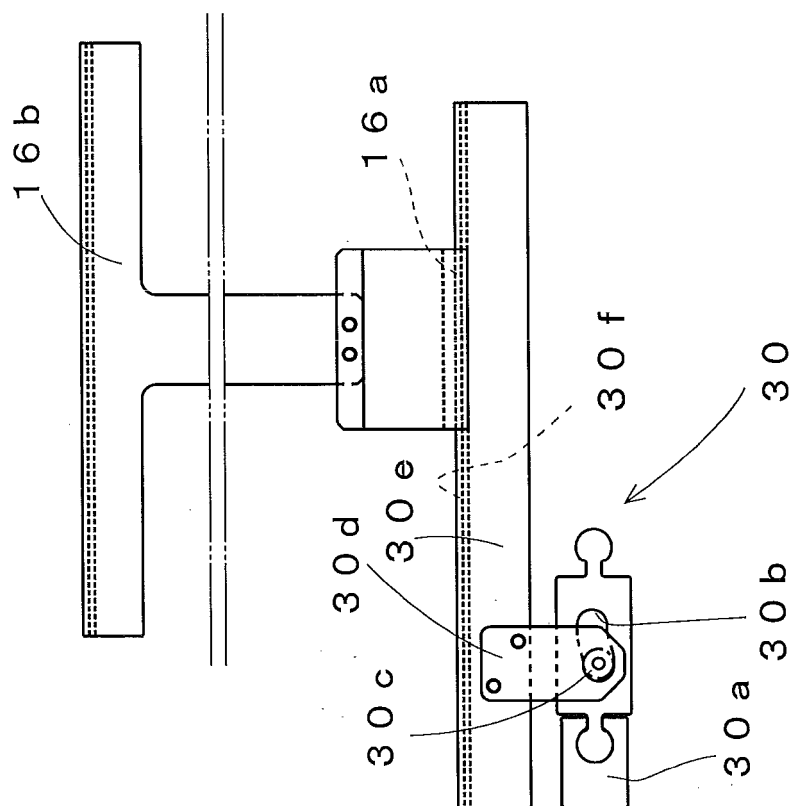


Fig. 4

(a)



(b)

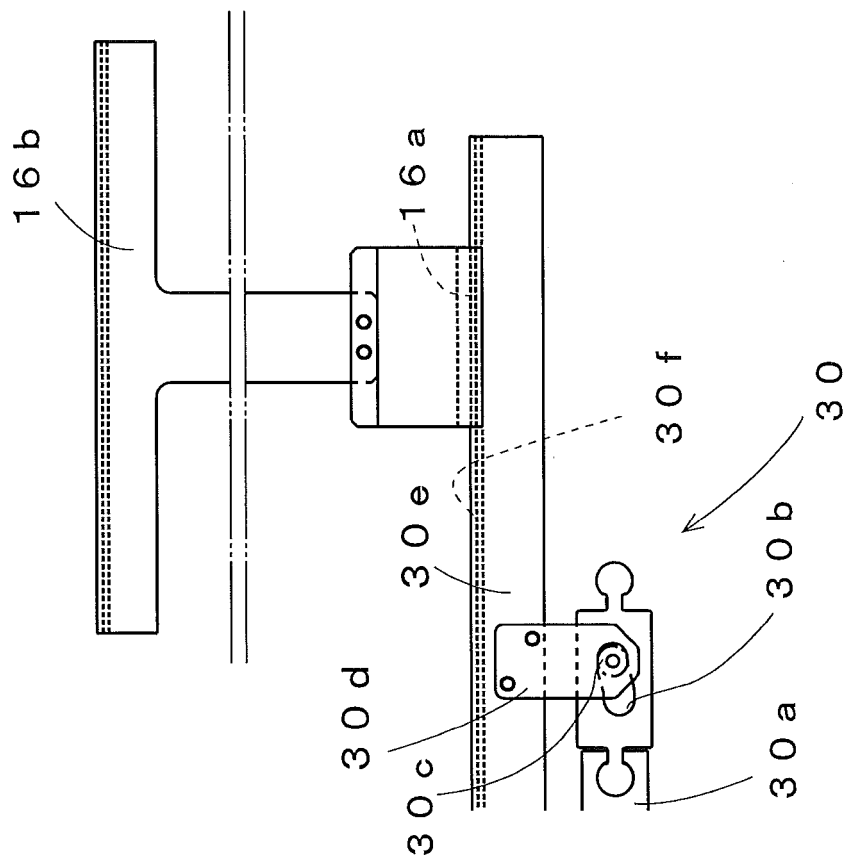


Fig. 5
(a)

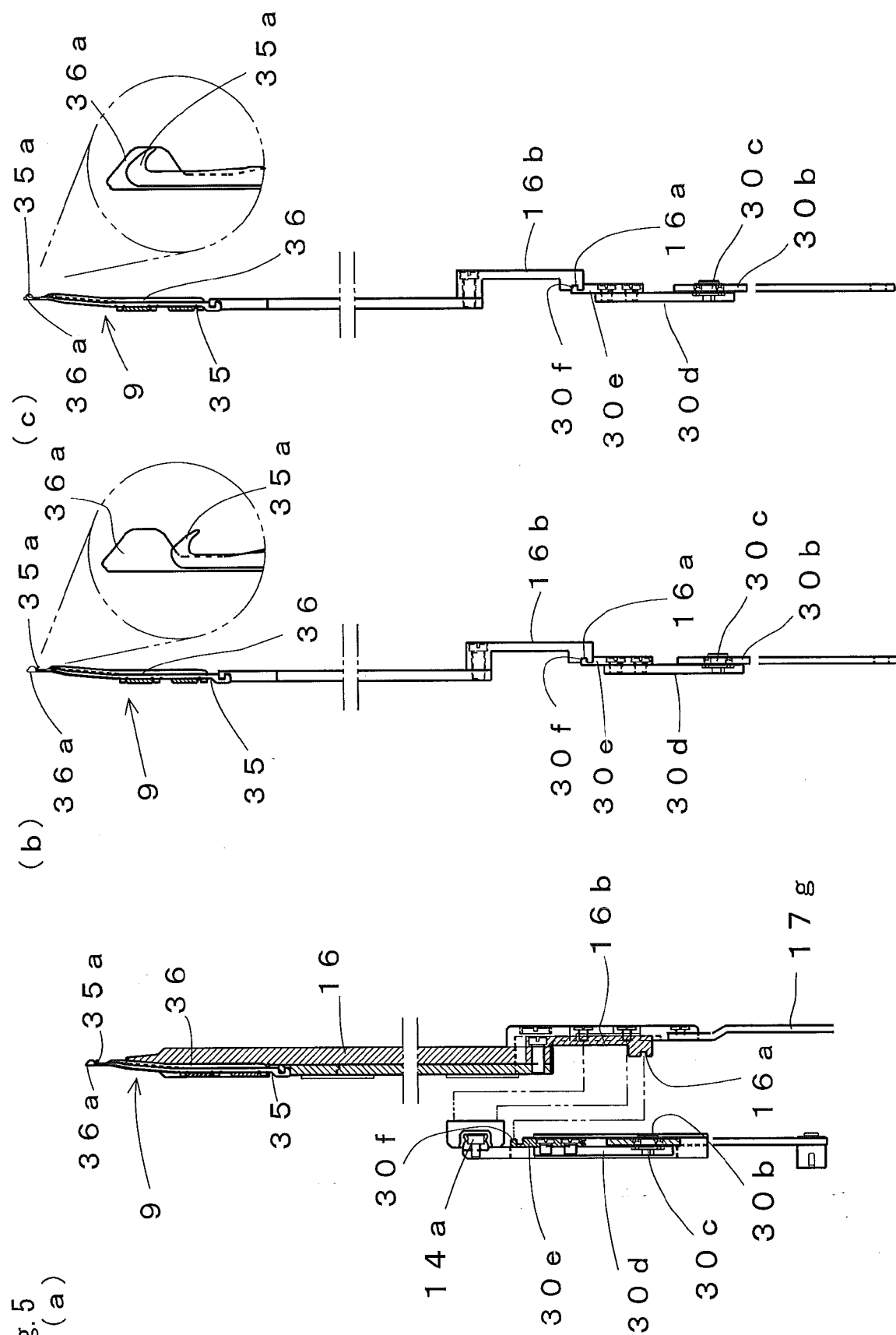


Fig. 6
(1)

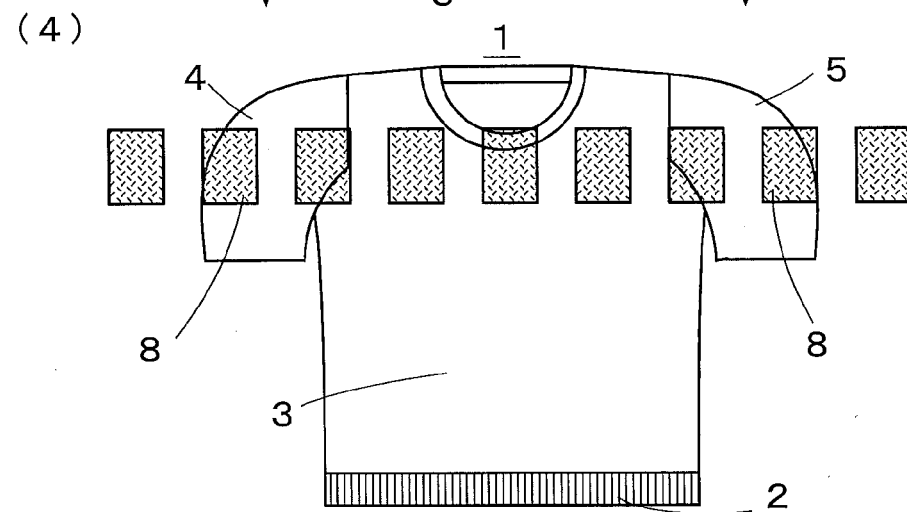
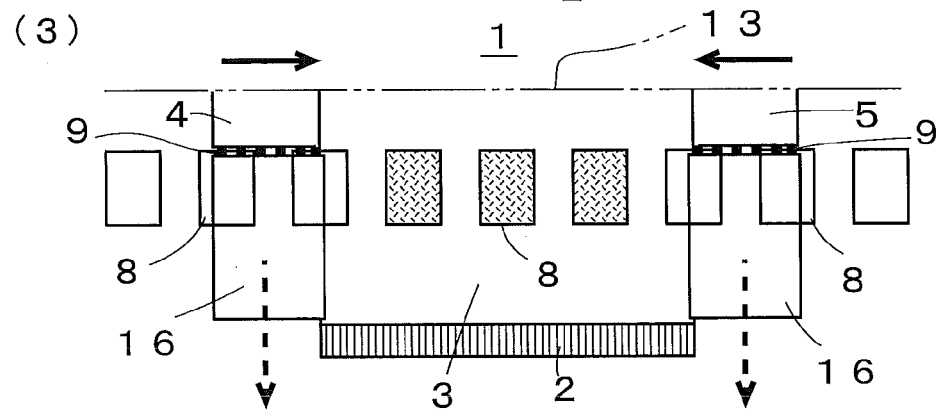
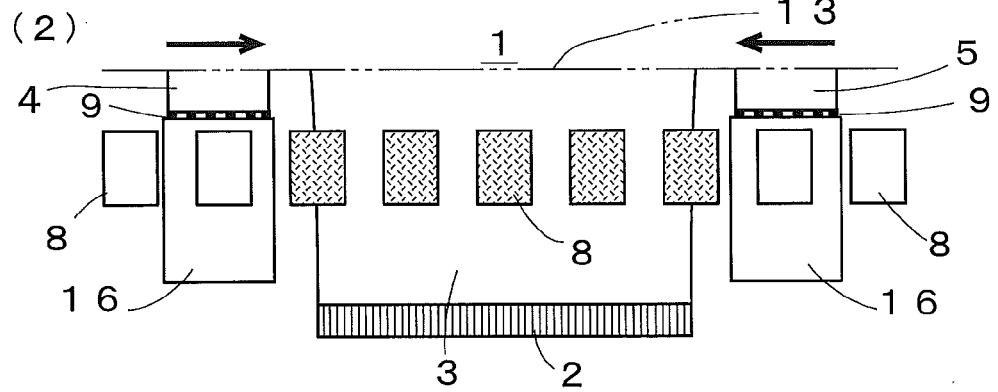
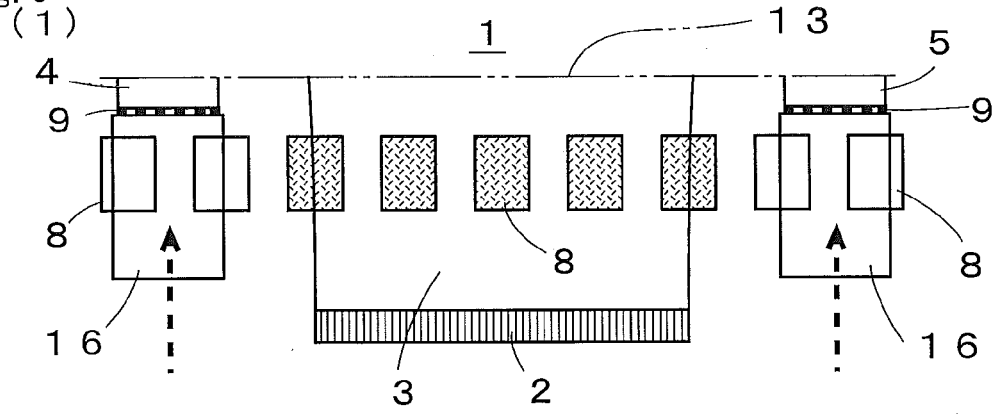


Fig. 7

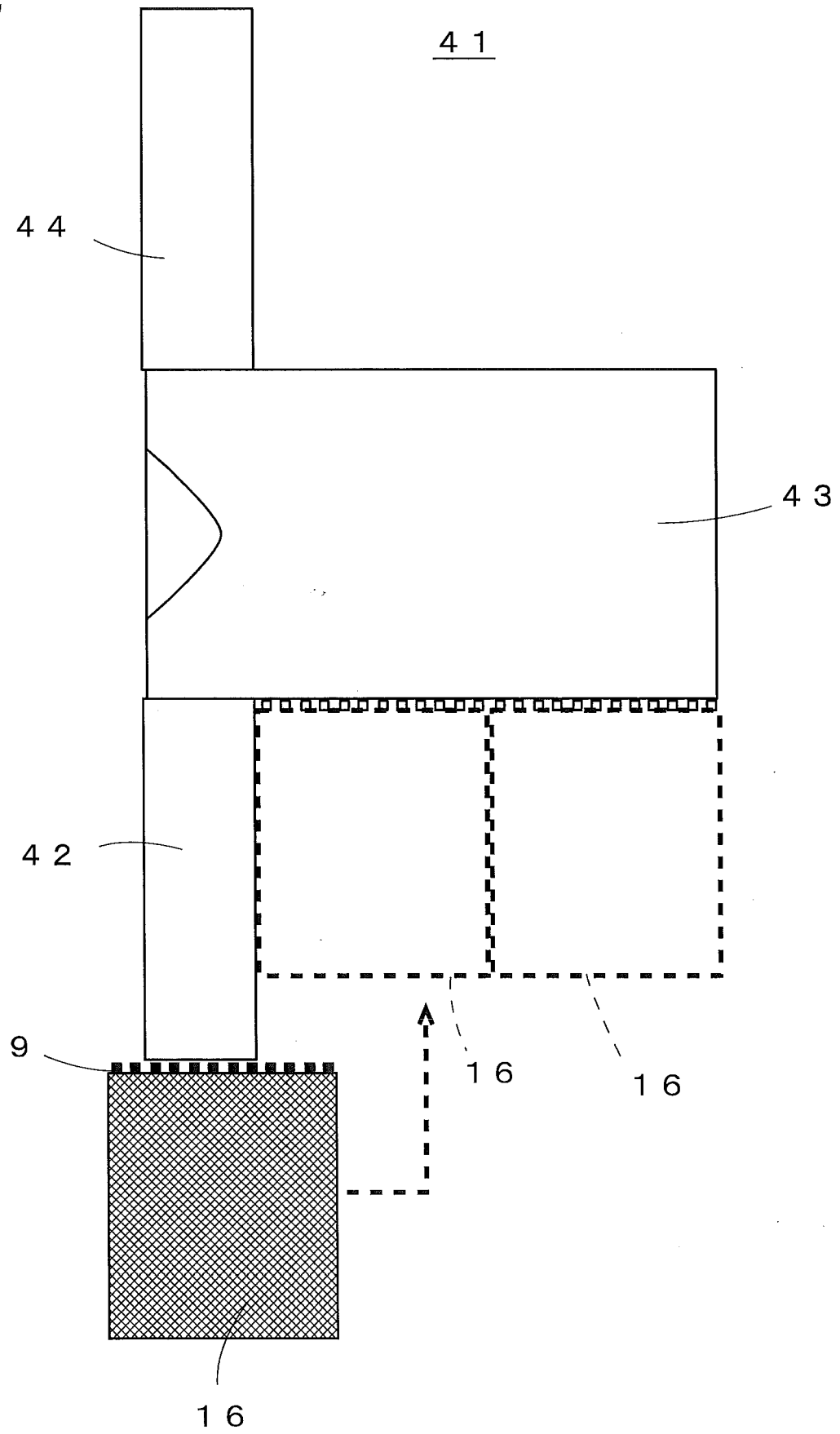


Fig. 8

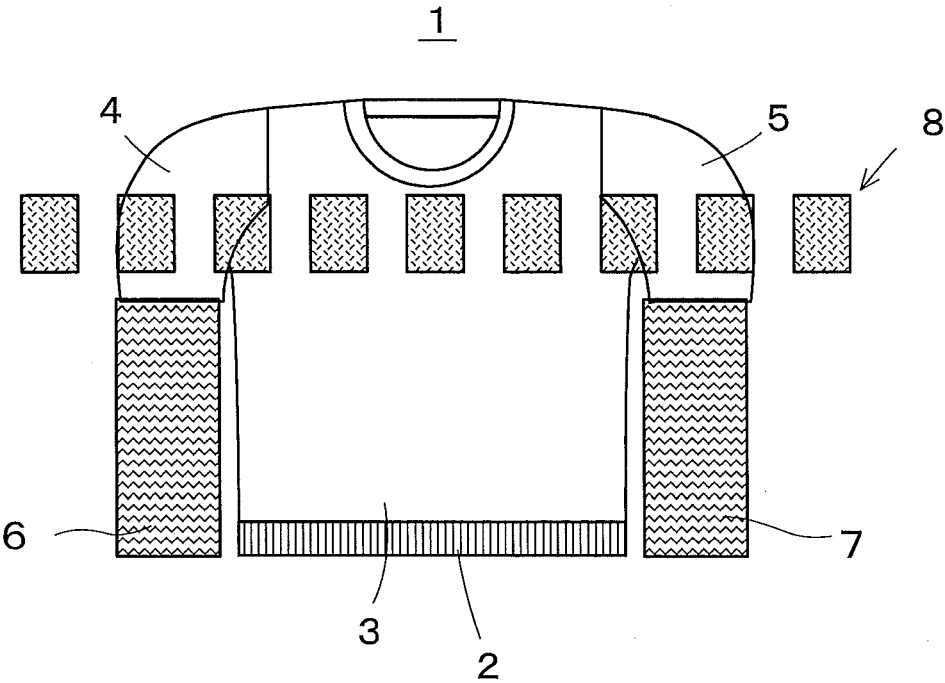
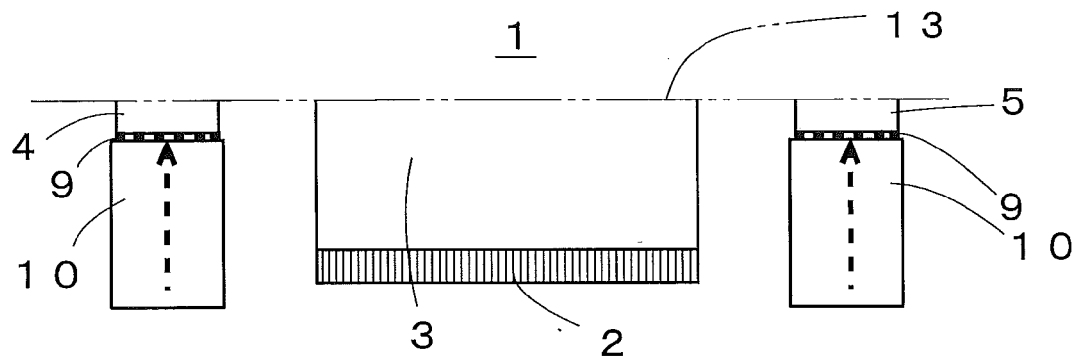
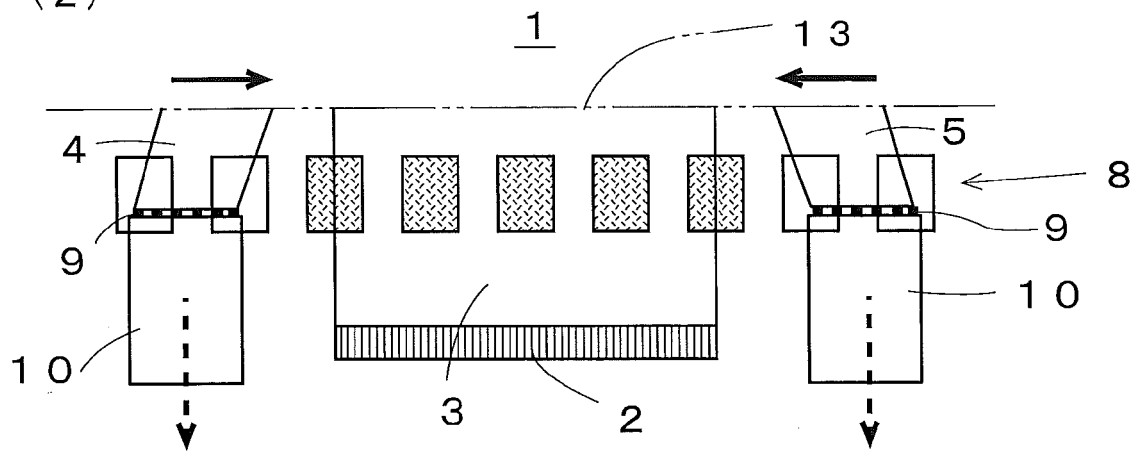


Fig. 9
(1)



(2)



(3)

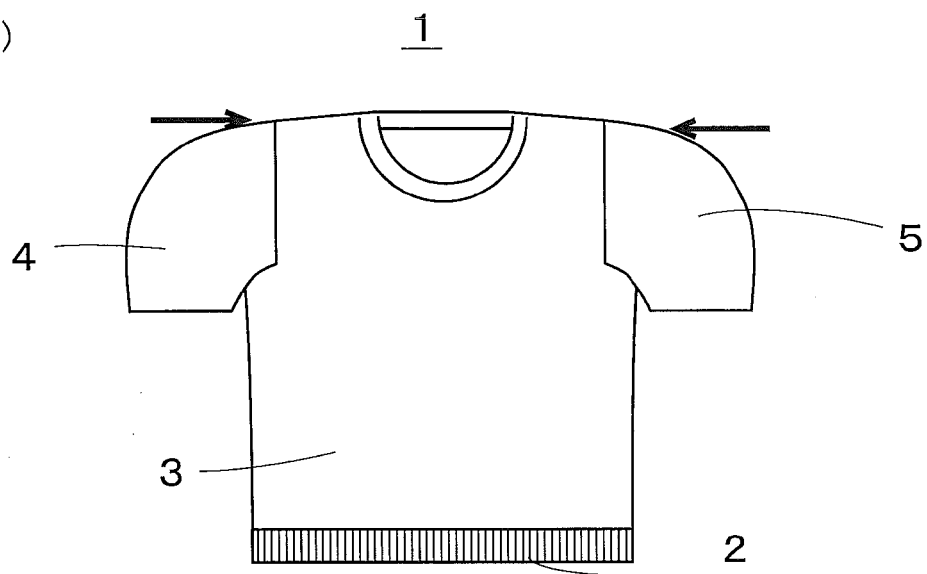


Fig. 10
(a)

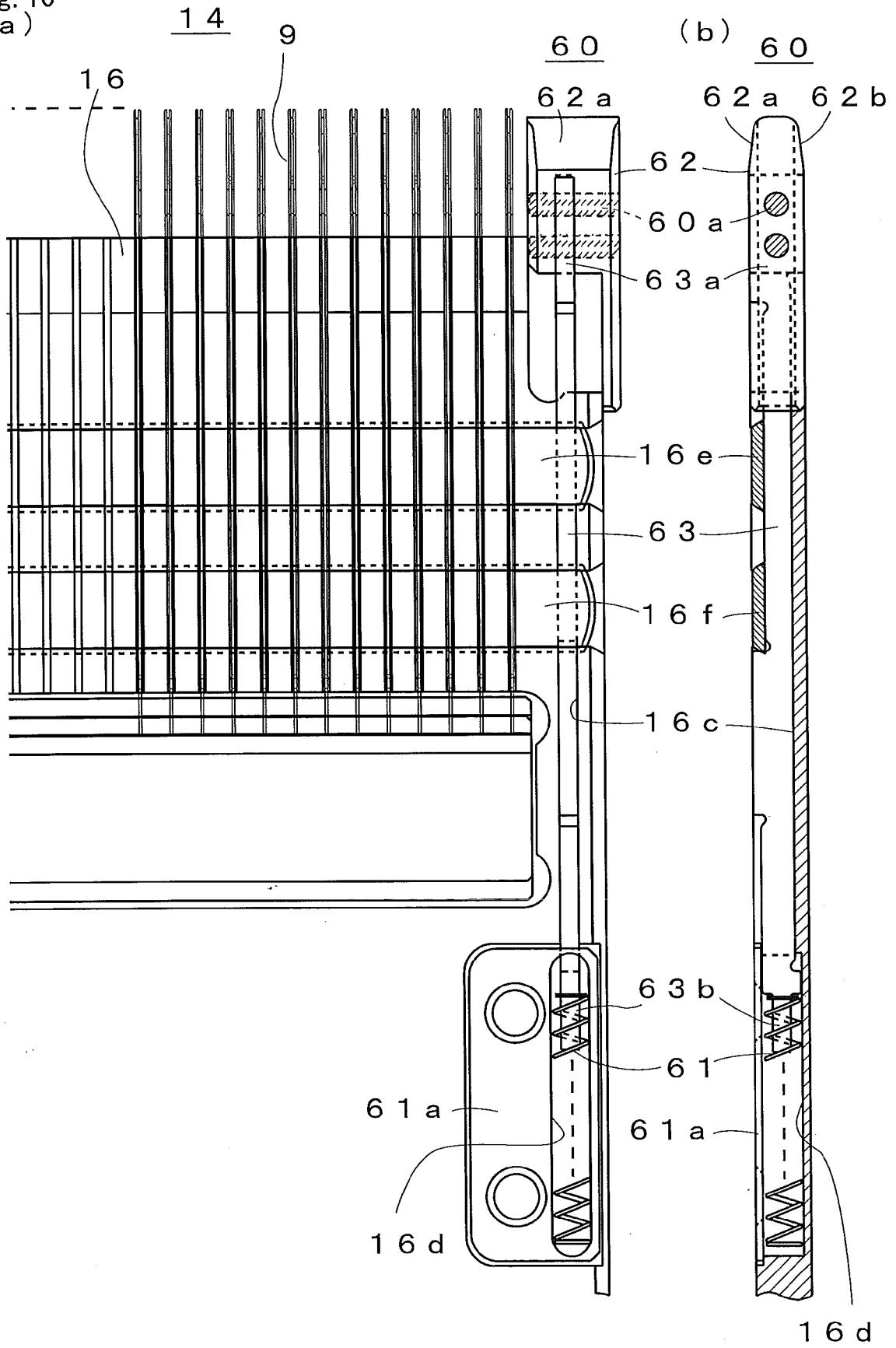


Fig. 11

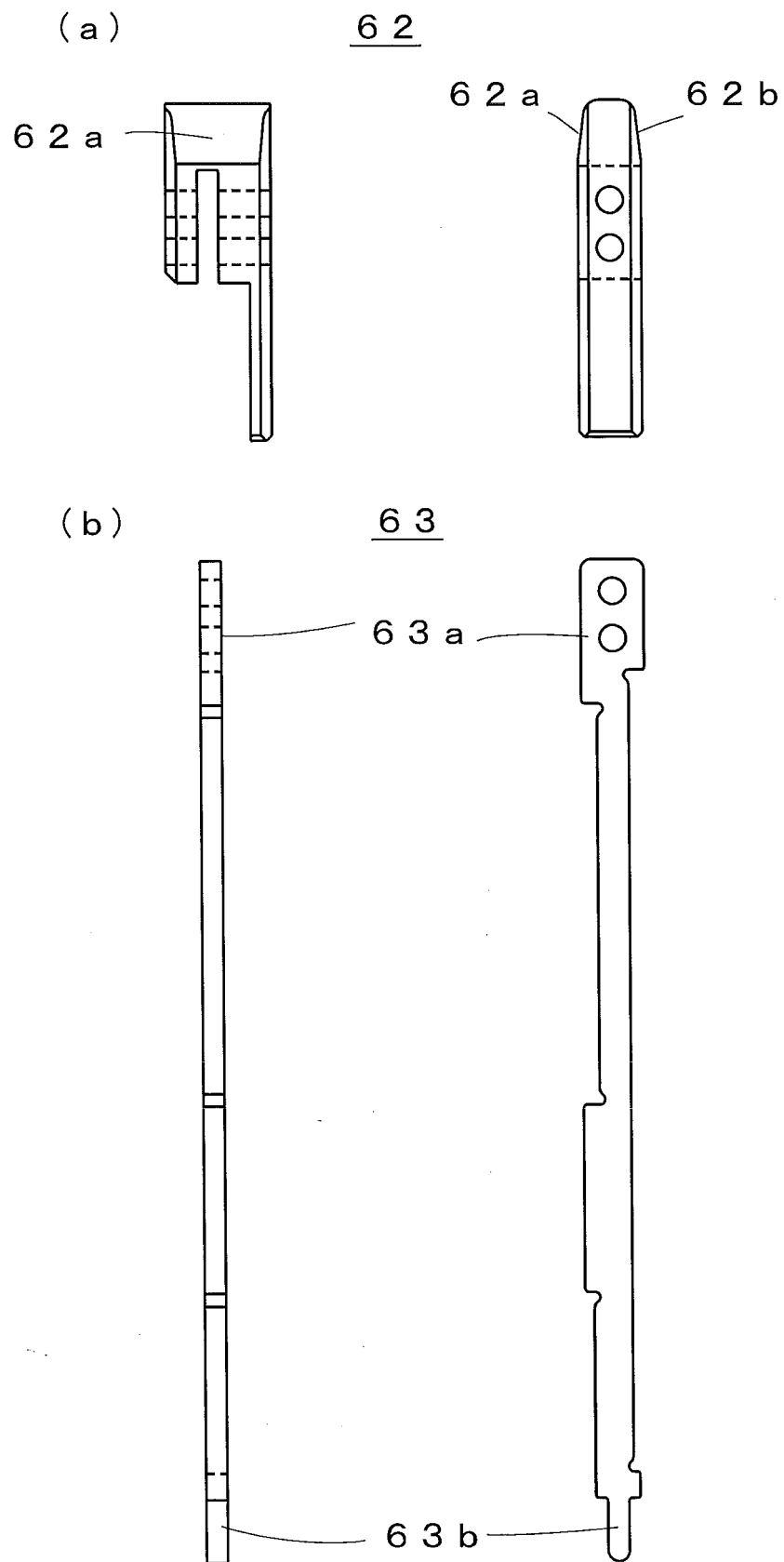
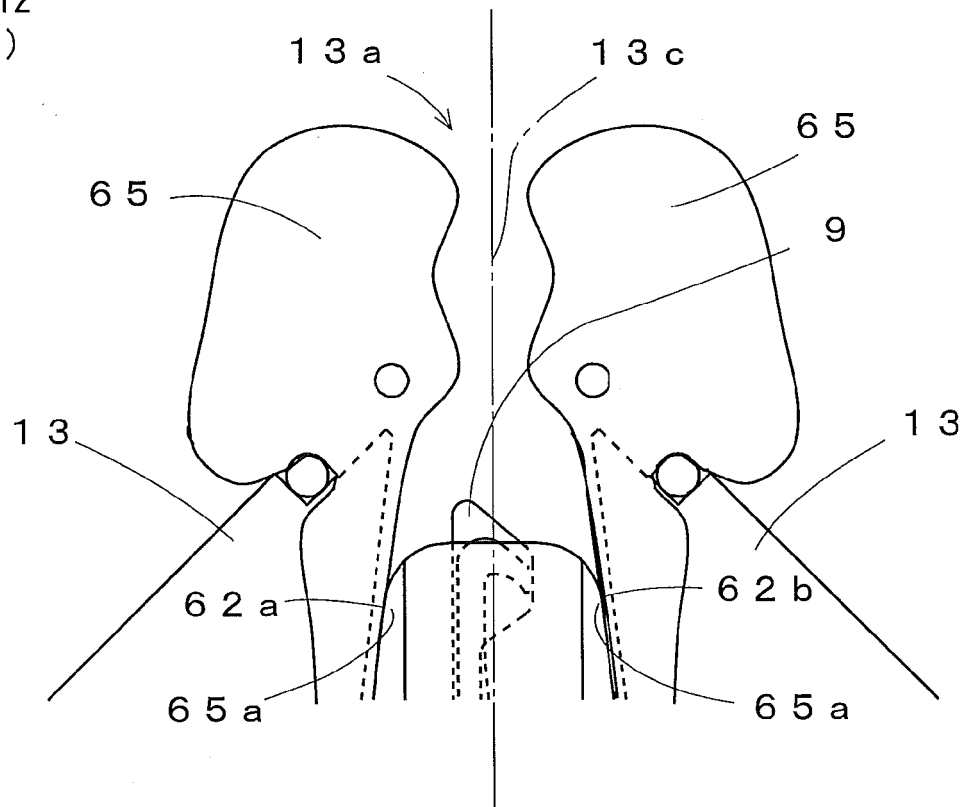


Fig. 12
(a)



(b)

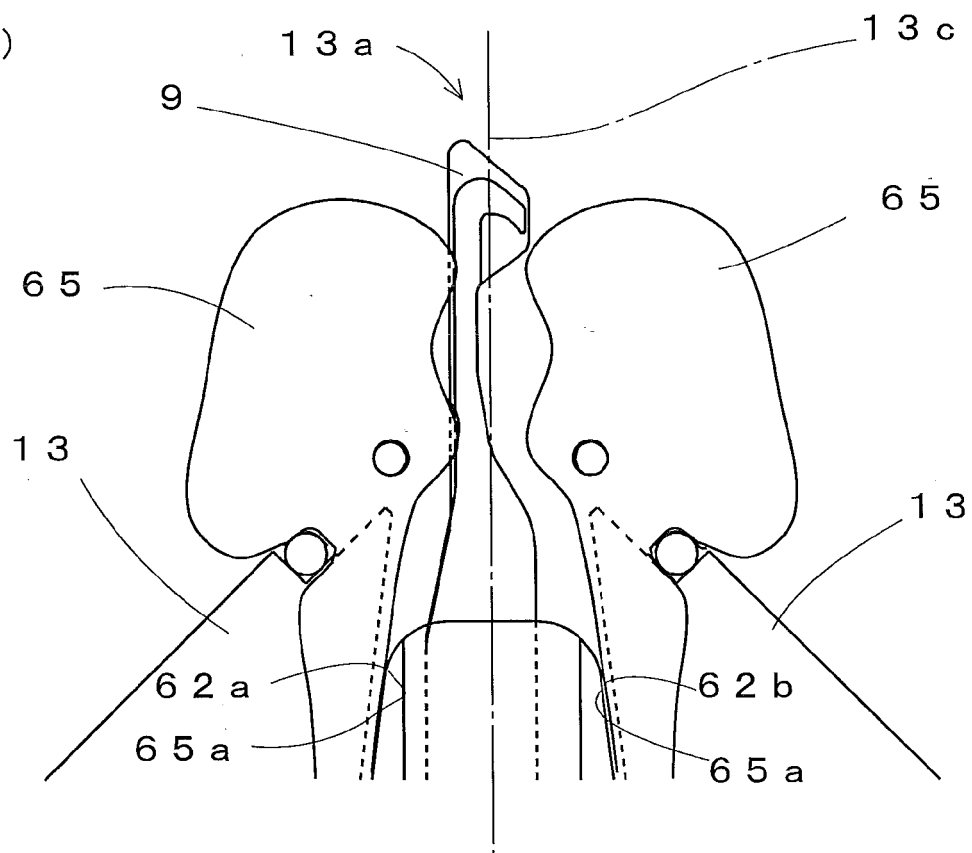
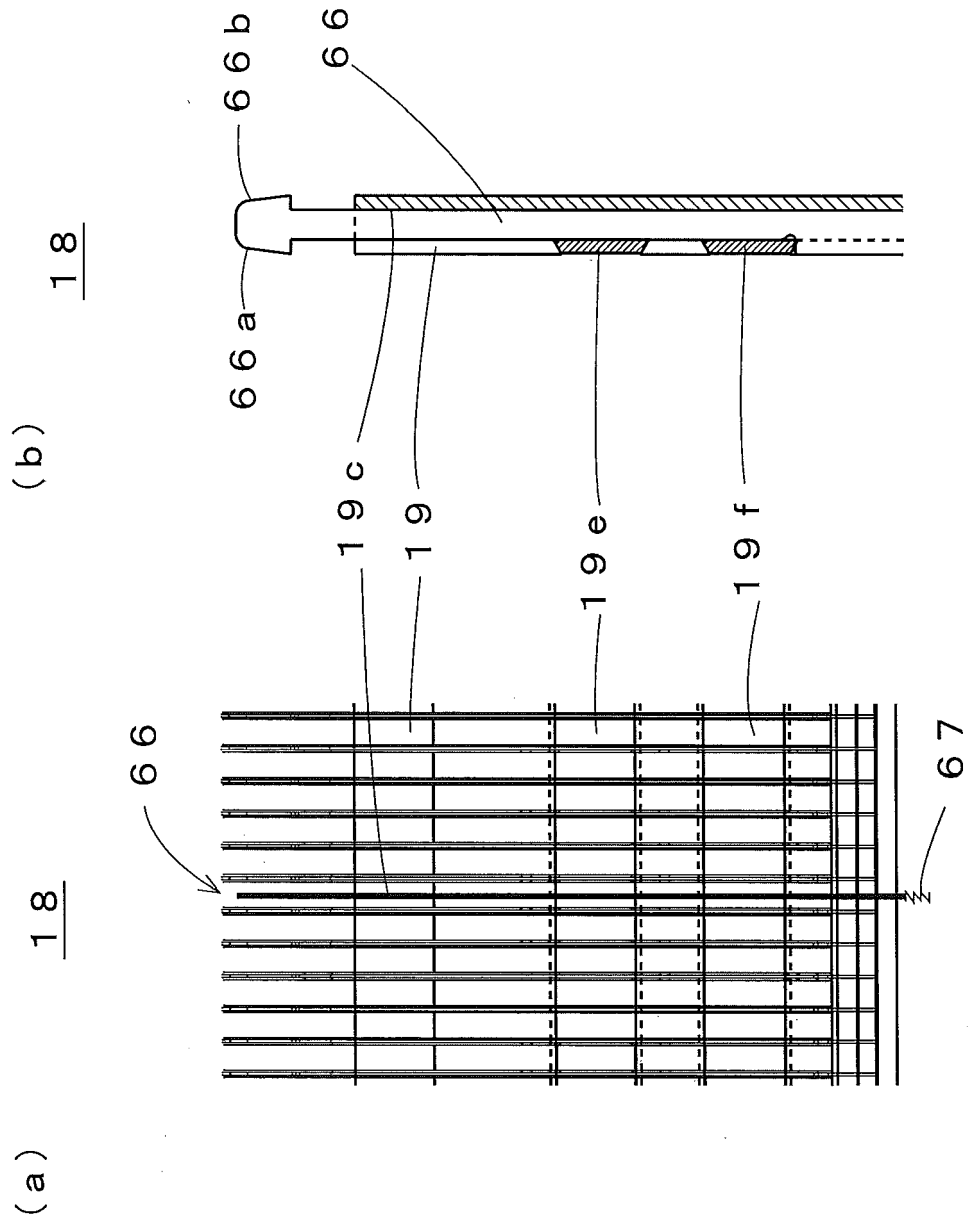


Fig. 13





EUROPEAN SEARCH REPORT

Application Number
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A	DE 278 250 C (A. ROCKENSTEIN, W. BORGERT) 26 June 1912 (1912-06-26) * page 1, line 1 - page 2, line 66 * * page 3, line 13 - line 22; figure 2 *	1-8	
A	DE 197 33 867 A1 (SCHIEBER UNIVERSAL MASCHF [DE]) 11 February 1999 (1999-02-11) * column 1, line 1 - column 3, line 16; figure 1 *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			D04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 April 2017	Examiner Braun, Stefanie
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The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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