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(71) Applicant: **SHIMA SEIKI MFG. LTD.**
Wakayama-shi
Wakayama 641-0003 (JP)

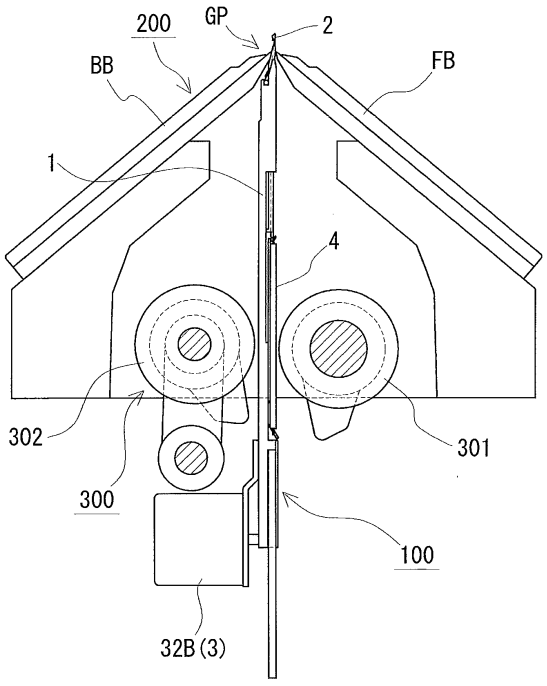
(72) Inventor: **MIYAMOTO, Masaki**
Wakayama-shi, Wakayama 641-0003 (JP)

(74) Representative: **Carstens, Dirk Wilhelm**
Wagner & Geyer
Gewürzmühlstraße 5
80538 München (DE)

(54) SET UP DEVICE

(57) There is provided a set up device that can achieve reduction of the mounting space in the flat knitting machine. A set up device 100 includes a base section 1, a set up needle 2 arranged on the base section 1, a needle control mechanism 3 for switching a state of the set up needle 2 between a holding state and a non-holding state, and an energizing body 4 for energizing a second needle member 21 toward a lower side of a needle bed gap GP. The needle control mechanism 3 includes a needle side engaging portion 30 arranged on the set up needle 2, an operation piece 31 that is attached to the base section 1 in a slidably moving manner and that includes a base side engaging portion 31w that acts on the needle side engaging portion 30, and a raising/lowering mechanism section 32 that moves the operation piece 31 up and down along an extending direction of the set up needle 2. The needle control mechanism 3 changes a relative position of a first needle member 20 and the second needle member 21 by moving the needle side engaging portion 30 up and down with the base side engaging portion 31w.

Fig. 1



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Description

Field of the Invention

[0001] The present invention relates to a set up device for pulling down a set up section of a knitted fabric knitted with a flat knitting machine toward a lower side of a needle bed gap.

Description of the Related Art

[0002] A flat knitting machine includes a front needle bed and a back needle bed disposed opposite each other, knitting needles arranged in each of a great number of needle grooves arranged side by side on each needle bed, and a carriage that reciprocates along a longitudinal direction of the needle beds (direction orthogonal to an extending direction of the needle grooves). A knitting cam is mounted on the carriage, which knitting cam causes the knitting needles to carry out the knitting operation. In the flat knitting machine having such configuration, a set up device that catches the set up section of the knitted fabric and pulls down the knitted fabric is sometimes arranged on the lower side of the needle bed gap formed between the front needle bed and the back needle bed (see e.g., Patent Document 1).

[0003] The set up device of Patent Document 1 includes a set up bed (base section) formed with a plurality of needle grooves, a set up needle arranged in each needle groove, and a device (needle control mechanism) for relatively sliding a needle main body (first needle member) and a slider (second needle member) configuring the set up needle. A hook for holding the set up section is formed at the upper end of the second needle member, and a hook housing portion for housing the hook of the second needle member is formed at the upper end of the first needle member. The first needle member and the second needle member are relatively slid by the needle control mechanism to project the hook of the second needle member out from the hook housing portion of the first needle member, so that the set up needle is in a holding state capable of holding the set up section. When the hook is housed in the hook housing portion, the set up needle is in a non-holding state of not being able to hold the set up section. In Patent Document 1, a coil spring (energizing body) for energizing the second needle member toward the lower side is further arranged (see Fig. 6 of Patent Document 1). According to such coil spring, even when knitting a knitted fabric in which the number of knitting courses of the wale differs for every constant knitting width, an appropriate pull-down force corresponding to the number of knitting courses can be applied to each wale of the knitted fabric.

[0004] In Patent Document 1 using the coil spring, a needle control mechanism using an oscillation lever is adopted. Specifically, an oscillation lever for sliding the second needle member with respect to the first needle member is arranged so that the energizing force from the coil spring is exerted on the second needle member. According to such configuration, the state of the set up needle can be switched from the holding state to the non-holding state, or from the non-holding state to the holding state by moving the oscillation lever regardless of the energizing force of the coil spring.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0005] [Patent Document 1] Japanese Patent Publication No. 3377700

SUMMARY OF THE INVENTION

[0006] In the conventional set up device, configurations such as an oscillation lever, a needle control plate, an oscillation arm and the like, excluding a drive section, of the needle control mechanism are greatly projected out in a thickness direction (same as a thickness direction of the needle bed of the set up device) of the set up device. The greatly projecting configuration is arranged across the entire region in the width direction of the set up device, and hence the conventional set up device requires a large mounting space.

[0007] In light of the foregoing, it is an object of the present invention to provide a set up device that can achieve reduction of the mounting space in the flat knitting machine.

[0008] A set up device of the present invention is a set up device arranged on a lower side of a needle bed gap between a front needle bed and a back needle bed in a flat knitting machine to catch a set up section of a knitted fabric and pull down the knitted fabric toward a lower side, the device including a plurality of set up needles, a base section, a needle control mechanism and an energizing body. The set up needle is obtained by combining a first needle member with a hook housing portion and a second needle member with a hook in a relatively slidable manner. The plurality of set up needles are slidably arranged on the base section. The needle control mechanism relatively slides the first needle member and the second needle member to switch a state of each of the set up needles between a holding state of holding the set up section and a non-holding state of not holding the set up section. The energizing body energizes the first needle member or the second needle member toward the lower side of the needle bed gap. The needle control mechanism arranged in the set up device of the present invention includes a needle side engaging portion arranged on either the first needle member or the second needle member on which the energizing body is not attached, an operation piece that is attached to the base section in a slidably moving manner and that includes a base side engaging portion that acts on the needle side engaging portion, and a raising/lowering mechanism section that moves the operation piece up and down

along an extending direction of the set up needle. The needle control mechanism changes a relative position of the first needle member and the second needle member by moving the needle side engaging portion up and down with the base side engaging portion.

[0009] According to one aspect of the set up device of the present invention, the energizing body is attached to the second needle member; and the needle side engaging portion is configured by a bat provided on the first needle member.

[0010] According to one aspect of the set up device of the present invention, the needle side engaging portion is configured by a bat; and the base side engaging portion is configured by a storage recess that stores the bat inside. In this case, an upper end edge of the storage recess pulls down the bat toward a lower side, or a lower end edge of the storage recess pushes up the bat toward an upper side, to change the relative position of the first needle member and the second needle member.

[0011] According to one aspect of the set up device of the present invention, the first needle member and the second needle member include a pair of slide engaging portions that defines a slide range of the needle members. In this case, one of the slide engaging portions is an engagement projection that projects out in a direction orthogonal to the extending direction of the set up needle, and the other slide engaging portion is an engagement recess that stores the engagement projection so as to be slidable in the extending direction of the set up needle.

[0012] According to one aspect of the set up device of the present invention, the raising/lowering mechanism section includes a cam follower arranged on the operation piece, a cam plate arranged on the base section and including a cam groove to which the cam follower engages, and a drive portion that moves the cam plate in a width direction of the base section. In such aspect, the cam groove includes an upper end flat portion and a lower end flat portion extending in the width direction of the base section at a position of an upper end and a position of a lower end of the cam groove, respectively. The lower end flat portion is formed so that, when the cam follower is arranged on the lower end flat portion, the bat is pulled down toward the lower side by the operation piece and the set up needle is in the non-holding state. The upper end flat portion is formed so that, when the cam follower is arranged on the upper end flat portion, the bat is pushed up toward the upper side by the operation piece and the set up needle is in the holding state.

[0013] According to one aspect of the set up device of the present invention including the cam follower and the cam plate, the cam groove includes an intermediate flat portion extending in a width direction of the base section at a position closer to the lower end flat portion. In such a case, the intermediate flat portion is formed so that the operation piece stops at a position immediately before making contact with the bat or at a position of making contact with the bat when the cam follower is arranged on the intermediate flat portion. Since the intermediate flat portion is located on the upper side with respect to the lower end flat portion, the bat will not be pulled down toward the lower side even if the operation piece is in contact with the bat.

[0014] In the set up device of the present invention, the needle control mechanism using an operation piece that moves up and down on the base section of the set up device is adopted in place of the needle control mechanism using an oscillation lever that oscillates in a thickness direction of the set up device. Thus, the set up device of the present invention is more compact than the conventional set up device.

[0015] An appropriate tension can be applied to the set up section held at the hook by attaching the energizing body to the second needle member including the hook. Furthermore, the strength of the first needle member can be more enhanced when the needle side engaging portion arranged on the first needle member is configured with the bat than when the needle side engaging portion is configured with a recess.

[0016] The set up needle is an elongate thin member. Thus, the strength of the set up needle can be more enhanced when the needle side engaging portion is configured with the bat and the base side engaging portion is configured with the storage recess than when the needle side engaging portion is configured with the storage recess and the base side engaging portion is configured with the bat. Moreover, the switch between the holding state and the non-holding state can be reliably carried out with the configuration of moving the bat with the upper end edge and the lower end edge of the storage recess.

[0017] When the engagement projection and the engagement recess that define the relative slide range of the first needle member and the second needle member are provided on the set up needle, the engagement projection is abutted and stopped on the inner wall of the engagement recess when the needle members are relatively slid, whereby the slide range can be finely defined. Moreover, the second needle member is less likely to be detached from the first needle member by the slide engaging portion.

[0018] According to the configuration of moving the operation piece by the engagement of the cam follower and the cam groove, the operation piece can be smoothly moved up and down. The upper end position and the lower end position of the moving range of the operation piece can be determined with high accuracy by forming the flat portion at the upper end and the lower end of the cam groove. As a result, the switch from the holding state to the non-holding state and the switch from the non-holding state to the holding state can be reliably carried out.

[0019] When the intermediate flat portion is formed on the cam groove, the set up needle is maintained in the holding state and the state in which the energizing force of the energizing body does not act on the set up needle can be obtained when the cam follower is moved from the upper end flat portion to the intermediate flat portion.

With the set up needle in such a state, the knitted fabric can be knitted with the flat knitting machine while maintaining a state in which a substantially constant tension is applied to the set up section.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is a schematic view of a flat knitting machine including a set up device;
Fig. 2 is a schematic configuration view of the set up device;
Fig. 3A is a schematic view of a first needle member and a second needle member of a set up needle, Fig. 3B is a schematic view of the set up needle in a non-holding state, and Fig. 3C is a schematic view of the set up needle in the holding state;
Fig. 4A is a partially enlarged view of the set up device, and Fig. 4B is a partially enlarged view of an operation piece; and
Figs. 5A to 5C are partial longitudinal cross-sectional views of the set up device, and are explanatory views describing the operation of the set up needle by a needle control mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Hereinafter, a set up device according to embodiments will be described based on the drawings.

<First Embodiment>

<<Overall configuration>>

[0022] A flat knitting machine 200 of the present embodiment shown in Fig. 1 is a device that includes a front needle bed FB and a back needle bed BB disposed opposite each other, and that knits a knitted fabric with knitting needles arranged on the needle beds FB, BB. The flat knitting machine 200 of the present example includes a set up device 100 arranged on the lower side of a needle bed gap GP formed between the front needle bed FB and the back needle bed BB. The set up device 100 is a device for catching a set up section of the knitted fabric knitted with the flat knitting machine and pulling down the set up section toward the lower side. The flat knitting machine 200 of the present example further includes a take-down device 300. The take-down device 300 is a device that includes a pair of take-down rollers 301, 302 to sandwich the knitted fabric between the take-down rollers 301, 302 and feed the knitted fabric toward the lower side.

[0023] When knitting the knitted fabric with the flat knitting machine 200, the set up section of the knitted fabric is knitted and the set up device 100 is moved toward the upper side to arrange a set up needle 2 at the position of the needle bed gap GP and catch the set up section with the set up needle 2. The knitted fabric is knitted while moving the set up device 100 toward the lower side. After knitting the knitted fabric to a position the knitted fabric can be sandwiched with the take-down device 300, the knitted fabric is sandwiched with the take-down rollers 301, 302, and the set up section is removed from the set up needle 2. The knitted fabric can be easily kitted by constantly applying a predetermined tension to the knitted fabric with the set up device 100 and the take-down device 300 in such manner.

[0024] Similar to the conventional set up device, the set up device 100 according to the embodiment includes a base section 1, the set up needle 2, a needle control mechanism 3, and an energizing body 4. The main difference between the set up device 100 and the conventional set up device lies in the configuration of the needle control mechanism 3. Each configuration of the set up device 100 will be specifically described below.

«Base section»

[0025] Fig. 2 is a schematic configuration view of the set up device 100 of Fig. 1 seen from the right side in the plane of drawing. The base section 1 includes a needle bed portion 10 arranged on the needle bed gap GP side, and an installing portion 11 where members such as an operation piece 31, a coil spring (energizing body) 4, and the like, to be described later, are arranged. The needle bed portion 10 includes a plurality of needle grooves 1g (see Fig. 4A) in which the set up needles 2 is fitted, to be described later. The installing portion 11 includes, on the other hand, a slide recess 1s (see Fig. 4A), to which an actuation arm 31B of the operation piece 31, to be described later, can be slidably fitted.

[0026] The base section 1 has both ends attached to a base section raising/lowering mechanism (not shown) by way of a bracket 12. Thus, the entire base section 1 can be moved up and down in a vertical direction.

«Set up needle»

[0027] As shown in Figs. 3A to 3C, the set up needle 2 includes a first needle member 20 and a second needle member 21, which are combined to be relatively slidable. The set up needle 2 is slidably arranged in the needle groove 1g (see Fig. 4A) of the base section 1. The set up needle 2 arranged in the needle groove 1g is held down with a band 1b (see Fig. 2) so as not to fall out from the needle groove 1g. The set up needle 2 is not limited to the configuration of being arranged in the needle groove 1g, and may be slidably arranged on the needle bed portion 10 with a cover, a wire, and the like.

[First needle member]

[0028] As shown in Fig. 3A, the first needle member 20 includes a slide groove 2g to which the second needle

member 21 can be fitted from the right side in the plane of drawing. The set up needle 2 shown in Figs. 3B and 3C is formed by fitting the second needle member 21 into the slide groove 2g. A hook housing portion 2c for housing a hook 2f of the second needle member 21, to be described later, is arranged at the upper end of the first needle member 20. The hook housing portion 2c is formed to a substantially trapezoidal shape, where the hook housing portion 2c does not have a portion the set up section of the knitted fabric can be hooked.

[0029] A slide engaging portion 2a that defines a relative slide range of the first needle member 20 and the second needle member 21 is arranged at an intermediate portion of the first needle member 20. The slide engaging portion 2a of the present example is formed by forming a rectangular hole that passes through the first needle member 20 in a front and back direction in the plane of drawing. The rectangular hole has one part formed so as to reach a position (position on the left side in the plane of drawing) deeper than the slide groove 2g, so that the slide groove 2g consequently becomes deep at the position of the rectangular hole. The deepened portion (engagement recess) of the slide groove 2g forms the slide engaging portion 2a in the present example. The positions of forming the slide engaging portion 2a and a slide engaging portion 2b, to be described later, are not particularly limited, and may be any position in the extending direction of the set up needle 2.

[0030] A bat (needle side engaging portion) 30 that projects out in a direction toward the base section 1 (see Figs. 5A to 5C) is arranged at the lower end of the first needle member 20. The bat 30 configures one part of the needle control mechanism 3 (see Figs. 2, 4A and 4B, 5A to 5C), to be described later. The position of forming the bat 30 is not particularly limited, and may be any position in the extending direction of the first needle member 20.

[Second needle member]

[0031] As shown in Fig. 3A, the hook 2f for hooking the set up section of the knitted fabric is arranged at the upper end of the second needle member 21. The configuration of the hook 2f may be similar to Patent Document 1. Under a state the hook 2f is housed in the hook housing portion 2c of the first needle member 20 as shown in Fig. 3B, the hook housing portion 2c does not have a portion the set up section of the knitted fabric can be hooked, and hence the set up needle 2 is in the non-holding state of not being able to hold the set up section of the knitted fabric. On the other hand, under a state the hook 2f is exposed from the hook housing portion 2c as shown in Fig. 3C, the set up section of the knitted fabric can be hooked at the hook 2f, and hence the set up needle 2 is in the holding state of being able to hold the set up section.

[0032] The slide engaging portion 2b for defining the slide range of the second needle member 21, along with the slide engaging portion (engagement recess) 2a of the first needle member 20, is arranged at the intermediate portion of the second needle member 21. The slide engaging portion 2b of the present example is a protrusion (engagement projection) that projects out toward the slide groove 2g side (direction orthogonal to the extending direction of the set up needle 2) of the first needle member 20 and that is stored inside the engagement recess 2a of the first needle member 20. As previously described above, the slide engaging portion 2a of the first needle member 20 is an engagement recess where one part of the slide groove 2g is formed deep, where the width in the up and down direction of the engagement recess 2a (extending direction of the set up needle 2) is greater than the width in the up and down direction of the engagement projection 2b. Thus, the engagement projection 2b is abutted and stopped on the lower end edge of the engagement recess 2a when the first needle member 20 is slid toward the upper side as shown in Fig. 3C, whereas the engagement projection 2b is abutted and stopped on the upper end edge of the engagement recess 2a when the first needle member 20 is slid toward the lower side as shown in Fig. 3B. Thus, according to the configuration of regulating the sliding of the first needle member 20 by abutting and stopping, the relative slide range of the first needle member 20 and the second needle member 21 is finely defined. An effect of being able to suppress the second needle member 21 from detaching from the first needle member 20 in the slide direction (same as extending direction of set up needle 2) is also obtained by the engagement of such slide engaging portions 2a, 2b. The engagement projection may be formed in the slide groove 2g of the first needle member 20, and the engagement recess to be engaged with the engagement projection may be formed in the second needle member 21.

[0033] A holding portion 2j, to which one end of the coil spring 4 (see Fig. 4A) is hooked, is provided at the lower end of the second needle member 21. As shown in Fig. 4A, the other end of the coil spring 4 is hooked to a hook-shaped holding member 1j attached to the installing portion 11 of the base section 1. That is, the second needle member 21 and the first needle member 20 to be combined with the second needle member 21 are in a state of being energized toward the lower side of the needle bed gap by the coil spring 4, which is a tension spring. Unless the first needle member 20 is moved, the set up needle 2 in the holding state remains in the holding state, and the set up needle 2 in the non-holding state remains in the non-holding state.

[0034] In addition to the configurations described above, a lower end defining portion 2w (2x) that defines the lower end of the slide range of the set up needle 2 in the needle groove 1g and an upper end defining portion 2y (2z) that defines the upper end of the slide range are provided on the first needle member 20 (second needle member 21), as a configuration of defining the slide range of the entire set up needle 2 in the needle groove 1g. The lower end defining portion 2w (2x) is abutted and stopped

on an abutting stop portion 1t of the base section 1 of Figs. 5A to 5C when the set up needle 2 is slid toward the lower side, thus defining the lower end of the slide range of the entire set up needle 2. The upper end defining portion 2y (2z) is abutted and stopped on the band 1b attached to the base section 1 of Figs. 4A and 5A to 5C when the set up needle 2 is slid toward the upper side, thus defining the upper end of the slide range of the entire set up needle 2.

[0035] The set up needle merely needs to have a configuration the set up needle can take the holding state or the non-holding state by relatively sliding the first needle member and the second needle member, and is not limited to the configuration described above. For example, the set up needle described in Figs. 1 to 3 of Japanese Unexamined Patent Application Publication No. H05-71051 or Japanese Unexamined Patent Application Publication No. 2011-513601 may be adopted. The former set up needle is a set up needle that takes the holding state by sliding the member corresponding to the second needle member 21 including the hook 2f toward the lower side. As opposed to the set up needle 2 of the present example shown in Figs. 3A to 3C, the latter set up needle is a set up needle that takes the holding state by sliding the member corresponding to the first needle member 20 including the hook housing portion 2c toward the lower side. The energizing body for exerting the energizing force on the second needle member 21 is not limited to the coil spring 4. For example, the energizing body may be configured by an elastic material such as rubber.

«Needle control mechanism»

[0036] As shown in Figs. 4A, 4B and 5A to 5C, the needle control mechanism 3 of the present example includes a bat 30 arranged at the lower end of the first needle member 20, an operation piece 31 attached to the installing portion 11 of the base section 1 in a slidably moving manner, and a raising/lowering mechanism section 32 (see Fig. 2) that moves the operation piece 31 up and down.

[Operation piece]

[0037] As shown in Figs. 4A and 4B, the operation piece 31 includes a plate-shaped portion 31A with a rectangular storage recess (needle side engaging portion) 31w, and an actuation arm 31B coupled to the lower part of the plate-shaped portion 31A (only one part of the plate-shaped portion 31A is illustrated in Figs. 4A and 4B). As shown in Fig. 2, the operation piece 31 of the present example is a member in which two actuation arms 31B are coupled to the plate-shaped portion 31A having substantially the same width as the width direction of the base section 1. As shown in Figs. 4A and 4B, the actuation arm 31B is fitted into the slide recess 1s of the base section 1, and hence the operation piece 31 slidably moves on the base section 1 along the extending direction (up and down direction in the plane of drawing) of the set up needle 2. The operation piece 31 is arranged on the rear side of the coil spring 4 on the front side of the installing portion 11. The actuation arm 31B of the operation piece 31 is covered by a cover member 13 (see Fig. 2), so that the operation piece 31 does not detach from the base section 1. The cover member 13 is arranged on the rear side of the coil spring 4, and is fixed to the installing portion 11. Thus, the number of actuation arms 31B connected to the plate-shaped portion 31A is not particularly limited.

[0038] The bat 30 of the first needle member 20 is arranged in the storage recess 31w provided in the plate-shaped portion 31A of the operation piece 31. The number of bats 30 to be arranged in one storage recess 31w, that is, the number of set up needles 2 corresponding to one storage recess 31w is not particularly limited. The number of storage recesses 31w to be formed in the operation piece 31 is not particularly limited. The storage recess 31w may be a recess having a bottom or may be a through-hole that passes through the plate-shaped portion 31A (latter in the present example). That is, in the configuration of the present example, the set up needle 2 can be moved in a range of the length of the storage recess 31w in the extending direction of the set up needle 2. When knitting a knitted fabric in which the number of knitting courses of the wale for every constant knitting width is different, the set up needle 2 is arranged along the shape of the knitted fabric. For example, in the example shown in Fig. 4A, the two set up needles 2 at the middle are moved toward the upper side in the plane of drawing within the range of the length of the storage recess 31w among the other set up needles 2 in correspondence with the shape of the knitted fabric. In this case, the energizing force of the coil spring 4 toward the downward direction in the plane of drawing is more strongly exerted on the two set up needles 2 at the middle than on the other set up needles 2. As a result, the pull-down force corresponding to the number of knitting courses of each wale for every constant knitting width of the knitted fabric can be applied to the knitted fabric.

[0039] Furthermore, according to the configuration in which the bat 30 of the first needle member 20 is arranged in the storage recess 31w, the bat 30 can be pushed toward the upper side by the lower end edge of the storage recess 31w by moving the plate-shaped portion 31A toward the upper side, and the bat 30 can be pulled down toward the lower side by the upper end edge of the storage recess 31w by moving the plate-shaped portion 31A toward the lower side. The pushing up and the pulling down of the bat 30 are related to the switching of the state of the set up needle 2 between the holding state and the non-holding state, as will be described later with reference to Figs. 5A to 5C.

[0040] A cam follower 31C is arranged at the lower end side of the actuation arm 31B of the operation piece 31. The cam follower 31C is a cylindrical member projecting

out from the surface of the actuation arm 31B, and is configured to be rotatable by a bearing. The cam follower 31C may be a cylindrical member that does not rotate or a member in which a spherical body is provided at the tip of a shaft portion. In such a case, if the portion that slidably makes contact with the cam groove 32g in the cam follower 31C is made with a slippery material, the damage to the cam follower 31C and the cam groove 32g can be suppressed.

[Raising/lowering mechanism section]

[0041] The raising/lowering mechanism section 32 includes the cam follower 31C, a cam plate 32A including the cam groove 32g to which the cam follower 31C engages, and a drive portion 32B (see Fig. 2) that moves the cam plate 32A. The number of cam grooves 32g corresponds to the number of cam followers 31C.

[0042] The cam plate 32A is slidably arranged in the width direction of the base section 1 (direction orthogonal to the extending direction of the set up needle 2) at the position on the lower end side of the installing portion 11. The surface of the cam plate 32A is covered by a cover member 14 (see Fig. 2) so as not to detach from the installing portion 11. The cam groove 32g formed in the cam plate 32A is entirely extended in the diagonal direction (direction intersecting the width direction of the base section 1). The cam groove 32g includes an upper end flat portion 320 and a lower end flat portion 329 extending in the width direction of the base section 1 at the position of the upper end and the position of the lower end, respectively, of the cam groove 32g. The lower end flat portion 329 is formed so that, when the cam follower 31C is arranged at the lower end flat portion 329, the bat 30 is pulled down toward the lower side by the operation piece 31 and the set up needle 2 is in the non-holding state. The upper end flat portion 320 is formed so that, when the cam follower 31C is arranged at the upper end flat portion 320, the bat 30 is pushed up toward the upper side by the operation piece 31 and the set up needle 2 is in the holding state. According to the configuration of moving the operation piece 31 by the engagement of the cam follower 31C and the cam groove 32g, the operation piece 31 can be smoothly moved up and down. Furthermore, the upper end position and the lower end position of the moving range of the operation piece 31 can be determined with high accuracy by forming the flat portions 320, 329 at the upper end and the lower end, respectively, of the cam groove 32g.

[0043] When using the set up needle (see Japanese Unexamined Patent Application Publication No. 2011-513601) that takes the holding state when the first needle member with the hook housing portion is slid toward the lower side in place of the set up needle 2 shown in Figs. 3A to 3C, the set up needle takes the non-holding state (holding state) when the cam follower 31C is arranged at the upper end flat portion 320 (lower end flat portion 329).

[0044] The cam groove 32g further includes an intermediate flat portion 325 extending in the width direction of the base section 1 at the position closer to the lower end flat portion 329. The intermediate flat portion 325 is formed so that the operation piece 31 stops at the position immediately before the operation piece 31 acts on the bat 30 when the cam follower 31C is arranged at the intermediate flat portion 325. As opposed to the cam groove 32g of the present example, the cam groove 32g without the flat portions 320, 329, 325 may also be adopted.

[0045] As shown in Fig. 2, the drive portion 32B for sliding the cam plate 32A is configured by a rack 32r formed at the lower end of the cam plate 32A, a pinion 32p that engages with the rack 32r, and a motor 32m that rotates the pinion 32p. That is, in the present example, the state of all the set up needles 2 arranged in the set up device 100 can be switched with one motor 32m.

[0046] The raising/lowering mechanism section 32 for moving the operation piece 31 up and down merely needs to have a configuration of not greatly projecting out in the thickness direction of the set up device 100, and is not limited to the configuration of the embodiment. For example, a rack extending in the up and down direction may be arranged on the operation piece 31, and the operation piece 31 may be moved up and down with the pinion or the operation piece 31 may be moved up and down using a crank mechanism. In addition, the raising/lowering mechanism section 32 may have a configuration of linearly moving the operation piece 31 up and down, and for example, may be configured with an actuator using a solenoid, an air cylinder, and the like.

<<Operation of set up needle by needle control mechanism>>

[0047] How the set up needle 2 is operated by the needle control mechanism 3 will now be described with reference to Figs. 5A to 5C. Fig. 5A shows a state in which the cam follower 31C is pulled down to a lower limit position (position of the lower end flat portion 329 of Fig. 4A) by the cam groove 32g (see Fig. 4A) of the cam plate 32A. The upper end edge of the storage recess 31w of the operation piece 31 pulls down the bat 30 of the first needle member 20 (see central circled portion) slightly before the cam follower 31C is pulled down to the lower limit position. When the bat 30 is pulled down toward the lower side, the first needle member 20 is slid toward the lower side, and the hook 2f is housed in the hook housing portion 2c as shown with the upper circled portion. That is, in Fig. 5A, the set up needle 2 is in the non-holding state.

[0048] Fig. 5C shows a state in which the cam follower 31C is pushed up to an upper limit position (position of the upper end flat portion 320 of Fig. 4A) by the cam groove 32g (see Fig. 4A) of the cam plate 32A. The lower end edge of the storage recess 31w of the operation piece 31 pushes up the bat 30 of the first needle member 20

(see central circled portion) slightly before the cam follower 31C is pushed up to the upper limit position. When the bat 30 is pushed up toward the upper side, the first needle member 20 is slid toward the upper side, and the hook 2f is exposed from the hook housing portion 2c as shown with the upper circled portion. That is, in Fig. 5C, the set up needle 2 is in the holding state.

[0049] When catching the set up section with the set up needle 2, the set up needle 2 is set to the non-holding state (see Fig. 5A), the base section 1 of the set up device 100 is raised toward the needle bed gap GP, and the set up needle 2 is arranged at the position of the set up section. Then, the set up needle 2 is set to the holding state (see Fig. 5C), and the base section 1 is lowered to catch the set up section with the hook 2f of the set up needle 2. The base section 1 is then lowered and the knitted fabric is knitted while applying tension to the set up section. After the set up section passes the take-down rollers 301, 302 (Fig. 1), the knitted fabric portion is sandwiched with the take-down rollers 301, 302, and the cam plate 32A of Fig. 4A is moved in the rightward direction in the plane of drawing to have the set up needle 2 in the non-holding state (see Fig. 5A).

[0050] Here, the cam plate 32A of Fig. 4A may be moved in the rightward direction and the cam follower 31C may be arranged at the position of the intermediate flat portion 325 after the cam plate 32A of Fig. 4A is moved in the leftward direction to have the set up needle 2 in the holding state (see Fig. 5C) and the set up section is caught. The upper end edge of the storage recess 31w of the operation piece 31 is thereby stopped at the position immediately before making contact with the bat 30, as shown with the central circled portion in Fig. 5B. As a result, the set up needle 2 is maintained in the holding state as shown with an upper circled enlarged view, and the upward movement of the bat 30 is regulated with the upper end edge of the storage recess 31w. The knitted fabric can be knitted in a state the energizing force of the coil spring 4 is not exerted on the set up needle 2 by limiting the movement of the bat 30. The upper end edge of the storage recess 31w may be brought into contact with the bat 30 when the cam follower 31C is arranged in the intermediate flat portion 325. However, the intermediate flat portion 325 needs to be formed such that the set up needle 2 is maintained in the holding state.

«Effect»

[0051] As shown in Figs. 5A to 5C, the set up device 100 of the present example does not have a configuration of greatly projecting out in the thickness direction of the set up device 100 (same as the thickness direction of the base section 1) excluding the drive portion 32B (see Figs. 1 and 2), and is more compact than the set up device of Patent Document 1. Thus, the mounting space of the set up device 100 in the flat knitting machine is smaller than that in the conventional set up device.

[0052] Furthermore, as shown in Fig. 1, according to the set up device 100 of the present example, the device can be easily juxtaposed with the take-down device 300 in the flat knitting machine. When catching the set up section of the knitted fabric with the set up device 100, the base section 1 of the set up device 100 is moved toward the needle bed gap GP. In this case, the base section 1 is passed between the take-down rollers 301 and 302 of the take-down device 300. In the base section 1 of the set up device 100 of the present example, the portion that passes the take-down rollers 301, 302 does not have a configuration that projects out greatly in the thickness direction of the base section 1, and hence problems such as the set up device 100 making contact with the take-down rollers 301, 302 do not arise. Therefore, the set up device 100 and the take-down device 300 can be juxtaposed without performing a special design change such as providing a mechanism for enlarging the interval between the take-down rollers 301, 302 up to the position of avoiding the set up device 100. Although the drive portion 32B is greatly projected out in the thickness direction of the base section 1, it is arranged at a position where contact is not made with the take-down device 300, and hence the drive portion does not become a cause of the problem.

<Second Embodiment>

[0053] As opposed to the first embodiment, the coil spring 4 may be attached to the lower end of the first needle member 20 and the bat (needle side engaging portion) 30 may be arranged on the second needle member 21 including the hook 2f. That is, a configuration of switching the state of the set up needle 2 between the non-holding state and the holding state by sliding the second needle member 21 with the hook 2f with respect to the first needle member 20 may be adopted. In this case, the set up needle 2 takes the holding state when the cam follower 31C of Figs. 4A and 4B is arranged in the lower end flat portion 329, similar to the first embodiment. In order to exert the energizing force of the coil spring 4 on the set up section of the knitted fabric by way of the set up needle 2, the cam follower 31C is to be moved from the lower end flat portion 329 to right before the upper end flat portion 320 after catching the set up section with the set up needle 2.

<Third Embodiment>

[0054] As opposed to the first and second embodiments, the base side engaging portion arranged on the operation piece 31 may be the bat, and the needle side engaging portion arranged on the set up needle 2 may be the storage recess. The storage recess formed in the set up needle 2 can be formed by cutting out a part of the set up needle 2. In addition, two protrusions separated in the extending direction of the set up needle 2 may be formed on the set up needle 2, and the portion between the protrusions may be assumed the storage recess. The

storage recess may be formed in either the first needle member 20 or the second needle member 21.

Claims

1. A set up device (100) arranged on a lower side of a needle bed gap (GP) between a front needle bed (FB) and a back needle bed (BB) in a flat knitting machine (200) to catch a set up section of a knitted fabric and pull down the knitted fabric toward a lower side, the device including,
a plurality of set up needles (2) obtained by combining a first needle member (20) with a hook housing portion (2c) and a second needle member (21) with a hook (2f) in a relatively slidable manner;
a base section (1) on which the plurality of set up needles (2) are slidably arranged;
a needle control mechanism (3) that relatively slides the first needle member (20) and the second needle member (21) to switch a state of each of the set up needles (2) between a holding state of holding the set up section and a non-holding state of not holding the set up section; and
an energizing body (4) that energizes the first needle member (20) or the second needle member (21) toward the lower side of the needle bed gap (GP);
characterized in that
the needle control mechanism (3) includes,

a needle side engaging portion (30) arranged on either the first needle member (20) or the second needle member (21) on which the energizing body (4) is not attached,
an operation piece (31) that is attached to the base section (1) in a slidably moving manner and that includes a base side engaging portion (31w) that acts on the needle side engaging portion (30), and
a raising/lowering mechanism section (32) that moves the operation piece (31) up and down along an extending direction of the set up needle (2); wherein

the needle control mechanism (3) changes a relative position of the first needle member (20) and the second needle member (21) by moving the needle side engaging portion (30) up and down with the base side engaging portion (31w).

2. The set up device (100) according to claim 1, wherein the energizing body (4) is attached to the second needle member (21); and
the needle side engaging portion (30) is configured by a bat (30) provided on the first needle member (20).

3. The set up device (100) according to claim 1 or 2, wherein
the needle side engaging portion (30) is configured by a bat (30);
the base side engaging portion (31w) is configured by a storage recess (31w) that stores the bat (30) inside; and
an upper end edge of the storage recess (31w) pulls down the bat (30) toward a lower side, or a lower end edge of the storage recess (31w) pushes up the bat (30) toward an upper side, to change the relative position of the first needle member (20) and the second needle member (21).

4. The set up device (100) according to any one of claims 1 to 3, wherein
the first needle member (20) and the second needle member (21) include a pair of slide engaging portions (2a, 2b) that defines a slide range of the needle members (20, 21); and
one of the slide engaging portions (2a, 2b) is an engagement projection (2b) that projects out in a direction orthogonal to the extending direction of the set up needle (2) and the other slide engaging portion is an engagement recess (2a) that stores the engagement projection (2b) so as to be slidable in the extending direction of the set up needle (2).

5. The set up device (100) according to any one of claims 1 to 4, wherein
the raising/lowering mechanism section (32) includes a cam follower (31C) arranged on the operation piece (31), a cam plate (32A) arranged on the base section (1) and including a cam groove (32g) to which the cam follower (31C) engages, and a drive portion (32B) that moves the cam plate (32A) in a width direction of the base section (1);
the cam groove (32g) includes an upper end flat portion (320) and a lower end flat portion (329) extending in the width direction of the base section (1) at a position of an upper end and a position of a lower end of the cam groove (32g), respectively;
the lower end flat portion (329) is formed so that, when the cam follower (31C) is arranged on the lower end flat portion (329), the bat (30) is pulled down toward the lower side by the operation piece (31) and the set up needle (2) is in the non-holding state; and
the upper end flat portion (320) is formed so that, when the cam follower (31C) is arranged on the upper end flat portion (320), the bat (30) is pushed up toward the upper side by the operation piece (31) and the set up needle (2) is in the holding state.

6. The set up device (100) according to claim 5, wherein the cam groove (32g) includes an intermediate flat portion (325) extending in a width direction of the base section (1) at a position closer to the lower end flat portion (329); and

the intermediate flat portion (325) is formed so that the operation piece (31) stops at a position immediately before making contact with the bat (30) or at a position of making contact with the bat (30) when the cam follower (31C) is arranged on the intermediate flat portion (325).

Fig. 1

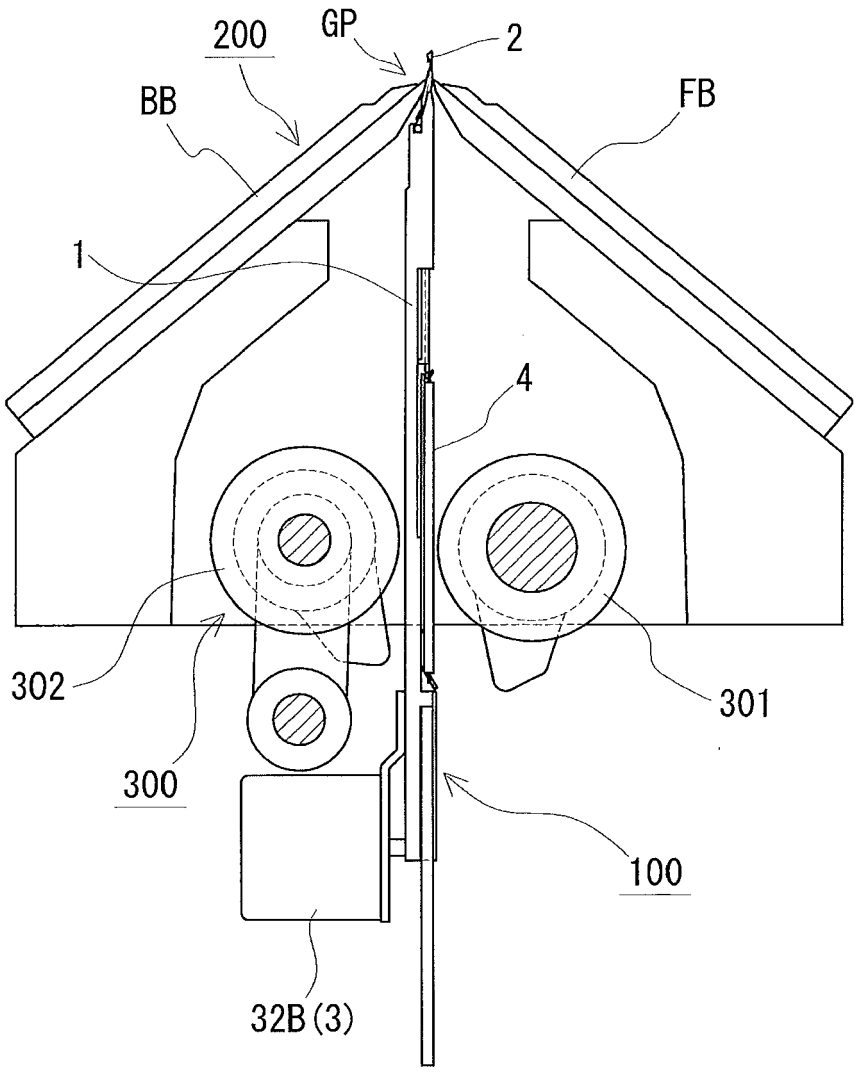
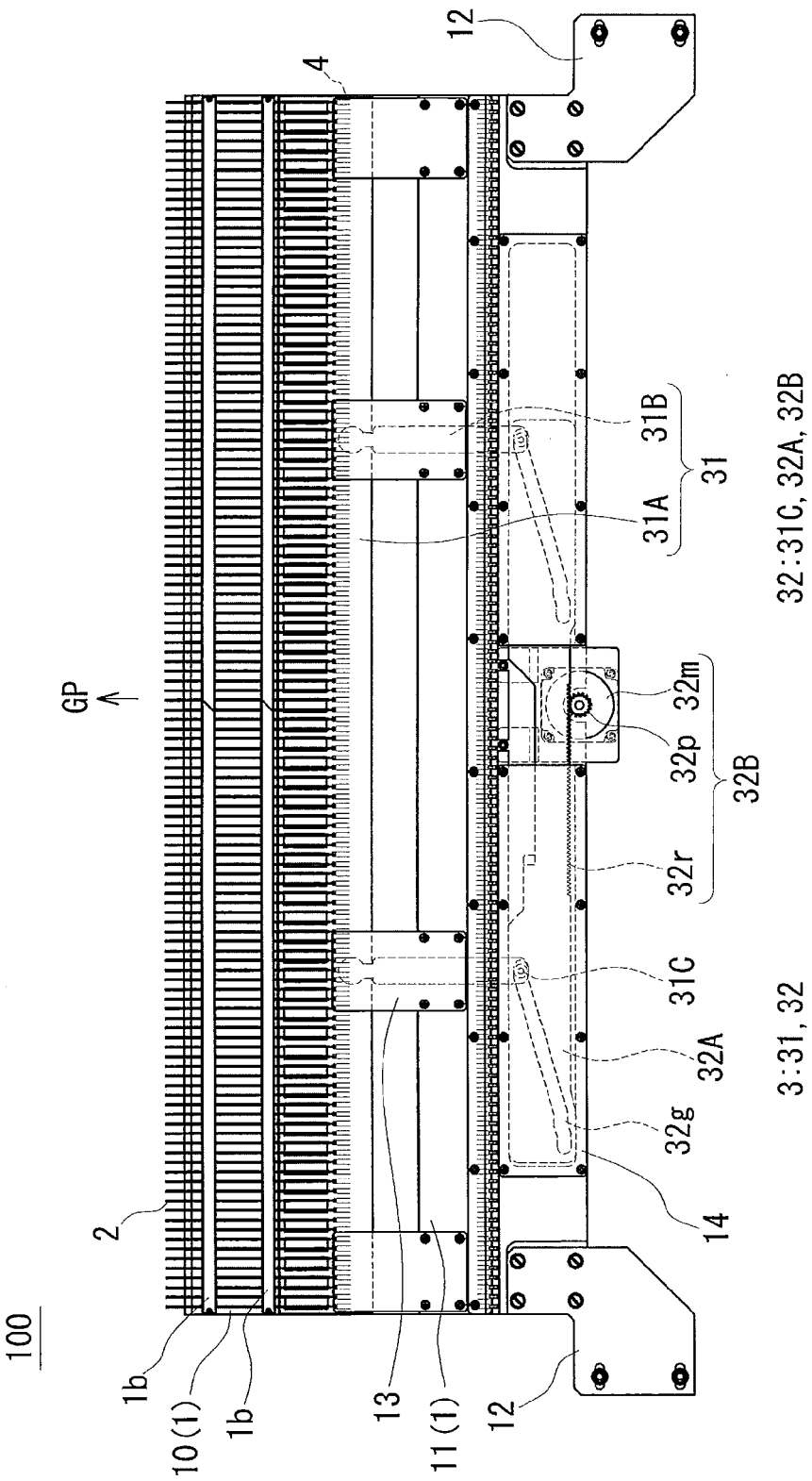


Fig. 2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GP
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4
12
1b
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13
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31B
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32m
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32r
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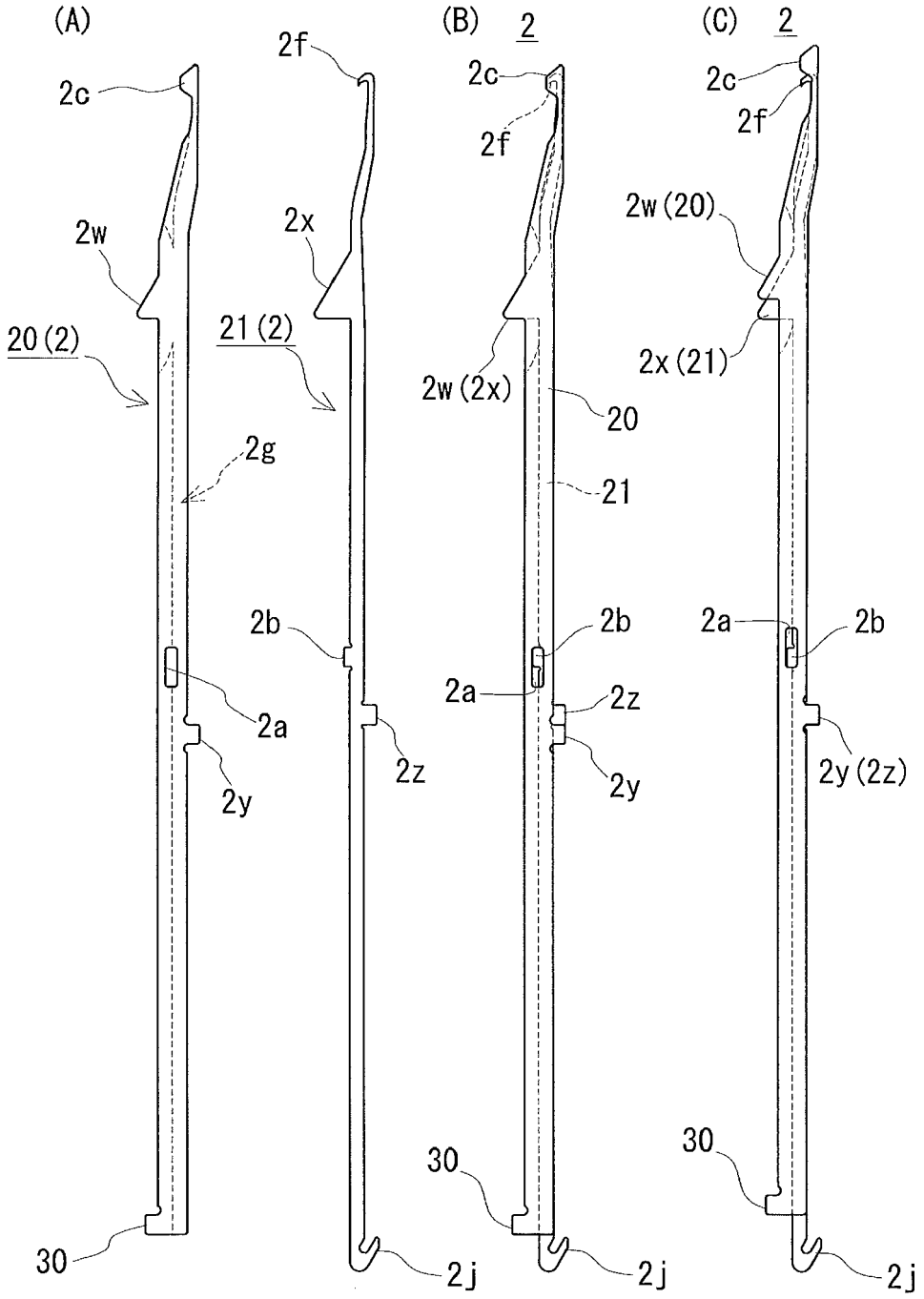
32g
3:31, 32

Fig. 3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2c
2f
2w (2x)
20
21
2b
2a
2z
2y
30
2j
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2b
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Fig. 4

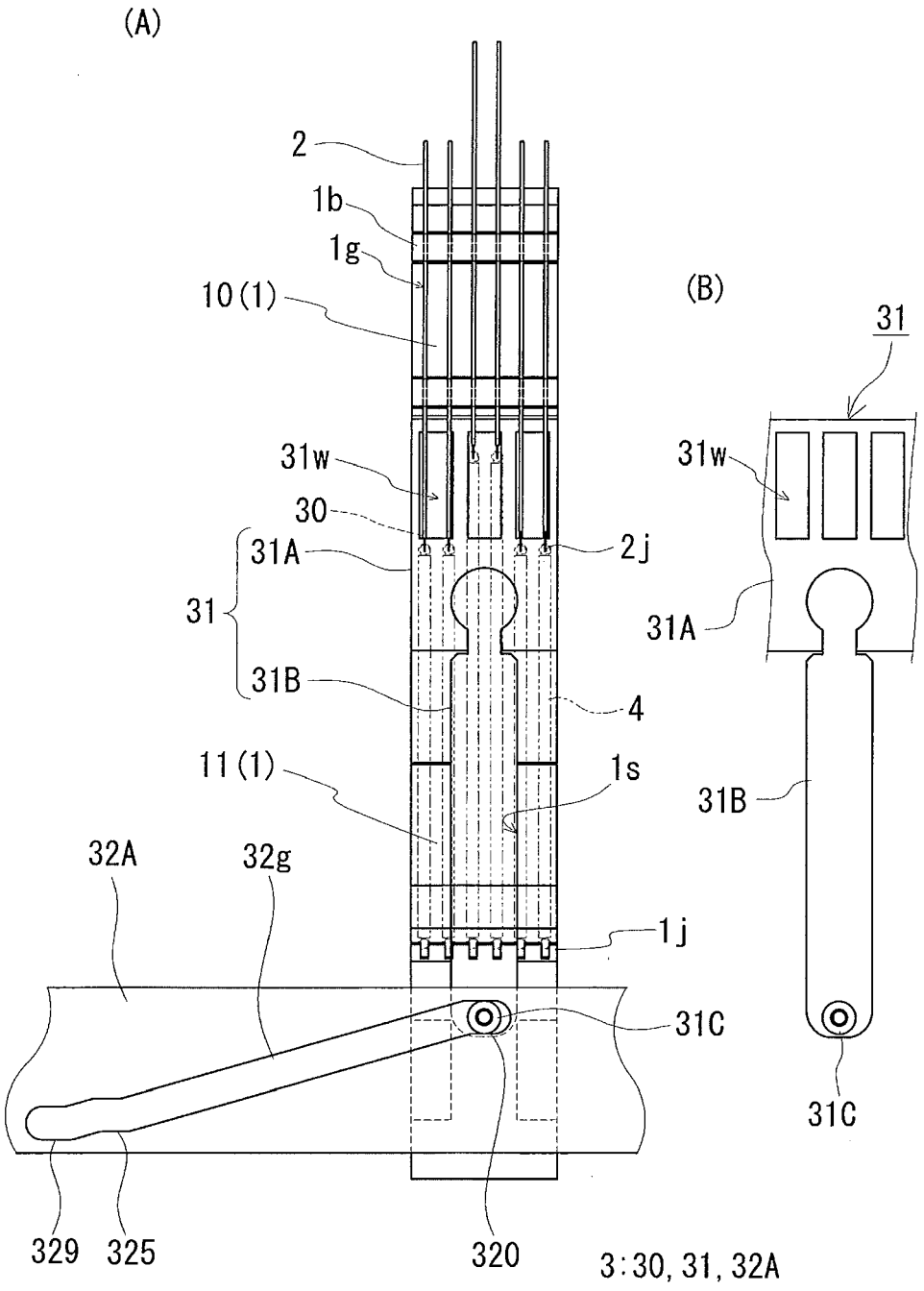
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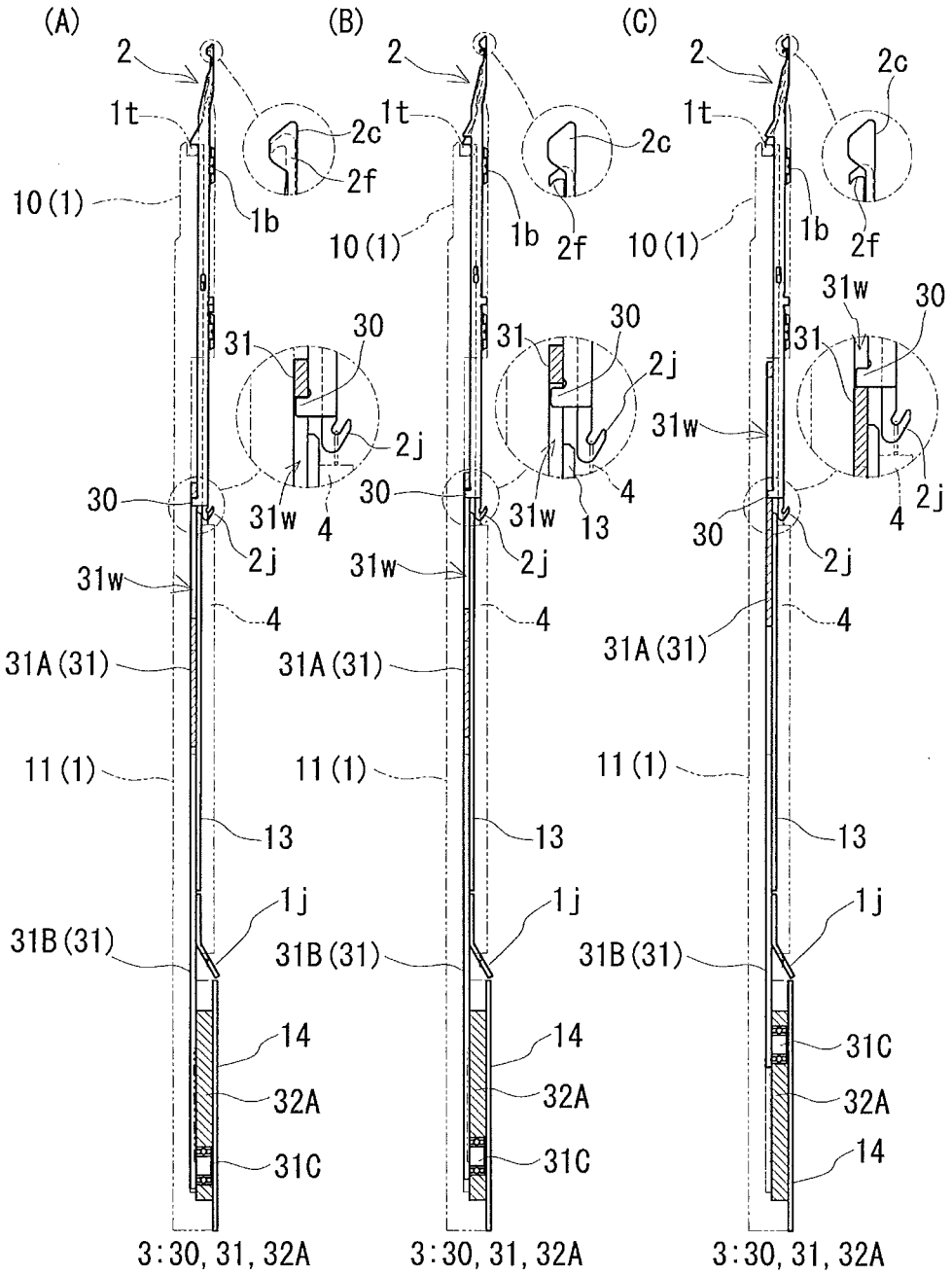
Fig. 5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11(1)
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31B(31)
14
32A
31C
3:30, 31, 32A

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 3560

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D04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 February 2017	Braun, Stefanie

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21-02-2017

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