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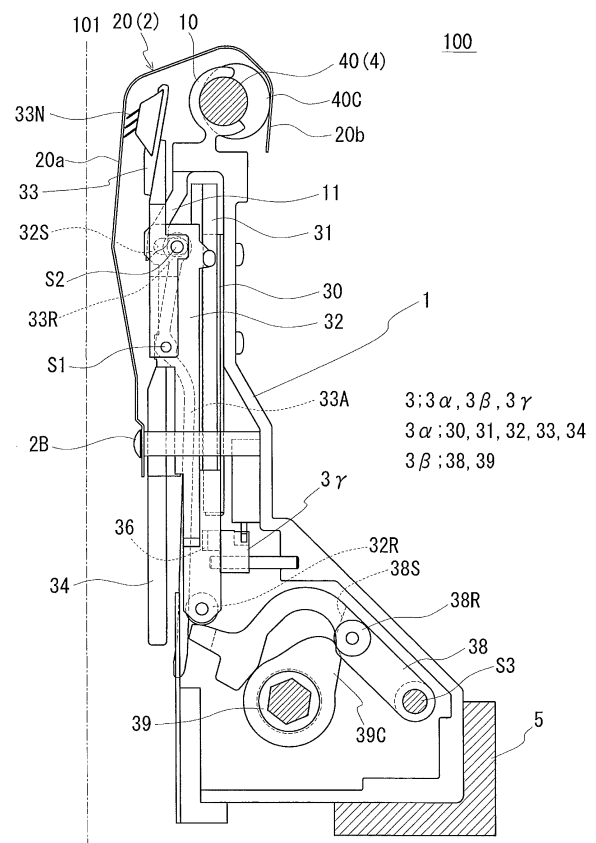
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(54) **PULL-DOWN DEVICE FOR KNITTED FABRIC**

(57) A pull-down device for a knitted fabric that has a simpler configuration than the conventional device and that can be easily installed with respect to the flat knitting machine is provided.

A pull-down device 100 for a knitted fabric includes a pair of base sections 1, a guiding plate 2 arranged at a position facing a knitted fabric passing path 101 on an upper side of each base section 1, and a catching/pull-down mechanism 3 for catching the knitted fabric drooped to a position facing the guiding plate 2 and pulling down the knitted fabric toward a lower side. In the pull-down device 100 for the knitted fabric, the base section 1 is fixed to the flat knitting machine. The pull-down device 100 of the knitted fabric includes an opening/closing mechanism 4 for displacing at least a part of each guiding plate 2 between a closed position which is proximate to the knitted fabric passing path 101 and an open position which is further separated from the knitted fabric passing path 101 than the closed position.

Fig. 2



Description

BACKGROUND OF THE INVENTION

Field of the Invention

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

Description of the Related Art

[0002] The flat knitting machine includes front and back needle beds disposed opposite to each other, knitting needles arranged in each of a great number of needle grooves lined on each needle bed, and a carriage that reciprocates along a longitudinal direction (direction orthogonal to an extending direction of the needle groove) of the needle beds. A knitting cam is mounted on the carriage, which knitting cam enables the knitting needles to carry out the knitting operation. Such flat knitting machine having such configuration may include a pull-down device of a knitted fabric for pulling down the knitted fabric drooped from the needle bed gap portion formed between the front needle bed and the back needle bed toward the lower side (see e.g., Patent Document 1).

[0003] As shown in a schematic view of Fig. 11, a conventional pull-down device 200 of a knitted fabric includes a pair of base sections 1, 1 arranged on a lower side of each of a front needle bed FB and a back needle bed BB of a flat knitting machine 300, a guiding plate 2 arranged on an upper side of each base section 1, and a catching/pull-down mechanism 3 arranged in each base section 1. The guiding plate 2 is a member that serves to limit the right and left movement of the knitted fabric drooped from the needle bed gap portion GP, and is arranged facing a passage (knitted fabric passing path 101) of the knitted fabric, where the guiding plate 2 of one base section 1 and the guiding plate 2 of the other base section 1 are arranged facing each other. Furthermore, the catching/pull-down mechanism 3 is a mechanism that catches the knitted fabric, which is drooped to a position facing the guiding plate 2 and which movement is limited by the guiding plate 2, and pulls down the knitted fabric to the lower side of the needle bed gap portion GP. In addition to the pull-down device 200 having the configuration described above, a set up device (not shown) of a knitted fabric is arranged on the lower side of the needle bed gap portion GP of the flat knitting machine 300.

[0004] A usage mode of the pull-down device 200 of the knitted fabric will be briefly described. After knitting a set up section of the knitted fabric using the front needle bed FB and the back needle bed BB of the flat knitting machine 300, a distal end of the set up device (not shown) is hooked to the relevant set up section. At this point, the guiding plate 2 of the pull-down device 200 of the knitted fabric is at an open position further separated from the

knitted fabric passing path 101 than an illustrated position, and a catching member at the upper end of the catching/pull-down mechanism 3 is also withdrawn to the position further separated from the knitted fabric passing path 101 than the illustrated position.

[0005] After hooking the distal end of the set up device to the set up section of the knitted fabric, the knitted fabric is knitted with the needle beds while being pulled down toward the lower side. When the set up device that moves toward the lower side passes the pull-down device 200 of the knitted fabric through the knitted fabric passing path 101, the set up device is detached from the set up section of the knitted fabric, and the guiding plate 2 of the pull-down device 200 of the knitted fabric described above is moved to a closed position (illustrated position) proximate to the knitted fabric passing path 101. In the conventional pull-down device 200 of the knitted fabric, the pair of base sections 1 including the guiding plate 2 is moved in a direction of approaching each other (direction indicated with arrows on a lower side of the plane of drawing) to move the guiding plates 2 to the closed position.

[0006] After the guiding plate 2 is moved to the closed position, the knitted fabric is caught with the catching/pull-down mechanism 3 arranged on the base section 1, and the knitting of the knitted fabric is continued while pulling down the knitted fabric toward the lower side. As the guiding plate 2 is arranged at the closed position, the movement of the knitted fabric is limited by the guiding plate 2, and the knitted fabric is sent out toward the lower side in a stable state along the knitted fabric passing path 101, so that a knitted fabric of satisfactory quality with a stable stitch forming state can be knitted.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0007] [Patent Document 1] Japanese Patent Publication No. 3457161

SUMMARY OF THE INVENTION

[Problems to be Solved by the Invention]

[0008] In the conventional pull-down device 200 of the knitted fabric, the guiding plate 2 is moved together with the base section 1, and thus the scale of the pull-down device 200 of the knitted fabric is large. The large scale pull-down device 200 of the knitted fabric inhibits reduction in size and weight of the flat knitting machine 300.

[0009] Furthermore, the configuration of moving the base section 1 has a problem in that the installation of the pull-down device 200 of the knitted fabric with respect to the flat knitting machine 300 is troublesome. Since the scale of the mechanism for moving the base section 1 is very large, the attachment of the mechanism for moving the base section 1 is cumbersome, and whether the knit-

ted fabric can be appropriately caught and pulled down by the operation of the catching/pull-down mechanism 3 arranged on the base section 1 needs to be checked by actually moving the base section 1 attached to the flat knitting machine 300. Moreover, if the knitted fabric is not appropriately caught by the catching/pull-down mechanism 3, the movement of the catching/pull-down mechanism 3 needs to be readjusted.

[0010] In light of the foregoing, it is one object of the present invention to provide a pull-down device of a knitted fabric that has a simpler configuration than the conventional device and that can be easily installed with respect to the flat knitting machine.

[Means for Solving the Problem]

[0011] The present invention is a pull-down device of a knitted fabric including a pair of base sections installed on a lower side of a front needle bed and a back needle bed in a flat knitting machine, a guiding plate arranged at a position facing a knitted fabric passing path or a passage of a knitted fabric drooped from a needle bed gap portion between the front needle bed and the back needle bed on an upper side of each base section, and a catching/pull-down mechanism for catching the knitted fabric drooped to a position facing the guiding plate and pulling down the knitted fabric toward a lower side. In the pull-down device of the knitted fabric, the base section is fixed to the flat knitting machine. Furthermore, the pull-down device of the knitted fabric includes an opening/closing mechanism for displacing at least a part of each guiding plate between a closed position which is proximate to the knitted fabric passing path and an open position which is further separated from the knitted fabric passing path than the closed position.

[0012] In the pull-down device of the knitted fabric according to one aspect of the present invention, a lower side of the guiding plate is a fixed end fixed to the base section, and an upper side of the guiding plate is a free end not fixed to the base section; and the opening/closing mechanism displaces an open/close section, which is a portion on an upper side of the guiding plate including the free end, between the closed position and the open position by deformation.

[0013] In the pull-down device of the knitted fabric according to another aspect of the present invention in which the guiding plate includes the open/close section, the opening/closing mechanism includes an opening/closing camshaft with an open/close cam for pressing the open/close section, and an open/close driving section for rotating the opening/closing camshaft.

[0014] In the pull-down device of the knitted fabric according to another aspect of the present invention including the opening/closing camshaft and the open/close driving section, the catching/pull-down mechanism and the open/close driving section can be configured as below.

[0015] The catching/pull-down mechanism includes a

catching member with a protrusion for catching the knitted fabric, a swing lever for moving the catching member up and down, a pull-down camshaft with a pull-down cam for swinging the swing lever up and down, and a pull-down driving section for rotating the pull-down camshaft. The catching-pull-down mechanism catches and pulls down the knitted fabric with the catching member that is moved up and down by rotating the pull-down camshaft in a specific direction (forward rotating direction).

[0016] The open/close driving section includes a main driving pulley, a driven pulley that is arranged on the opening/closing camshaft and that follows the rotation of the main driving pulley, and a one-way rotating mechanism for rotating the main driving pulley accompanying the rotation of the pull-down camshaft in a direction (reverse rotating direction) opposite to the specific direction (forward rotating direction), and preventing the main driving pulley from cooperatively operating with the rotation of the pull-down camshaft in the specific direction (forward rotating direction).

[0017] The pull-down device of the knitted fabric according to another aspect of the present invention further includes a spacing adjustment mechanism for adjusting spacing of the pair of base sections by changing the position of the base section with respect to the flat knitting machine. The spacing adjustment mechanism may include a fixed bracket fixed to the flat knitting machine, a movable bracket fixed to the base section, a shaft extending in opposing direction of the pair of base sections to couple the fixed bracket and the movable bracket, an adjustment member for a manufacturer for moving the shaft along its axial direction, and changing the position of the movable bracket with respect to the fixed bracket with the shaft, and an adjustment member for a user for moving the movable bracket along the axial direction of the shaft, and changing the position of the movable bracket with respect to the fixed bracket.

[Effects of the Invention]

[0018] The pull-down device of the knitted fabric of the present invention has a configuration in which the guiding plate is moved with respect to the base section, so that a mechanism for moving the base section itself during the knitting of the knitted fabric is not required as in the conventional pull-down device of the knitted fabric. As such mechanism is unnecessary, the pull-down device of the knitted fabric of the present invention becomes smaller and lighter than the conventional pull-down device of the knitted fabric by such extent, whereby the flat knitting machine mounted with the pull-down device of the knitted fabric can be made smaller and lighter.

[0019] Furthermore, the pull-down device of the knitted fabric of the present invention can be easily installed with respect to the flat knitting machine. This is because in the pull-down device of the knitted fabric of the present invention, the work of installing a mechanism for moving the base section during the knitting of the knitted fabric

on the flat knitting machine is not carried out. Moreover, in the pull-down device of the knitted fabric of the present invention, the trouble of readjusting the movement of the catching/pull-down mechanism after fixing the position of the base section can be reduced by adjusting the movement of the catching/pull-down mechanism with respect to the base section before fixing the position of the base section in the flat knitting machine. Since the base section is immovable during the knitting of the knitted fabric, the catching/pull-down mechanism can also be easily arranged at an appropriate position as long as the base section is accurately fixed at a predetermined position in the flat knitting machine.

[0020] With the guiding plate in which the upper side is the open/close section, the pull-down device of the knitted fabric in which the guiding plate can be opened/closed by simply deforming the open/close section can be achieved.

[0021] The configuration of the opening/closing mechanism can be simplified by configuring the opening/closing mechanism of the guiding plate with the opening/closing camshaft. This is because even if a plurality of guiding plates is arranged with respect to one base section, a plurality of open/close cams corresponding to each guiding plate merely needs to be arranged for one opening/closing camshaft, and the opening/closing mechanism individually corresponding to each guiding plate does not need to be arranged.

[0022] The opening/closing camshaft for opening/closing the guiding plate has a configuration of cooperatively operating with the pull-down camshaft for operating the catching/pull-down mechanism, so that the opening/closing camshaft and the pull-down camshaft can be rotated with one driving source (e.g., motor). That is, both the opening/closing mechanism and the catching/pull-down mechanism can be driven with one driving source. Furthermore, the opening/closing camshaft is prevented from rotating during the rotation of the pull-down camshaft in the forward rotating direction by the one-way rotating mechanism, so that the guiding plate is not opened/closed when the knitted fabric is pulled down by the catching/pull-down mechanism, and the holding of the knitted fabric by the guiding plate does not become unstable.

[0023] The spacing of the pair of base sections (base spacing) in the pull-down device of the knitted fabric is adjusted in the factory. There is also a need for the user to adjust the base spacing as the thickness of the knitted fabric differs depending on the knitted fabric to be knitted. With respect to such needs, the spacing adjustment mechanism according to the present invention integrally includes the spacing adjustment mechanism for a manufacturer and the spacing adjustment mechanism for a user. Thus, the spacing adjustment mechanism becomes compact compared to the conventional one, and the spacing adjustment mechanism can be applied to the pull-down device of the knitted fabric in the flat knitting machine to enhance the productivity of the flat knitting

machine including cost and assembly workability.

BRIEF DESCRIPTION OF THE DRAWINGS

5 **[0024]**

Fig. 1 is a schematic perspective view showing one part of a pull-down device of a knitted fabric shown in an embodiment;

10 Fig. 2 is a schematic view showing an internal structure of the pull-down device of the knitted fabric of Fig. 1;

15 Figs. 3A and 3B are schematic explanatory views of an opening/closing mechanism arranged on the pull-down device of the knitted fabric of Fig. 1, where Fig. 3A is a view showing a state in which an open/close section of a guiding plate is at an open position, and Fig. 3B is a view showing a state in which the open/close section of the guiding plate is at a closed position;

20 Figs. 4A to 4C are schematic explanatory views showing the operation of the catching/pull-down mechanism arranged in the pull-down device of the knitted fabric of Fig. 1 in sequence;

25 Fig. 5A is a schematic front view of a spacing adjustment mechanism arranged in the pull-down device of the knitted fabric, and Fig. 5B is a bottom view of the spacing adjustment mechanism;

30 Figs. 6A to 6C are three views of a fixed bracket arranged in the spacing adjustment mechanism, where Fig. 6A is a front view, Fig. 6B is a right side view, and Fig. 6C is a bottom view;

35 Figs. 7A to 7C are three views of a movable bracket arranged in the spacing adjustment mechanism, where Fig. 7A is a front view, Fig. 7B is a right side view, and Fig. 7C is a bottom view;

Fig. 8 is a cross-sectional view taken along line A-A of Fig. 5B;

40 Figs. 9A and 9B are schematic views of an eccentric collar, which is an adjustment member for a user arranged in the spacing adjustment mechanism, where Fig. 9A is a front view and Fig. 9B is a top view;

Fig. 10 is an explanatory view for describing the movement of the movable bracket by the eccentric collar; and

45 Fig. 11 is a schematic view of a conventional pull-down device of a knitted fabric.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

50 **[0025]** Hereinafter, a pull-down device of a knitted fabric according to an embodiment will be described based on the drawings.

55

<First Embodiment>

<<Overall configuration>>

[0026] Similar to the conventional pull-down device 200 of the knitted fabric shown in Fig. 11, a pull-down device of a knitted fabric according to an embodiment is a device for catching and pulling down a knitted fabric drooped from a needle bed gap portion GP formed between a front needle bed FB and a back needle bed BB. Fig. 1 is a schematic perspective view showing one part of a portion arranged on a lower side of the back needle bed of the flat knitting machine in a pull-down device 100 of the knitted fabric. In the actual pull-down device 100 of the knitted fabric, the configuration similar to the illustrated configuration is continued to the left side in the plane of drawing, and a configuration similar to the illustrated configuration is also provided at a position facing the illustrated configuration (i.e., position on the lower side of the front needle bed).

[0027] Similar to the conventional pull-down device 200 (see Fig. 11) of the knitted fabric, the pull-down device 100 of the knitted fabric according to the embodiment includes the base section 1, the guiding plate 2, and the catching/pull-down mechanism 3. Opposed to the conventional configuration, the pull-down device 100 of the knitted fabric is configured such that the guiding plate 2 is arranged at the open position or the closed position when the upward portion of the guiding plate 2 is displaced with respect to the base section 1, without the base section 1 being displaced with respect to the flat knitting machine. Each configuration of the pull-down device 100 of the knitted fabric will be described in detail below.

«Base section»

[0028] The base section 1 is a section to become the base of the pull-down device 100 of the knitted fabric, and interiorly accommodates a great number of catching/pull-down mechanisms 3, to be described later. The base section 1 is arranged on a lower side of the needle bed in the flat knitting machine. The base section 1 is fixed to the lower end portion and the like of a main body frame or a main body bed of the flat knitting machine by way of a spacing adjustment mechanism 5 (Fig. 2). The spacing adjustment mechanism 5 will be described later with reference to Fig. 5A to Fig. 10.

[0029] An open/close driving section 41 for driving an opening/closing mechanism 4, to be described later, is arranged at one end side (right side end in Fig. 1) in an extending direction of the base section 1. The open/close driving section 41 will be described later.

«Guiding plate»

[0030] As shown in Figs. 1 and 2, the lower side of the guiding plate 2 is a fixed end fixed to the base section 1

with a screw 2B, and the upper side of the guiding plate 2 is a free end not fixed to the base section 1. The portion on the upper side of the guiding plate 2 including the free end is an open/close section 20 that is displaced between an open position (see Fig. 3A) and a closed position (see Fig. 3B) by being elastically deformed. The open/close section 20 includes a portion (proximal portion 20a) that is most proximate to the knitted fabric and substantially parallel to the knitted fabric passing path 101 at the closed position shown in Fig. 3B. The portion closer to the free end side than the proximal portion 20a in the open/close section 20 is bent in a direction of moving away from the knitted fabric passing path 101, and then further bent toward the lower side, as shown in Figs. 2 and 3A and 3B. Thus, when the guiding plate 2 is viewed from the side, the guiding plate 2 has a shape bent to a substantially J-shape.

[0031] As shown in a partially enlarged view surrounded by a dotted line in Fig. 1, the open/close section 20 of the guiding plate 2 is formed with a plurality of slits 2S. A needle (protrusion) 33N arranged on a catching member 33 of the catching/pull-down mechanism 3, to be described later, is inserted to the slit 2S. As the needle 33N projects out from the guiding plate 2 through the slit 2S, the knitted fabric facing the guiding plate 2 can be caught by the catching member 33.

[0032] The guiding plate 2 of the present example is configured such that the open/close section 20 is displaced with respect to the base section 1. The open/close section 20 is displaced by the opening/closing mechanism 4, to be described later. A situation where the open/close section 20 is displaced to the open position by the opening/closing mechanism 4 includes when carrying out transfer of stitches involving racking in the middle of pulling down the knitted fabric other than when the set up device passes the open/close section 20 (not shown).

«Catching/pull-down mechanism»

[0033] The catching/pull-down mechanism 3 is a mechanism that catches the knitted fabric facing the guiding plate 2 and pulls down the knitted fabric toward the lower side, and can use a known configuration shown in, for example, Patent Document 1. The catching/pull-down mechanism 3 includes the catching member 33 with a needle for catching the knitted fabric, and moves the catching member 33 up and down to pull down the knitted fabric toward the lower side. When the guiding plate 2 is at the open position, the catching member 33 is always withdrawn to a position (position of point A of Fig. 3B, to be described later) separated from the knitted fabric passing path 101, so that the needle 33N of the catching member 33 does not get caught in the knitted fabric. The details of the catching/pull-down mechanism 3 of the present example will be described later.

<<Opening/closing mechanism>>

[0034] The opening/closing mechanism 4 will be described mainly with reference to Fig. 1, Figs. 3A and 3B. Figs. 3A and 3B show only the configuration related to the guiding plate 2 and the opening/closing of the guiding plate 2.

[0035] As shown in Fig. 1, the opening/closing mechanism 4 of the present example includes an opening/closing camshaft 40, and the open/close driving section 41 for rotating the opening/closing camshaft 40. The opening/closing camshaft 40 is inserted to the inside of the open/close section 20 (portion bent to a substantially J-shape) of the guiding plate 2, and is supported by a shaft supporting section 10, which is a part of the base section 1, as shown in Figs. 3A and 3B. The opening/closing camshaft 40 includes a plurality of open/close cams 40C that presses the open/close section 20 from the inside. Each open/close cam 40C is spaced apart in a longitudinal direction of the opening/closing camshaft 40, and is configured such that the two open/close cams 40C press the open/close section 20 of one guiding plate 2.

[0036] The open/close driving section 41 is not particularly limited as long as the opening/closing camshaft 40 can be rotated, but in the present example, a driving source that operates the catching/pull-down mechanism 3 is used. The detailed configuration thereof will be described later in a specific section.

[0037] As shown in Fig. 3A, the open/close cam 40C of the present example is an eccentric cam which center is shifted from the shaft center of the opening/closing camshaft 40. In the present example, a projecting portion, which projects out toward the radially outer side of the opening/closing camshaft 40, of the open/close cam 40C presses a far end portion 20b (distal end portion of the J-shape of the open/close section 20) of the open/close section 20 of the guiding plate 2 from the inner side. In the state shown in Fig. 3A, the open/close cam 40C presses the far end portion 20b of the open/close section 20 of the guiding plate 2 from the inward side toward the outward side (side of moving away from the knitted fabric passing path 101). As a result, the open/close section 20 of the guiding plate 2 is elastically deformed, and the proximal portion 20a of the open/close section 20 is arranged at a position (open position) separated from the knitted fabric passing path 101. The open/close cam 40C is not limited to the eccentric cam, and may be a substantially elliptical cam like a pull-down cam 39C, to be described later.

[0038] When the opening/closing camshaft 40 is rotated 180° from the state of Fig. 3A, the projecting portion of the open/close cam 40C is arranged on the side of the knitted fabric passing path 101, and a state in which a portion smoothly connected to the outer peripheral surface of the opening/closing camshaft 40 in the open/close cam 40C supports the far end portion 20b from the inside thereof (pressed state) is obtained, as shown in Fig. 3B. At this point, the far end portion 20b is displaced closer

to the side of the knitted fabric passing path 101 than the position shown in Fig. 3A, and the proximal portion 20a connecting to the far end portion 20b is also displaced to the position (closed position) proximate to the knitted fabric passing path 101. Among the plurality of open/close cams 40C lined in the axial direction of the opening/closing camshaft 40, the radial orientation (phase) of the projecting portion of some open/close cams 40C may be changed. In such a manner, among the plurality of guiding plates 2 lined in the depth direction in the plane of drawing, some guiding plates 2 can be arranged at the closed position and the other guiding plates 2 can be arranged at the open position.

[0039] When the proximal portion 20a is displaced to the closed position shown in Fig. 3B, the catching member 33 of the catching/pull-down mechanism 3 is moved from the position (withdrawing position) of point A to the position (knitted fabric catching position) of point B to catch the knitted fabric with the needle 33N of the catching member 33. As a force of the catching member 33 to move from the position of point B to the position (lower end position) of point C by its own weight acts on the knitted fabric, the knitted fabric caught by the catching member 33 is pulled down toward the lower side. That is, the trace of the catching member 33 of point A → point B → point C is the catching trace of catching and pulling down the knitted fabric.

[0040] The catching member 33 that pulled down the knitted fabric drawing the catching trace is moved from point C to point B, and further moved from point B to the position of point A by the configuration to be described later. Since the needle 33N of the catching member 33 is extended toward the diagonally lower side, the needle 33N of the catching member 33 is removed from the knitted fabric while the catching member 33 moves from point C to point B. That is, the trace of the catching member 33 of point C → point B → point A is the non-catching trace in which the knitted fabric is not caught. Thus, the catching member 33 can pull down the knitted fabric by repeating the movement along the catching trace and the movement along the non-catching trace.

«Effect»

[0041] The pull-down device 100 of the knitted fabric having the configuration described above is small and light compared to the conventional pull-down device of the knitted fabric. This is because in the pull-down device 100 of the knitted fabric of the present example, a configuration of displacing one part (open/close section 20) of the guiding plate 2 with respect to the base section 1 is adopted, and hence the pull-down device 100 of the knitted fabric of the present example does not require a configuration of moving the base section 1 itself as in the conventional configuration. In addition, the work of installing the configuration of moving the base section 1 is not carried out, whereby the pull-down device 100 of the knitted fabric can be easily installed on the flat knitting

machine.

[0042] According to the configuration of the present example, the fixing position of the base section 1 is accurately determined, so that the catching/pull-down mechanism 3 can be arranged at an appropriate position. Thus, the trouble of readjusting the position of the catching/pull-down mechanism 3 (projection amount of the needle 33N from the guiding plate 2, spacing of opposing needles 33N, etc.) after installing the base section 1 on the flat knitting machine can be reduced.

<<Other configurations>>

[0043] In the pull-down device 100 of the knitted fabric of the present example, one part of the catching/pull-down mechanism 3 is used to configure the open/close driving section 41 for operating the opening/closing mechanism 4 (see Fig. 1). Hereinafter, the configuration of the catching/pull-down mechanism 3 and the configuration of the open/close driving section 41 will be described.

[Catching/pull-down mechanism]

[0044] As shown in Fig. 2, the catching/pull-down mechanism 3 of the present example is configured by a plurality of slide mechanism units 3α for catching and pulling down the knitted fabric while sliding in the up and down direction, a swing mechanism unit 3β for moving the slide mechanism unit 3α up and down, and a holding mechanism unit 3γ for holding the slide position of the slide mechanism unit 3α at a specific position. In addition, the catching/pull-down mechanism 3 may include a pull-down force adjusting mechanism unit (not shown). A known configuration can be used for the pull-down force adjusting mechanism unit.

[[Slide mechanism unit]]

[0045] Two slide mechanism units 3α are arranged for one guiding plate 2 (see also Fig. 1). Each slide mechanism unit 3α includes a slide seating 30 fixed to the base section 1, and a slider 31 supported to be slidable in the up and down direction on the slide seating 30. A supporting member 32 for supporting the catching member 33 and a weight 34 is fixed on the slider 31 (see also Fig. 1 for the catching member 33 and the weight 34). The supporting member 32 has substantially the same width as the catching member 33 in the depth direction in the plane of drawing, and includes a roller 32R at a position on the near side in the plane of drawing in the relevant width direction.

[0046] The catching member 33 is supported to be swingable in the right and left direction in the plane of drawing (direction of approaching the knitted fabric passing path 101 and direction of moving away from the knitted fabric passing path 101) by way of a shaft portion S1. The needle 33N is provided at the portion on the upper

end side of the catching member 33, so that the knitted fabric can be caught with the needle 33N (see also Fig. 1). The catching member 33 includes a long arm 33A arranged on the far side in the plane of drawing, where a shaft portion S2 extending in the depth direction in the plane of drawing provided at the upper end of the arm 33A is fitted into a slit 32S of the supporting member 32. The shaft portion S2 includes a roller 33R that makes contact with a nail member 11 arranged on the upper side of the base section 1 when the catching member 33 is sled toward the upper side. The nail member 11 is inclined in the direction of separating from the knitted fabric passing path 101 from the lower end toward the upper end. Thus, when the catching member 33 is sled toward the upper side, the roller 33R of the catching member 33 is moved along the inclination of the nail member 11, and the portion on the upper end side of the catching member 33 is swung in the rightward direction in the plane of drawing (direction of moving away from the knitted fabric passing path 101) within the length range of the slit 32S. The portion on the lower side of the shaft portion S1 in the arm 33A serves as a pendulum that energizes the portion on the upper end side of the catching member 33 toward the knitted fabric passing path 101. Thus, when the catching member 33 is sled toward the lower side from the position at the slide upper end thereof, the roller 33R of the catching member 33 is moved along the nail member 11, and the portion on the upper end side of the catching member 33 is swung in the leftward direction in the plane of drawing (direction of approaching the knitted fabric passing path 101). The portion on the lower side of the arm 33A does not make contact with a swing lever 38 of the swing mechanism unit 3β , to be described later.

[[Swing mechanism unit]]

[0047] The swing mechanism unit 3β includes a substantially L-shaped swing lever 38, and a pull-down camshaft 39. One swing lever 38 is arranged for one slide mechanism unit 3α . The swing lever 38 has one end axially supported by the base section 1 by way of a shaft portion S3, and the other end swingable in the up and down direction. The other end of the swing lever 38 supports the roller 32R, which is arranged at the lower end of the supporting member 32 of the slide mechanism unit 3α , from the lower side. Thus, when the other end is swung toward the upper side, the supporting member 32 and the catching member 33 arranged on the supporting member 32 are moved toward the upper side. The swing lever 38 includes a roller 38R at the position of the intermediate portion thereof. Furthermore, a slit 38S, which passes through in the up and down direction in the plane of drawing, is formed at the portion on the other end side of the roller 38R in the swing lever 38.

[0048] The pull-down camshaft 39 of the swing mechanism unit 3β is a member including a plurality of pull-down cams 39C for swinging the other end of the swing

lever 38 up and down. One pull-down camshaft 39 is arranged for one base section 1. Each pull-down cam 39C arranged on the pull-down camshaft 39 is formed to a substantially elliptical shape, and corresponds to each swing lever 38 (pull-down cam 39C may be an eccentric cam). The timing to pull down the knitted fabric by each slide mechanism unit 3 α can be shifted by changing the radial orientation (phase) of the projecting portion of each pull-down cam 39C. A state in which the knitted fabric is always caught by one of the plurality of catching members 33 lined in the depth direction in the plane of drawing is obtained by shifting the timing of each slide mechanism unit 3 α . As a result, the downward tension can be continuously acted on the knitted fabric while knitting the knitted fabric, so that the knitting state of the knitted fabric can be stabilized.

[0049] The pull-down camshaft 39 of the swing mechanism unit 3 β can be rotated by a driving source (pull-down driving section) (not shown) such as a motor and the like, for example. With the motor, the pull-down camshaft 39 can be rotated in any direction.

[[Holding mechanism unit]]

[0050] The holding mechanism unit 3 γ has a distal end portion 36 formed to a L-shape and projected out toward the near side in the plane of drawing, where the distal end portion 36 is configured to fix the position of the catching member 33 arranged on the supporting member 32 to a specific position by engaging with the inner side surface of the supporting member 32 of the slide mechanism unit 3 α , and a known configuration can be used. The holding mechanism unit 3 γ can use an electromagnetic configuration that uses a solenoid. The specific position may be point A or a position close to point A, and point B or a position close to point B in Fig. 3B. The former position is the position (withdrawing position) of withdrawing the catching member 33 from the knitted fabric passing path 101. The latter position is the position (knitted fabric catching position) of maintaining the state in which the knitted fabric is caught with the catching member 33. For example, when stopping the knitting of the sleeve and carrying out only the knitting of the body in the knitting of the sweater, the catching member 33 for catching the sleeve is fixed at point B or the position close to point B, and the catching member 33 for catching the body is moved. The sleeve is thus not pulled toward the lower side with the knitting of the body, and the stitches of the sleeve can be avoided from stretching.

[[Operation order]]

[0051] The operation of the catching/pull-down mechanism 3 having the configuration described above will now be described based on Figs. 4A to 4C. Fig. 4A shows a state in which the catching member 33 is projected up toward the most upper side and withdrawn from the knitted fabric passing path 101, Fig. 4B shows a state in

which the catching member 33 is located proximate to the knitted fabric passing path 101 and the knitted fabric is caught, and Fig. 4C shows a state in which the catching member 33 is located at the lowermost side. The positions of the catching member 33 in Figs. 4A, 4B, and 4C correspond to the positions of point A, point B, and point C of Fig. 3B.

[0052] In Fig. 4A, the roller 38R of the swing lever 38 is projected up toward the vertically upper side by a projection end of the pull-down cam 39C, so that the other end (end on the opposite side of the shaft portion S3) of the swing lever 38 is swung toward the upper side. The other end of the swing lever 38 projects up the roller 32R at the lower end of the supporting member 32, and slides the catching member 33 arranged on the supporting member 32 toward the upper side. In this case, the roller 33R arranged at the upper end of the arm 33A of the catching member 33 is moved along the nail member 11 of the base section 1, and the catching member 33 is raised in the direction of moving away from the knitted fabric passing path 101.

[0053] When the pull-down camshaft 39 is rotated in the counterclockwise direction (specific direction) from the state of Fig. 4A, the projection end of the pull-down cam 39C shifts from the roller 38R and the other end of the swing lever 38 lowers, as shown in Fig. 4B. Accompanying therewith, the upper end portion (portion where the needle 33N is arranged) of the catching member 33 is swung toward the knitted fabric passing path 101 while the catching member 33 is lowered.

[0054] When the pull-down camshaft 39 is further rotated in the counterclockwise direction, the projecting portion of the pull-down cam 39C is fitted into the slit 38S of the swing lever 38 so that the other end of the swing lever 38 is in the most lowered state, as shown in Fig. 4C. In this case, the catching member 33 is also lowered to the position to be supported by the other end of the swing lever 38.

[0055] When the pull-down camshaft 39 is further rotated in the counterclockwise direction, the catching member 33 is held at the position of point C until the projecting portion of the pull-down cam 39C makes contact with the swing lever 38. As the swing lever 38 is gradually projected up by the projecting portion of the pull-down cam 39C, the catching member 33 is moved along point C $\rightarrow$ point B $\rightarrow$ point A. Thus, when the pull-down camshaft 39 is rotated in the counterclockwise direction (forward rotating direction), the catching member 33 repeats the movement along point A $\rightarrow$ point B $\rightarrow$ point C (catching trace) and the movement along point C $\rightarrow$ point B $\rightarrow$ point A (non-catching trace), as shown in Fig. 3B, so that the knitted fabric is pulled down.

[Open/close driving section]

[0056] As shown in Fig. 1, the open/close driving section 41 of the present example includes a main driving pulley 41A, a driven pulley 41B, an endless belt 41C, and

a one-way rotating mechanism 41D. The main driving pulley 41A is arranged in a freely rotating manner on the side surface of the base section 1, and includes a gear portion at its distal end. The driven pulley 41B is a member that is rotated following the rotation of the main driving pulley 41A by the endless belt 41C such as a timing belt and the like bridged between the main driving pulley 41A and the driven pulley 41B. The driven pulley 41B is arranged on the opening/closing camshaft 40, and the opening/closing camshaft 40 is also rotated with the rotation of the driven pulley 41B. The one-way rotating mechanism 41D rotates the main driving pulley 41A when the pull-down camshaft 39 is rotated in the clockwise direction, and prevents the main driving pulley 41A from cooperatively moving with the rotation of the pull-down camshaft 39 when the pull-down camshaft 39 is rotated in the counterclockwise direction.

[0057] The one-way rotating mechanism 41D of the present example is configured by a gear member arranged on the outer periphery of the pull-down camshaft 39 on the outer side of the base section 1. A mechanism that co-rotates the gear member when the pull-down camshaft 39 is rotated in the clockwise direction, and idles the pull-down camshaft 39 with respect to the gear member when the pull-down camshaft 39 is rotated in the counterclockwise direction is arranged inside the gear member. Such mechanism includes, for example, a one-way clutch mechanism, a ratchet mechanism and the like.

[Effects of other configurations]

[0058] According to the catching/pull-down mechanism 3 and the open/close driving section 41 of the opening/closing mechanism 4 described above, when the pull-down camshaft 39 is rotated in the clockwise direction, the gear member configuring the one-way rotating mechanism 41D is also rotated in the clockwise direction. The main driving pulley 41A including a gear portion that meshes with the gear member is rotated in the counterclockwise direction, and the driven pulley 41B is also rotated in the counterclockwise direction by the endless belt 41C bridged between the main driving pulley 41A and the driven pulley 41B. The opening/closing camshaft 40 is also rotated in the counterclockwise direction with the driven pulley 41B, and the open/close section 20 of the guiding plate 2 is opened/closed by the open/close cam 40C. As described above, the opening/closing mechanism 4 can also be operated with the driving source (pull-down driving section) for operating the catching/pull-down mechanism 3 according to the above configuration, while the catching/pull-down mechanism 3 and the opening/closing mechanism 4 normally require separate driving sources.

[0059] Furthermore, since the one-way rotating mechanism 41D is formed in the open/close driving section 41 of the present example, the gear member of the one-way rotating mechanism 41D does not rotate when the pull-

down camshaft 39 is rotated in the counterclockwise direction to pull down the knitted fabric with the catching member 33. In other words, the main driving pulley 41A including the gear portion that meshes with the gear member is also not rotated, and hence the opening/closing mechanism 4 is not operated. The guiding plate 2 thus is not opened/closed when the knitted fabric is pulled down, and the holding of the knitted fabric by the guiding plate 2 does not become unstable.

«Spacing adjustment mechanism»

[0060] The spacing adjustment mechanism 5 shown in Fig. 2 will be described in detail based on Fig. 5A to Fig. 10. The spacing adjustment mechanism 5 shown in Figs. 5A and 5B is a mechanism that adjusts the spacing of the pair of base sections 1 by changing the position of the base section 1 with respect to the flat knitting machine 300. A plurality of spacing adjustment mechanisms 5 is arranged at an interval in a longitudinal direction (depth direction in the plane of drawing of Fig. 2) of the base section 1 at the position on the lower end of each base section 1. The spacing adjustment mechanism 5 includes a fixed bracket 6 fixed to the flat knitting machine 300, a movable bracket 7 fixed to the base section 1, a shaft 8 that couples the brackets 6, 7, an adjustment member 8A for a manufacturer used for the adjustment of the position of the base section 1 by the manufacturer, and an adjustment member 9 for a user used for the adjustment of the position of the base section 1 by the user. The difference between the adjustment member 8A for a manufacturer and the adjustment member 9 for a user will be described later.

[Fixed bracket]

[0061] As shown in Figs. 6A to 6C, the fixed bracket 6 includes an FB main body portion 60, a flat attachment portion 69 arranged at the upper end of the FB main body portion 60, and a first leg piece 61 and a second leg piece 62 arranged at the lower end of the FB main body portion 60. The first leg piece 61 and the second leg piece 62 are spaced apart in the opposing direction (right and left direction in the plane of drawing of Figs. 1 and 6A) of the pair of base sections 1. The first leg piece 61 and the second leg piece 62 include an FB shaft hole 63 through which the shaft 8 (Figs. 5A and 5B and Fig. 8), to be described later, is inserted. An axis line of the FB shaft hole 63 coincides with the axis line of the shaft 8, and also coincides with the opposing direction of the pair of base sections 1.

[0062] As shown in Fig. 6C, the first leg piece 61 is formed with an FB long hole 64 communicating with the FB shaft hole 63 from the lower end face of the first leg piece 61. A major axis direction of the FB long hole 64 is directed in a direction parallel to the axial direction of the FB shaft hole 63.

[0063] As shown in Figs. 5A and 5B, the fixed bracket

6 having the configuration described above is fixed to the lower part of the main body bed of the flat knitting machine 300 with a screw 6A.

[Movable bracket]

[0064] As shown in Figs. 7A to 7C, the movable bracket 7 includes an MB main body portion 70, an attachment portion 79 arranged at the upper end of the MB main body portion 70, and an overhang portion 72 overhung toward the side (rightward direction of Figs. 5A and 5B, and Figs. 7A, and 7C) from the MB main body portion 70. In the overhang portion 72, a portion connecting to the MB main body portion 70 is divided to two, so that a leg piece insertion hole 71 passing through in the height direction (up and down direction of Figs. 5A, 7A) of the movable bracket 7 is formed at the central part of the movable bracket 7. As shown in Fig. 5B, the first leg piece 61 of the fixed bracket 6 is inserted to the leg piece insertion hole 71 when the movable bracket 7 and the fixed bracket 6 are fitted together.

[0065] The overhang portion 72 includes an MB shaft hole 73 coaxial with and having the same diameter as the FB shaft hole 63 of the fixed bracket 6. The overhang portion 72 is formed with an MB long hole 74 communicating with the MB shaft hole 73 from the lower end face thereof. The major axis direction of the MB long hole 74 is directed in the direction orthogonal to the axial direction of the MB shaft hole 73 (up and down direction in Fig. 7C).

[0066] As shown in Figs. 5A and 5B, the movable bracket 7 having the configuration described above is fixed to the lower end of the base section 1 with a screw 7A to support the base section 1.

[Shaft]

[0067] Upon describing the shaft 8, Fig. 8 showing a cross-sectional view taken along line A-A of Fig. 5B will be mainly referenced. As shown in Fig. 8, the shaft 8 is a circular column body, and includes a first screw hole 81, a second screw hole 82, and a third screw hole 83. The first screw hole 81 is formed at the end face of the fixed bracket 6 side (right side in the plane of drawing) of the shaft 8, and the axis line thereof coincides with the axis line of the shaft 8. The second screw hole 82 is formed at the peripheral surface in the vicinity of the end on the movable bracket 7 side (left side in the plane of drawing) of the shaft 8, and the axis line thereof is orthogonal to the axis line of the shaft 8. The third screw hole 83 is formed at the peripheral surface of the intermediate portion in the length direction of the shaft 8, and the axis line thereof is parallel to the axis line of the second screw hole 82. The third screw hole 83 includes a thick diameter portion arranged on the screw head side of the third screw 8C and a narrow diameter portion having a smaller diameter than the thick diameter portion, where a screw groove is not formed in the thick diameter portion but the screw groove is formed in the narrow di-

ameter portion.

[0068] The shaft 8 is a member that couples the fixed bracket 6 and the movable bracket 7. In order to couple the brackets 6, 7, the first leg piece 61 of the fixed bracket 6 is arranged in the leg piece insertion hole 71 of the movable bracket 7, the FB shaft hole 63 of the fixed bracket 6 and the MB shaft hole 73 of the movable bracket 7 are coaxially aligned, and the shaft 8 is inserted through the FB shaft hole 63 and the MB shaft hole 73.

[0069] The first screw 8A is screwed into the first screw hole 81 of the shaft 8. A hold-down plate 8D is interposed between the screw head of the first screw 8A and the side surface of the second leg piece 62 of the fixed bracket 6. A nut 8N is attached on the movable bracket 7 side of the hold-down plate 8D in the first screw 8A. The shaft 8 is fixed to the fixed bracket 6 by way of the hold-down plate 8D and the first screw 8A. The hold-down plate 8D is fixed to the fixed bracket 6 with a fourth screw 8E (see also Figs. 5A and 5B). The shaft 8 can be advanced and retreated with respect to the fixed bracket 6 by rotating the first screw 8A. The first screw 8A is an adjustment member for a manufacturer to adjust the position of the base section 1.

[0070] A second screw (shaft fixing screw) 8B arranged in the FB long hole 64 formed in the first leg piece 61 of the fixed bracket 6 is screwed into the second screw hole 82 of the shaft 8. A washer 8W, which is greater than the FB long hole 64, is interposed between the second screw 8B and the first leg piece 61. When the second screw 8B is tightened, the lower surface portion of the first leg piece 61 is sandwiched by the screw head of the second screw 8B and the peripheral surface of the shaft 8, whereby the shaft 8 is fixed to the fixed bracket 6. When the second screw 8B is loosened, the shaft 8 can be moved with respect to the fixed bracket 6.

[0071] A third screw (movable bracket fixing screw) 8C arranged in the MB long hole 74 formed in the overhang portion 72 of the movable bracket 7 is screwed into the third hole 83 of the shaft 8. An eccentric collar 9 is interposed between the third screw 8C and the overhang portion 72. The eccentric collar 9 is an adjustment member for a user to adjust the position of the base section 1, as will be described later. When the third screw 8C is tightened, the lower surface portion of the overhang portion 72 is sandwiched by the eccentric collar 9, to be described later, and the peripheral surface of the shaft 8, whereby the movable bracket 7 is fixed with respect to the shaft 8. When the third screw 8C is loosened, the movable bracket 7 can be moved with respect to the shaft 8.

[Eccentric collar]

[0072] As shown in Figs. 9A and 9B, the eccentric collar 9 includes an accommodating portion 91 for accommodating the screw head of the third screw 8C, and a pass-through portion 92 through which the shaft portion of the third screw 8C (Fig. 8) is passed. A cylindrical eccentric

portion 93 having a center shifted from the axis line of the eccentric collar 9, and a cylindrical engagement portion 94 having a center coincided with the axis line are arranged on the outer periphery of the eccentric collar 9, as shown in Fig. 9B. As shown in Fig. 8, the eccentric portion 93 is fitted into the MB long hole 74 of the movable bracket 7, and the engagement portion 94 is fitted into the thick diameter portion of the third screw hole 83 of the shaft 8.

[Usage mode of spacing adjustment mechanism]

[0073] When the manufacturer adjusts the position of the base section 1 in a factory using the spacing adjustment mechanism 5, the second screw 8B shown in Fig. 8 is loosened, and the fixation of the shaft 8 with respect to the fixed bracket 6 is released. Then, the first screw 8A is rotated, and the shaft 8 is advanced and retreated with respect to the fixed bracket 6. Since the shaft 8 is fixed to the movable bracket 7 with the third screw 8C, the movable bracket 7 and the base section 1 (Figs. 5A and 5B) to which the movable bracket 7 is fixed are also advanced and retreated with the advancement and retreat of the shaft 8. As shown in Fig. 10, the second screw 8B is arranged to pass through the FB long hole 64, so that the movement of the first screw 8A accompanying the advancement and retreat of the shaft 8 in the length range of the FB long hole 64 is not inhibited by the fixed bracket 6.

[0074] When the user adjusts the position of the base section 1 using the spacing adjustment mechanism 5, the third screw 8C shown in Fig. 8 is loosened, the fixation of the movable bracket 7 with respect to the shaft 8 is released, and the eccentric collar 9 is rotated. As shown in Fig. 10, the center of the eccentric portion 93 indicated with an x mark is shifted with respect to the center (axis line of the eccentric collar 9) of the engagement portion 94 shown with a black dot, so that when the eccentric collar 9 is rotated, the eccentric portion 93 of the eccentric collar 9 pushes the inner wall of the MB long hole 74 of the movable bracket 7 thus changing the position of the movable bracket 7 with respect to the shaft 8. The moving range of the movable bracket 7 can be changed by the diameter of the eccentric portion 93 and the shape and size of the MB long hole 74. The user operates only the third screw 8C and the eccentric collar 9 without turning the first screw 8A and the second screw 8B. Accordingly, the origin (position to become the reference of movement of the base section 1) of the shaft 8 with respect to the fixed bracket 6 (flat knitting machine 300) adjusted by the manufacturer is maintained.

[0075] As described above, the spacing adjustment mechanism 5 of the present example is compact as the adjustment mechanism for a manufacturer and the adjustment mechanism for a user are grouped together. Thus, the productivity of the flat knitting machine 300 including the cost and the assembly workability can be enhanced, and furthermore, the weight of the flat knitting

machine 300 can be reduced by applying the spacing adjustment mechanism 5 to the pull-down device 100 of the knitted fabric in the flat knitting machine 300.

5 <Second Embodiment>

[0076] As opposed to the first embodiment, the open/close section 20 of the guiding plate 2 may be moved to the closed position by pressing the back surface (surface on the side opposite to the surface facing the knitted fabric passing path 101) of the proximal portion 20a in the open/close section 20 of Fig. 2. In this case as well, the opening/closing mechanism 4 using the opening/closing camshaft 40 can be used, similar to the first embodiment.

<Third Embodiment>

[0077] As opposed to the first and second embodiments, the open/close section 20 of the guiding plate 2 can be opened/closed with a linear motion mechanism such as a solenoid including a plunger. In this case, the current flow to the solenoid for opening/closing the open/close section 20 of each guiding plate 2 is individually controlled to independently open/close each open/close section 20. For example, the open/close section 20 of some guiding plates 2 may be arranged at the closed position, and the open/close section 20 of other guiding plates 2 may be arranged at the open position.

[0078] The entire guiding plate 2 may be configured to move in a direction of approaching the knitted fabric passing path 101 by using the linear motion mechanism. For example, the upward portion and the downward portion of the guiding plate 2 may be fixed to the base section 1 by way of the solenoid including the plunger. In this case, the entire guiding plate 2 can be moved with respect to the base section 1 by flowing current to the solenoid and operating the plunger.

Claims

1. A pull-down device (100) of a knitted fabric comprising a pair of base sections (1) installed on a lower side of a front needle bed and a back needle bed in a flat knitting machine, a guiding plate (2) arranged at a position facing a knitted fabric passing path (101) or a passage of a knitted fabric drooped from a needle bed gap portion between the front needle bed and the back needle bed on an upper side of each base section (1), and a catching/pull-down mechanism (3) for catching the knitted fabric drooped to a position facing the guiding plate (2) and pulling down the knitted fabric toward a lower side; **characterized in that** the base section (1) is fixed to the flat knitting machine; and an opening/closing mechanism (4) for displacing at

least a part of each guiding plate (2) between a closed position which is proximate to the knitted fabric passing path (101) and an open position which is further separated from the knitted fabric passing path (101) than the closed position is arranged.

2. The pull-down device (100) of the knitted fabric according to claim 1, wherein
a lower side of the guiding plate (2) is a fixed end fixed to the base section (1), and an upper side of the guiding plate (2) is a free end not fixed to the base section (1); and
the opening/closing mechanism (4) displaces an open/close section (20), which is a portion on an upper side of the guiding plate (2) including the free end, between the closed position and the open position by deformation.
3. The pull-down device (100) of the knitted fabric according to claim 2, wherein
the opening/closing mechanism (4) includes,

an opening/closing camshaft (40) with an open/close cam (40C) for pressing the open/close section (20), and
an open/close driving section (41) for rotating the opening/closing camshaft (40).
4. The pull-down device (100) of the knitted fabric according to claim 3, wherein
the catching/pull-down mechanism (3) includes,

a catching member (33) with a protrusion (33N) for catching the knitted fabric,
a swing lever (38) for moving the catching member (33) up and down,
a pull-down camshaft (39) with a pull-down cam (39C) for swinging the swing lever (38) up and down, and
a pull-down driving section for rotating the pull-down camshaft (39); wherein

the catching member (33) that is moved up and down by rotating the pull-down camshaft (39) in a specific direction catches and pulls down the knitted fabric; and
the open/close driving section (41) includes,

a main driving pulley (41A),
a driven pulley (41B) that is arranged on the opening/closing camshaft (40) and that follows the rotation of the main driving pulley (41A), and
a one-way rotating mechanism (41D) for rotating the main driving pulley (41A) accompanying the rotation of the pull-down camshaft (39) in a direction opposite to the specific direction, and preventing the main driving pulley (41A) from cooperatively moving with the rotation of the

pull-down camshaft (39) in the specific direction.

5. The pull-down device (100) of the knitted fabric according to any one of claims 1 to 4, further comprising:

a spacing adjustment mechanism (5) for adjusting spacing of the pair of base sections (1) by changing the position of the base section (1) with respect to the flat knitting machine (300); wherein
the spacing adjustment mechanism (5) includes,

a fixed bracket (6) fixed to the flat knitting machine (300),
a movable bracket (7) fixed to the base section (1),
a shaft (8) extending in opposing direction of the pair of base sections (1) to couple the fixed bracket (6) and the movable bracket (7),
an adjustment member (8A) for a manufacturer for moving the shaft (8) along its axial direction, and changing the position of the movable bracket (7) with respect to the fixed bracket (6) with the shaft (8), and
an adjustment member (9) for a user for moving the movable bracket (7) along the axial direction of the shaft (8), and changing the position of the movable bracket (7) with respect to the fixed bracket (6).

Fig. 1

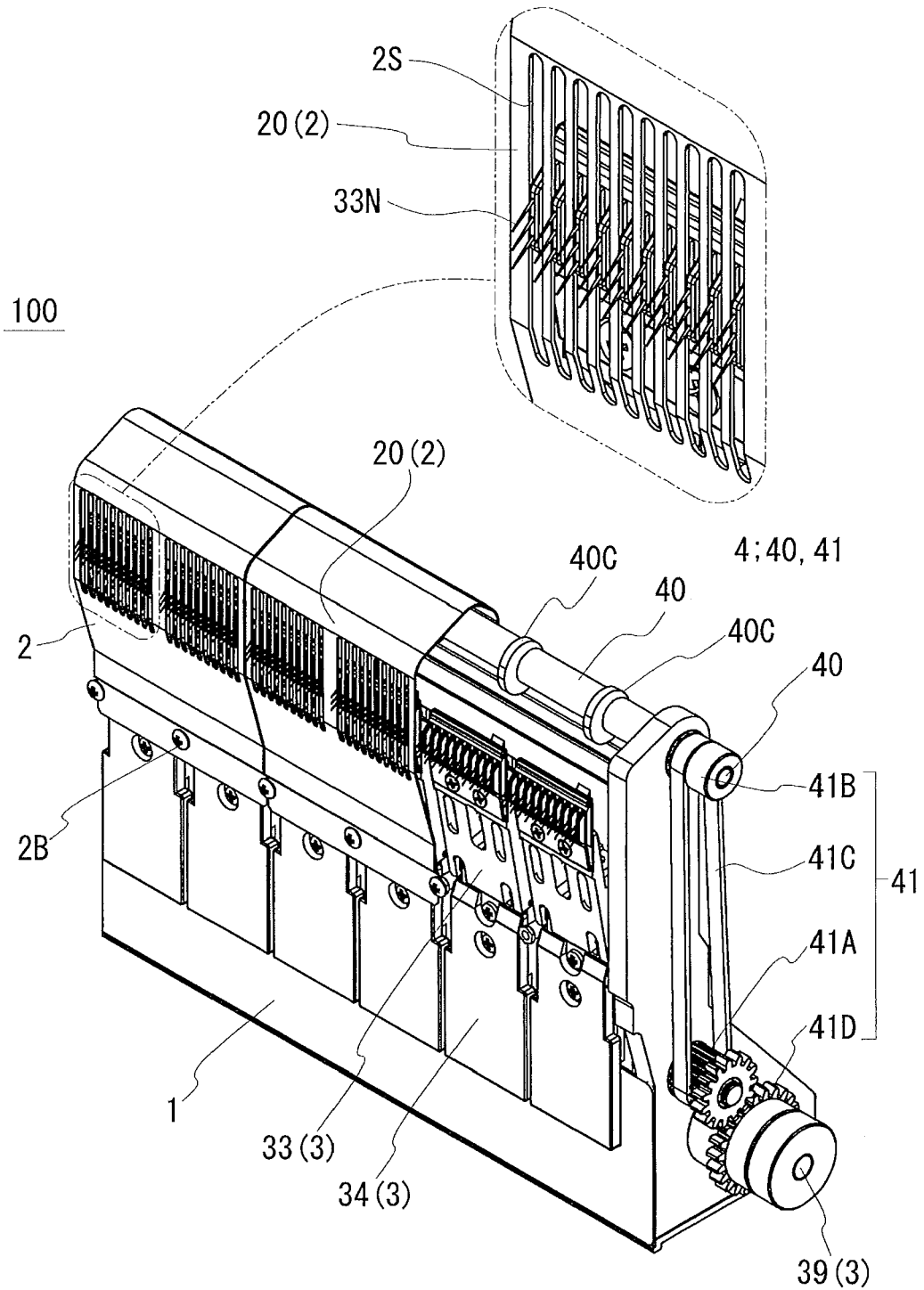


Fig. 2

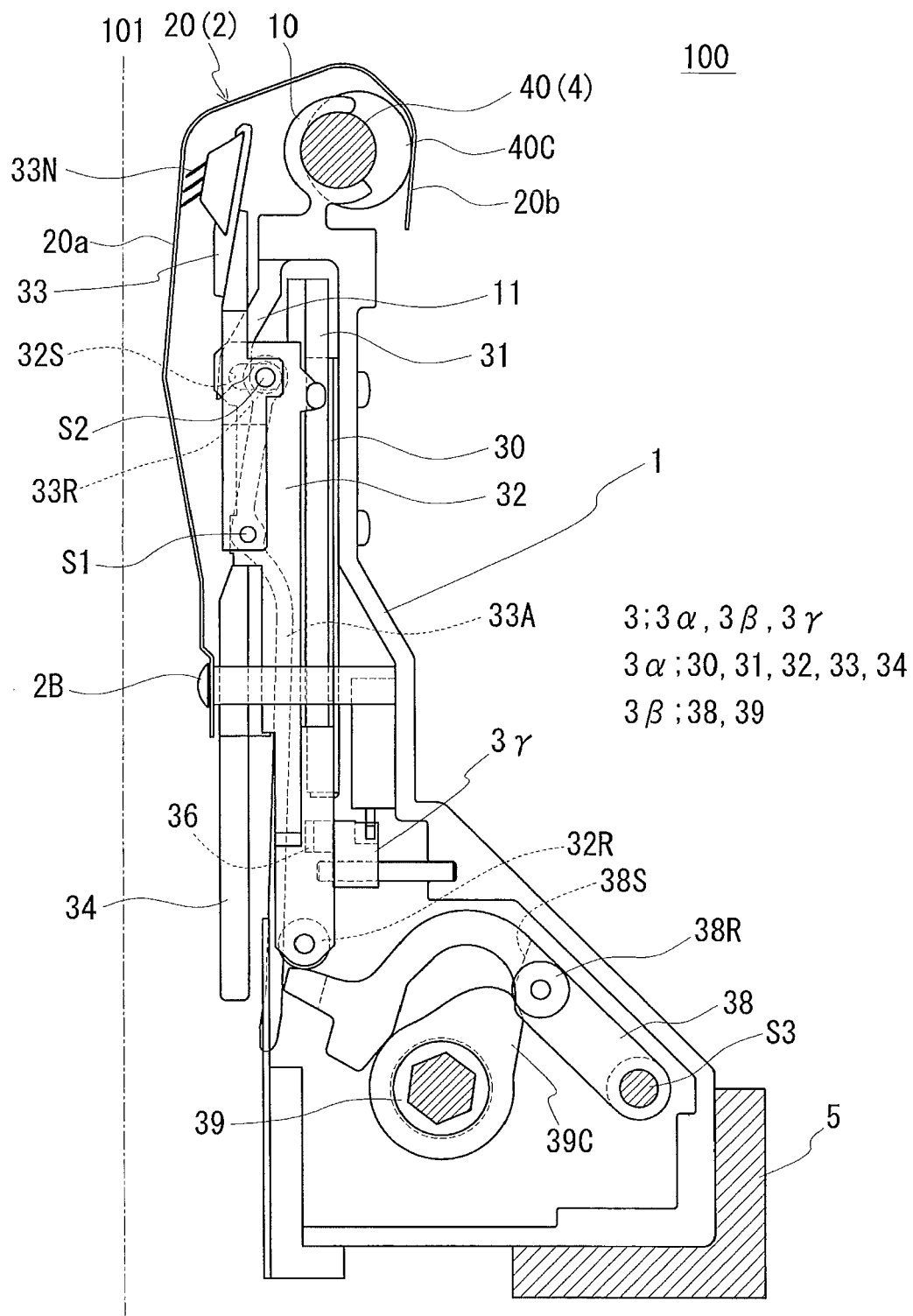


Fig. 3

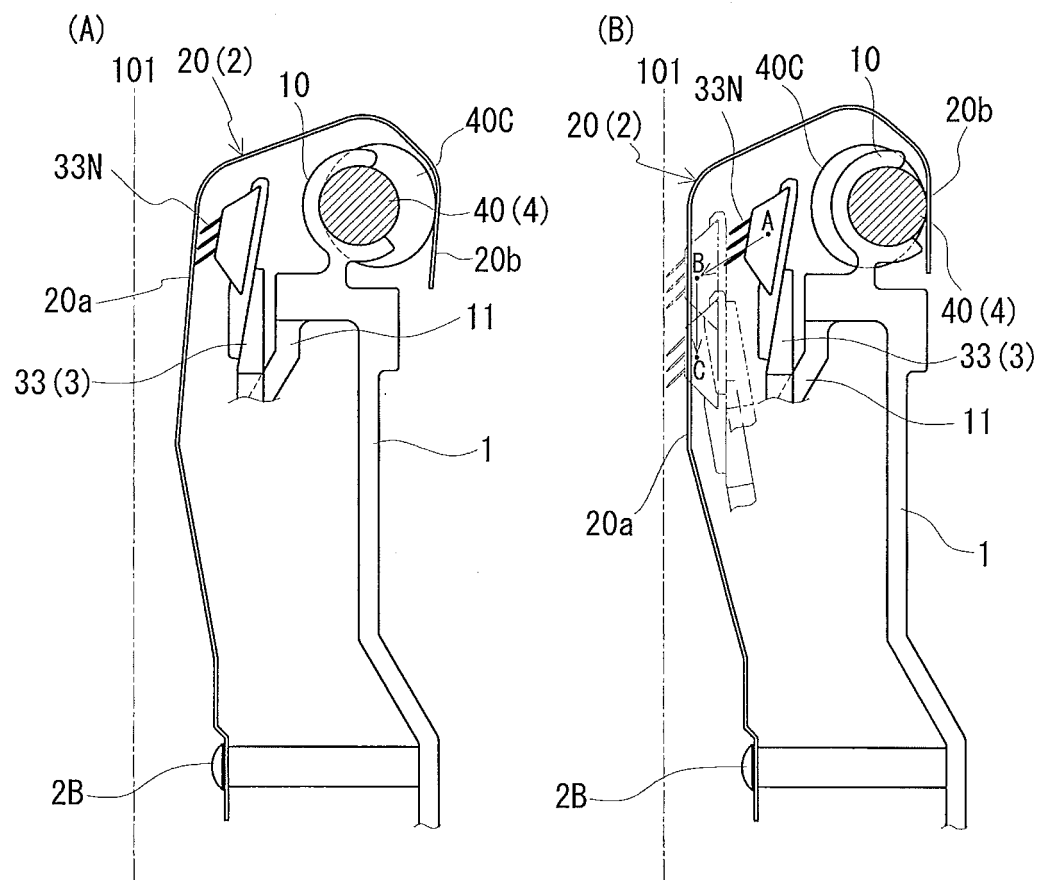


Fig. 4

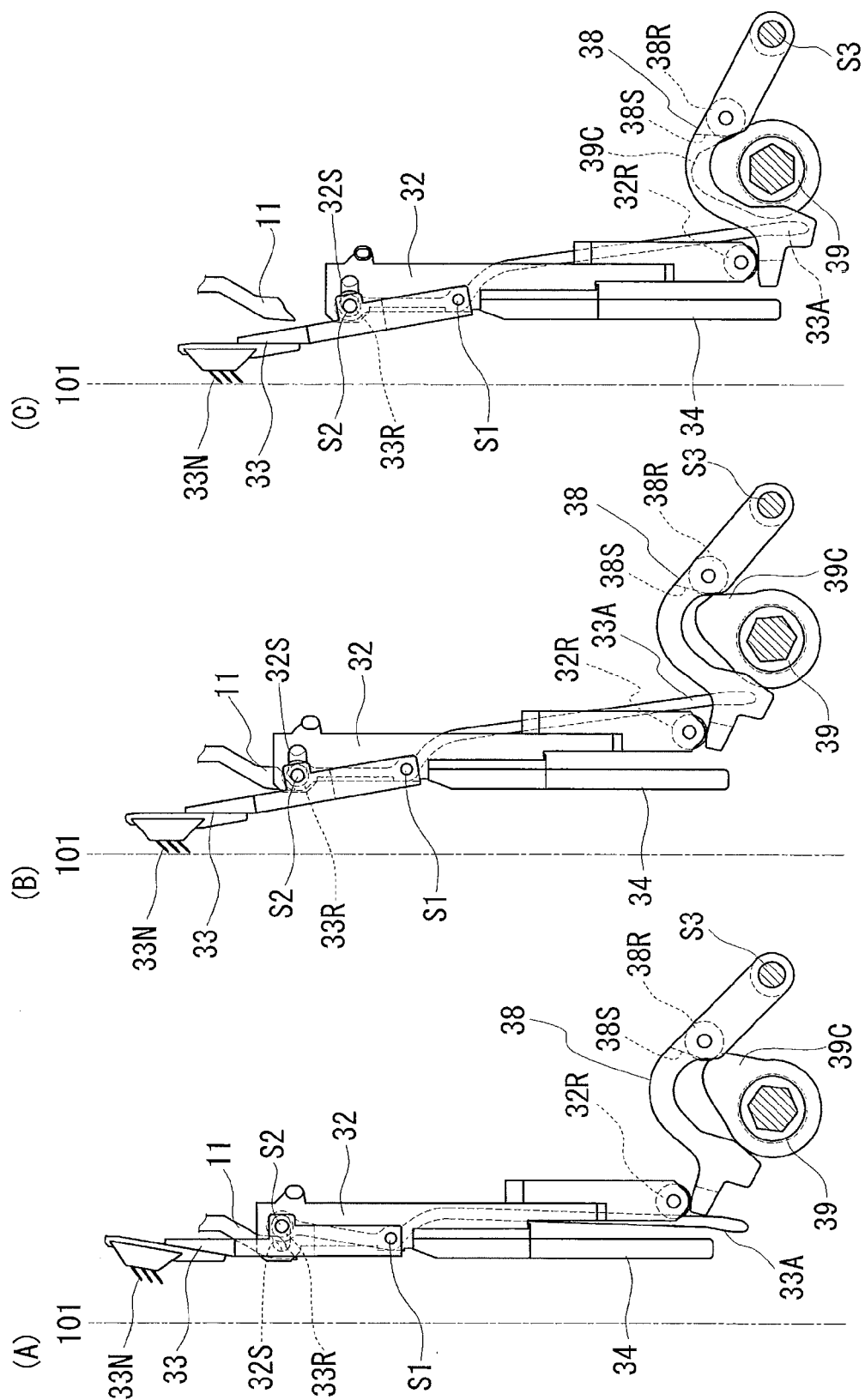
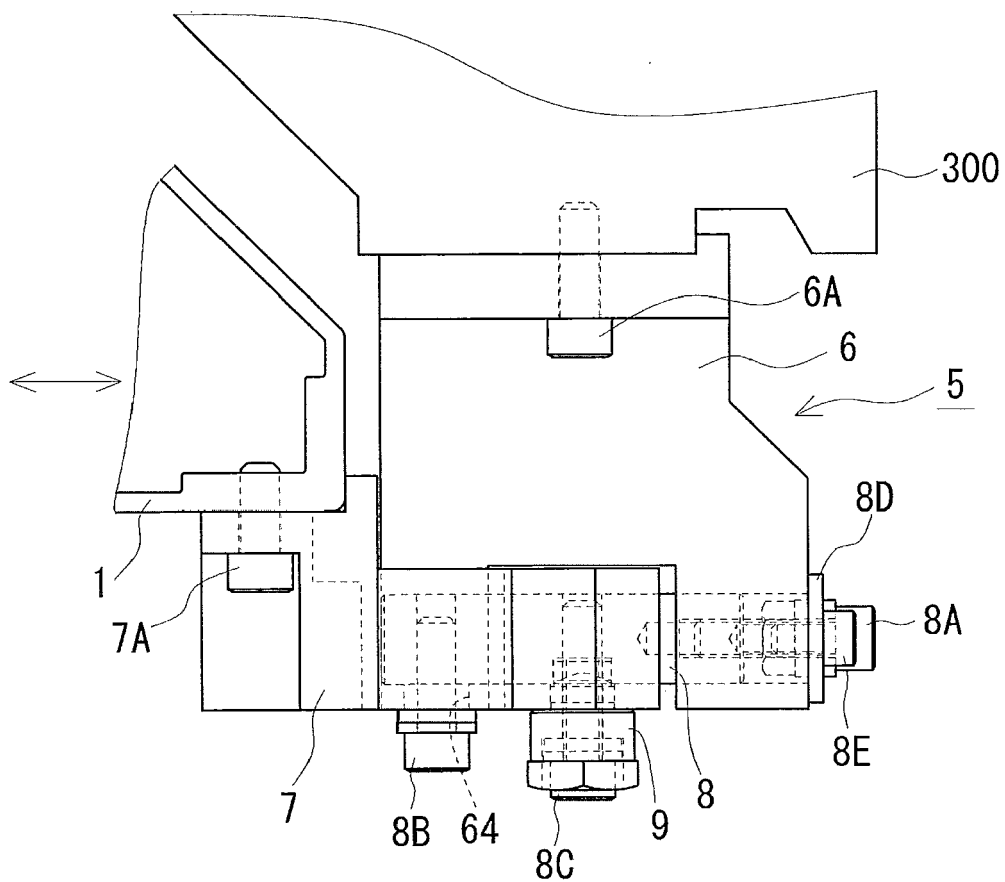


Fig. 5

(A)



(B)

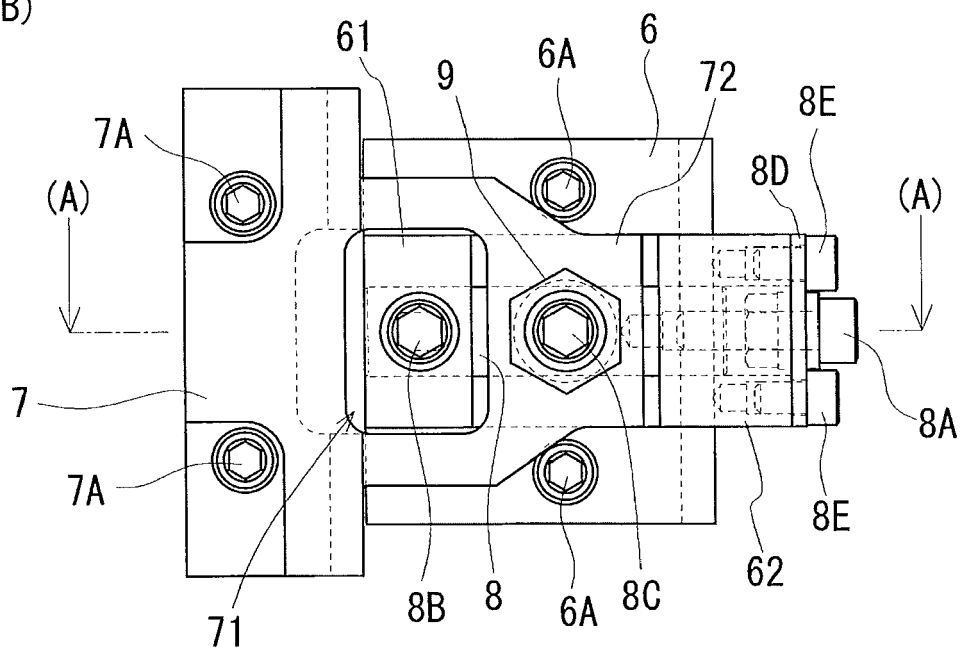


Fig. 6

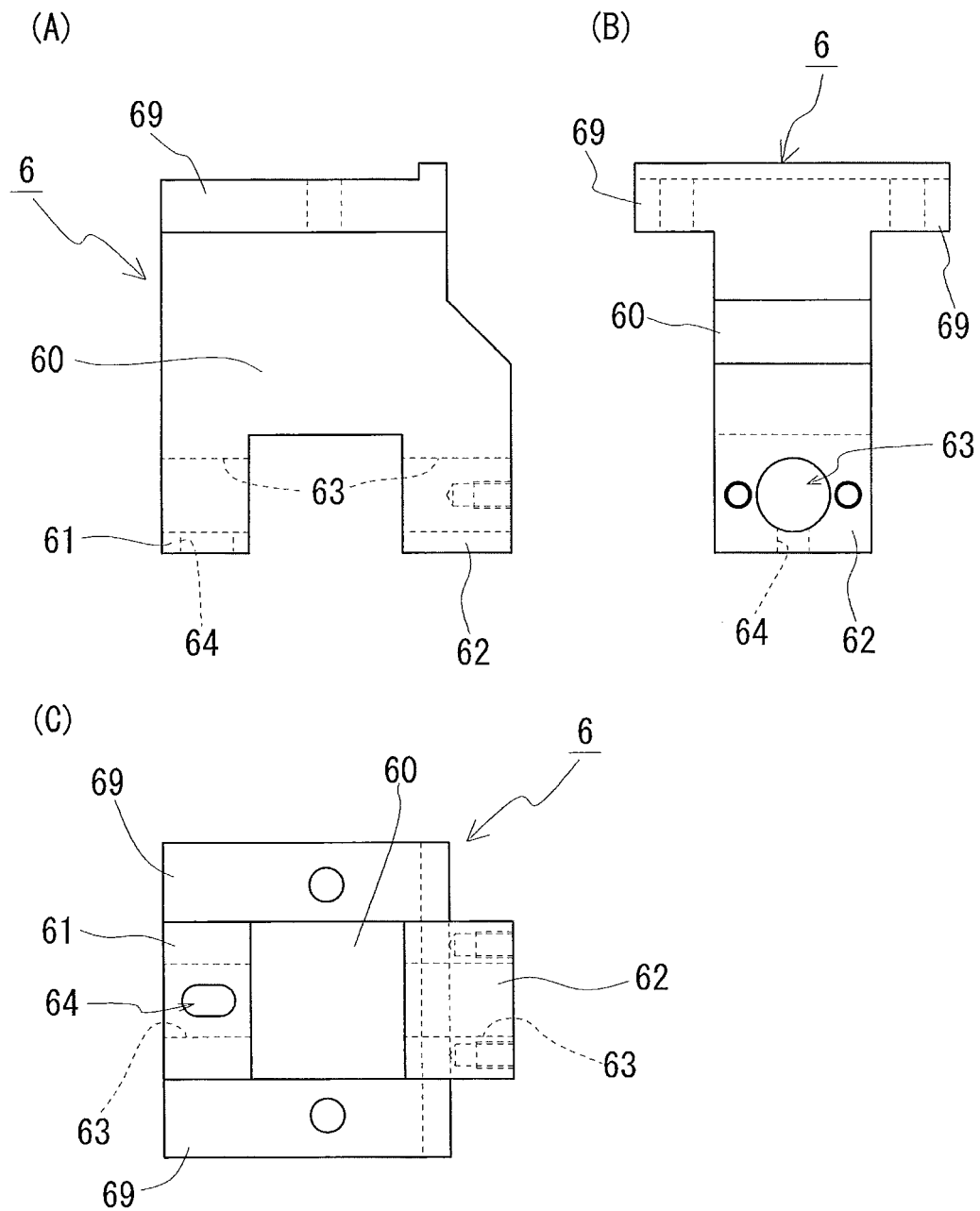


Fig. 7

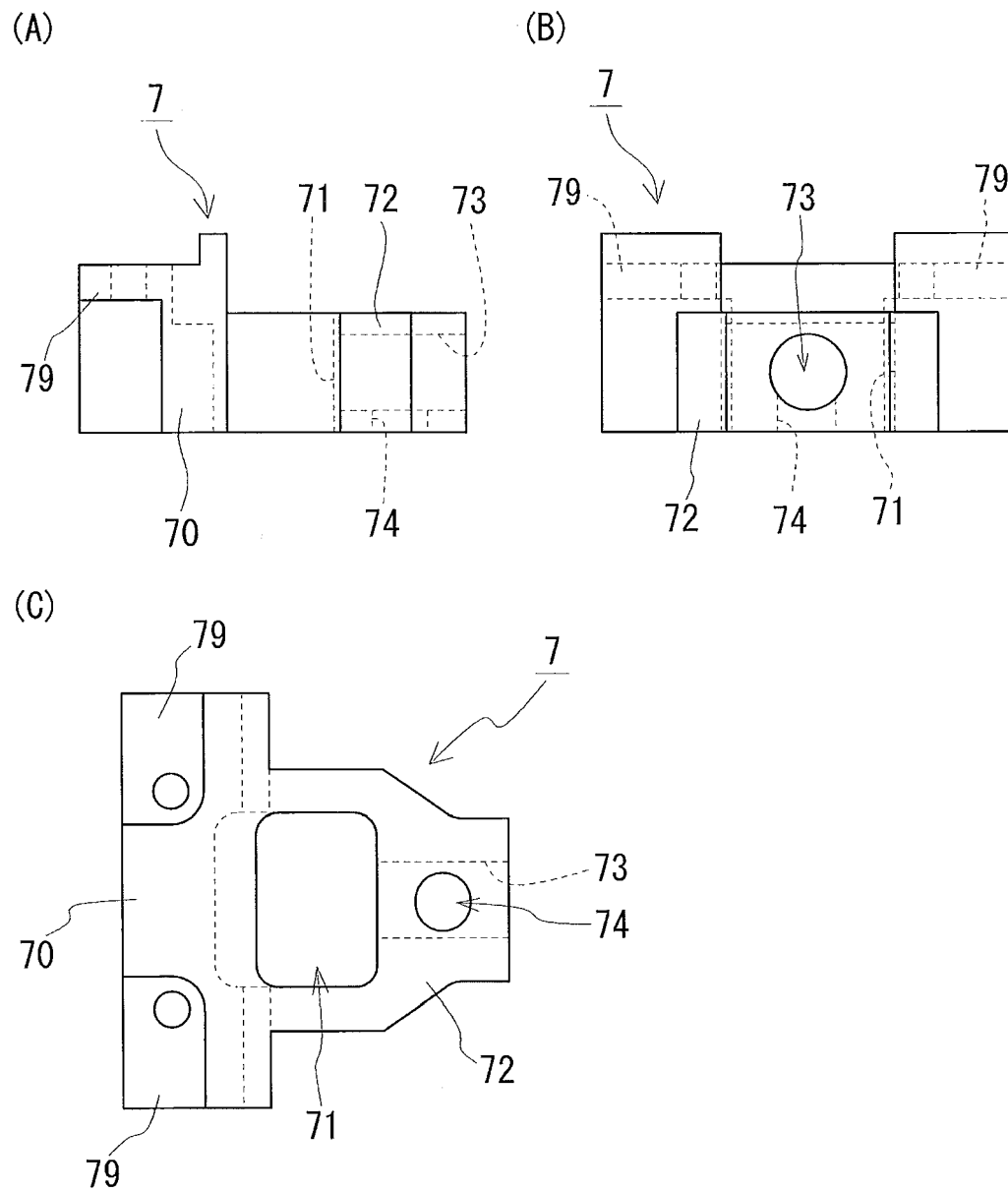


Fig. 8

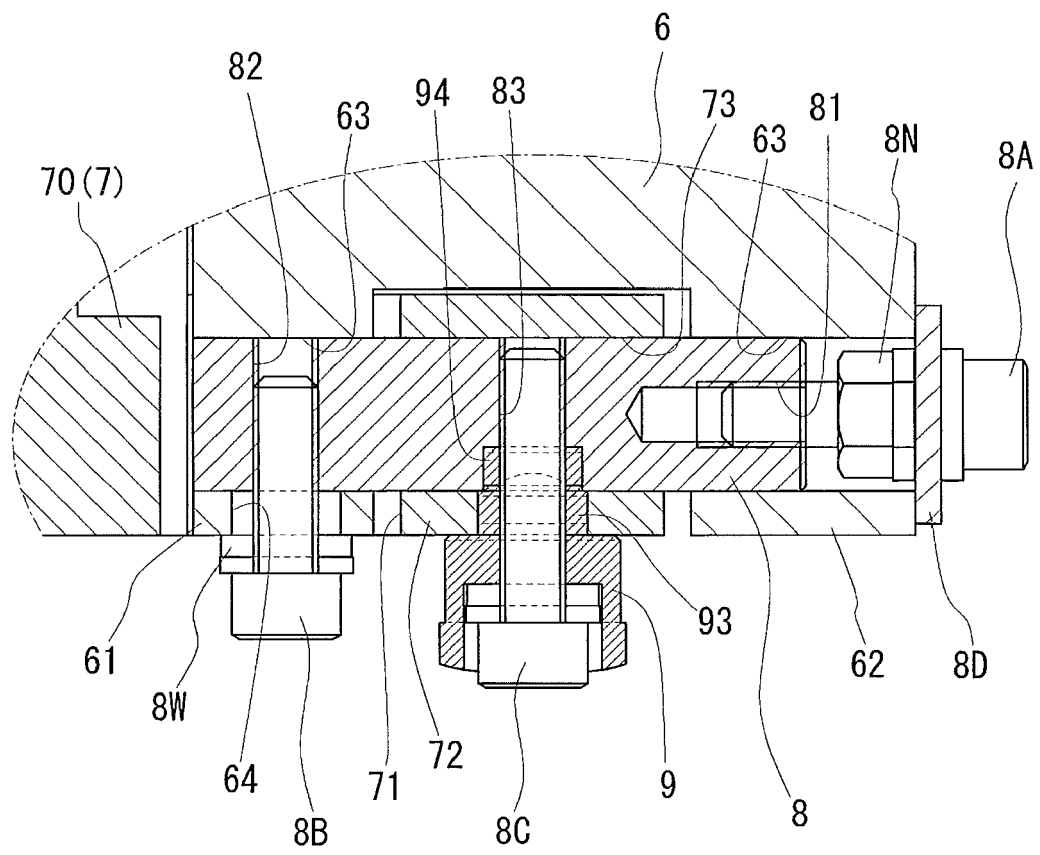


Fig. 9

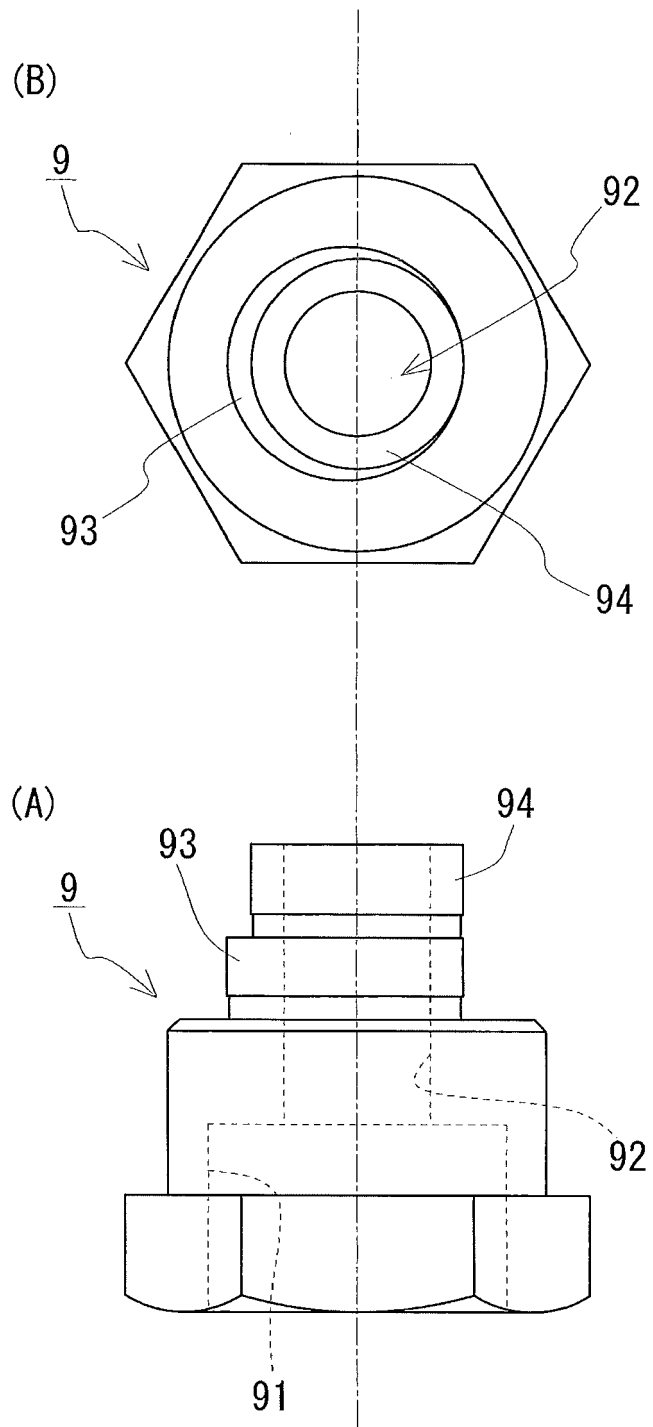


Fig. 10

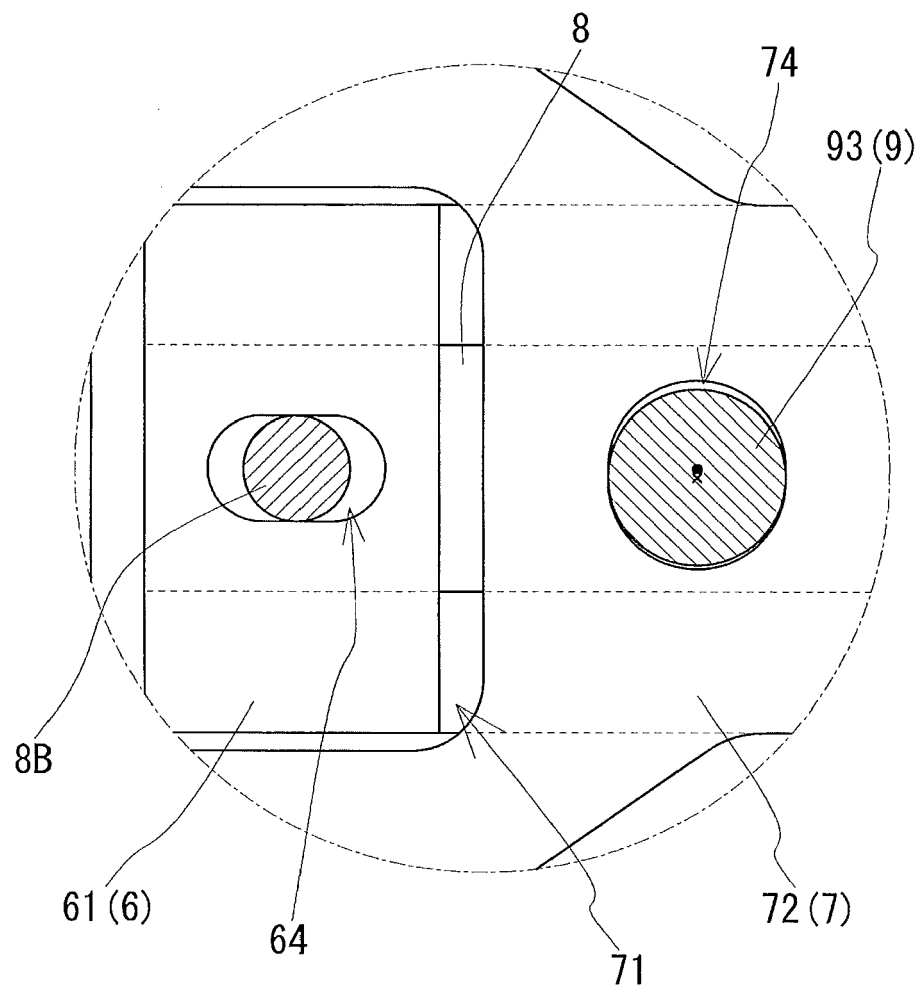
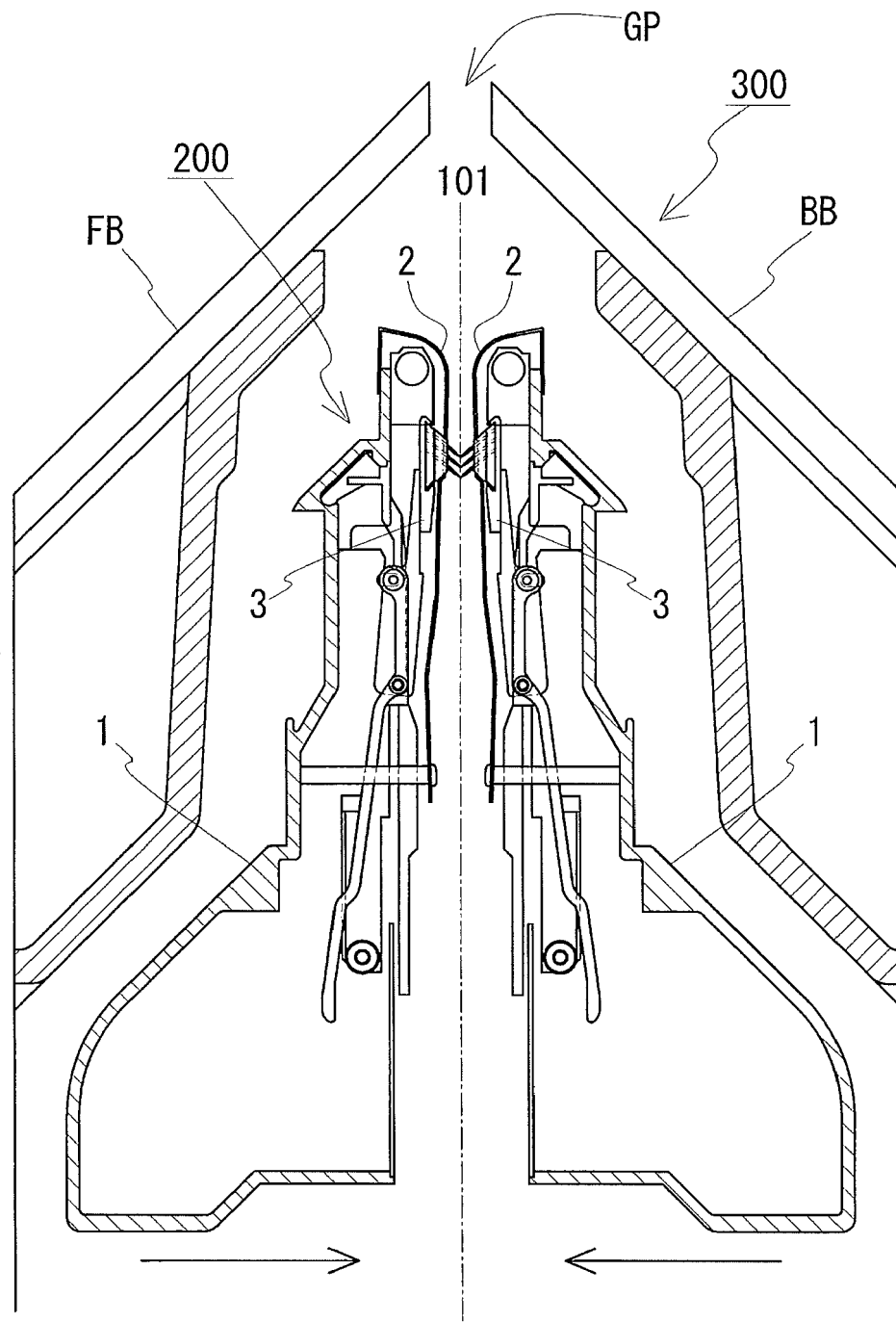


Fig. 11





EUROPEAN SEARCH REPORT

 Application Number
 EP 16 17 0160

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 841 422 A2 (SHIMA SEIKI MFG [JP]) 13 May 1998 (1998-05-13)	1	INV. D04B15/90
A	* column 7, line 38 - column 9, line 10; figures 1, 2, 6-11, 21, 22 * * column 10, lines 30-44 * * column 13, line 33 - column 15, line 27 *	2-5	
X,D	----- JP 3 457161 B2 (SHIMA SEIKI MFG) 14 October 2003 (2003-10-14)	1	
A	* figures 1-19 *	2-5	
X	----- US 5 271 250 A (BENITO STOPPAZZINI [IT]) 21 December 1993 (1993-12-21)	1	TECHNICAL FIELDS SEARCHED (IPC) D04B
A	* column 3, lines 1-41; figures 1-3, 6, 8, 9 * * column 4, lines 15-44 * * column 5, lines 29-34 * * column 5, line 67 - column 6, line 7 *	2-5	
The present search report has been drawn up for all claims			
Place of search Munich			
Date of completion of the search 23 August 2016		Examiner Kirner, Katharina	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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 EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 17 0160

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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23-08-2016

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		DE 69732811 T2	06-04-2006
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