(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 382 648 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.06.2024 Bulletin 2024/24

(21) Application number: **23209337.7**

(22) Date of filing: **13.11.2023**

(51) International Patent Classification (IPC):
D02G 1/02 *(2006.01)* ***D02J 13/00*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
D02G 1/0266; D02J 13/003

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **30.11.2022 JP 2022191392**

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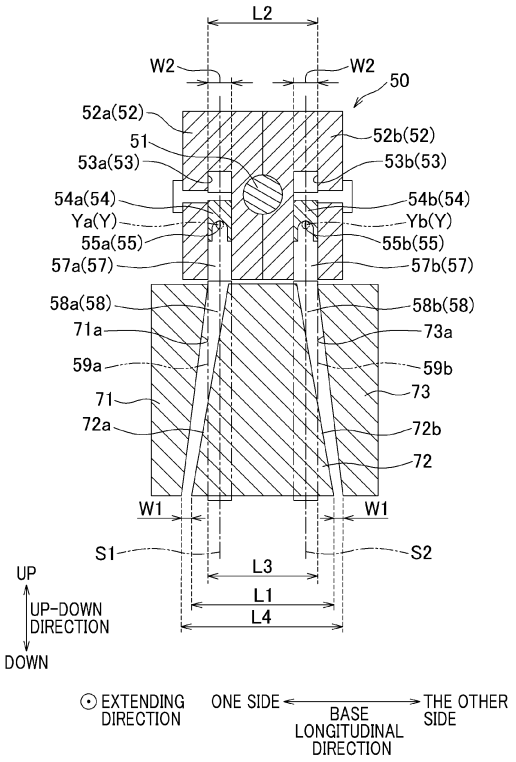
(54) YARN HEATER AND FALSE-TWIST TEXTURING MACHINE

(57) Easy detachment of a yarn contact member and reduction of power consumption are both achieved. Yarn contact members 54a and 54b are detachably attached to respective concave grooves 53a and 53b which are defined by a heating member 52, extend along a predetermined extending direction, and are open on one side (i.e., downward) in an up-down direction orthogonal to an extending direction. Lateral heat insulation members 71 and 73 and a central heat insulation member 72 are provided to be aligned in a base longitudinal direction. Gaps between the central heat insulation member 72 and the lateral heat insulation members 71 and 73 constitute yarn guide passages 58a and 58b through which yarns Ya and Yb are guided to the respective two yarn contact members 54a and 54b attached to the two concave grooves 53a and 53b. At an opposing area 59a (59b) opposing each of the concave grooves 53a and 53b in the up-down direction, a central heat insulation member 72 is provided. The central heat insulation member 72 provided at the opposing area 59a (59b) is detachable.

FIG.10



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn heater configured to heat a yarn and a false-twist texturing machine.

[0002] Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2002-194631) discloses a heater (yarn heater) provided in a false-twist texturing machine configured to false-twist a running yarn. Such a heater includes a sheathed heater (hear source), a heating body (heating member) heated by the sheathed heater, and a contact plate (yarn contact member) which has a yarn contact surface that is to be in contact with a yarn and which is heated by the heating body. The contact plate is provided in a concave groove which is partially defined by the heating body. The concave groove extends along a predetermined extending direction and is open on one side in an orthogonal direction that is orthogonal to the extending direction.

SUMMARY OF THE INVENTION

[0003] In regard to the above-described yarn heater, suppression of power consumption by suppressing dissipation of heat from the heat source to the outside through the internal space of the concave groove has been desired. To achieve this, a heat insulation member may be provided at a position opposing the concave groove in the orthogonal direction.

[0004] The yarn contact member of the yarn heater must be regularly detached from the concave groove in order to remove stains and fused yarns for the purpose of maintenance. When the above-described heat insulation member is provided, the yarn contact member cannot be detached in the orthogonal direction. The yarn contact member is therefore detached in the extending direction. In order to detach the yarn contact member in the extending direction, it is necessary to avoid interference between the yarn contact member and members on the yarn path such as a guide and another apparatus. To be more specific, it is necessary to move members such as the guide on the yarn path or to rotate the yarn heater. Such operations are tiresome and deteriorates the functionality.

[0005] An object of the present invention is to provide a yarn heater and a false-twist texturing machine, in which a yarn contact member is easily detachable and at the same time power consumption is decreased.

[0006] According to a first aspect of the invention, a yarn heater has at least one concave groove in which a yarn runs and is capable of heating the yarn running in the at least one concave groove, the concave groove being open on one side in an orthogonal direction orthogonal to an extending direction in which the at least one concave groove extends, the yarn heater comprising: a heating member which extends along the extending direction, defines at least part of the at least one concave groove, and is configured to heat the yarn running in the at least one concave groove; at least one yarn contact member which is detachably attached to each of the at least one concave groove and is capable of making contact with the yarn running in the at least one concave groove; and at least two heat insulation members provided to be aligned in a width direction orthogonal to both the extending direction and the orthogonal direction, a gap between two neighboring heat insulation members constituting a yarn guide passage through which the yarn is guided to the yarn contact member attached to the at least one concave groove, at an opposing area opposing each of the at least one concave groove in the orthogonal direction, at least part of one or more heat insulation member of the at least two heat insulation members being provided, and all of the one or more heat insulation member provided at the opposing area being arranged to be detachable.

[0007] According to the aspect of the present invention, the heat insulation member suppress the dissipation of heat to the outside through the internal spaces of the concave groove, with the result that the power consumption is decreased. When the yarn is guided to the yarn contact member attached to the concave groove in order to set the yarn, it is possible to guide the yarn through the yarn guide passage without detaching the heat insulation member. On this account, when the yarn is set, the heat insulation member suppresses the dissipation of heat to the outside, with the result that the power consumption is decreased. Furthermore, by detaching all heat insulation members provided at the opposing area, the opposing area opposing the concave groove in the orthogonal direction is exposed. Consequently, it becomes possible to detach the yarn contact member attached to the concave groove, in the orthogonal direction. On this account, being different from the case where the yarn contact member is detached in the extending direction, tiresome operations such as moving members such as a guide on the yarn path and rotating the yarn heater are not necessary. Therefore the detachment of the yarn contact member can be easily done.

[0008] According to a second aspect of the invention, the yarn heater of the first aspect is arranged such that at least one of the two or more heat insulation members is provided outside the opposing area and is arranged not to be detachable, and does not move in accordance with detachment of the heat insulation member provided in the opposing area.

[0009] The aspect of the present invention prevents the heat insulation member from being erroneously and unnecessarily detached when the yarn contact member is detached from the concave groove.

[0010] According to a third aspect of the invention, the yarn heater of the first or second aspect is arranged such that the length in the width direction of a yarn guide port that is an inlet of the yarn into the yarn guide passage is shorter than the length in the width direction of the at

least one concave groove.

[0011] According to this aspect of the present invention, the width of the yarn guide port of the yarn guide passage (i.e., an end portion on the side opposite to the concave groove side) is arranged to be narrow. It is therefore possible to reliably suppress the dissipation of heat to the outside through the internal space of the concave groove.

[0012] According to a fourth aspect of the invention, the yarn heater of any one of the first to third aspects is arranged so that the number of heat insulation members provided at one opposing area is one.

[0013] According to this aspect of the present invention, when one heat insulation member is detached, the opposing area opposing at least one concave groove is exposed, and the yarn contact member attached to that concave groove becomes detachable. Therefore the detachment of the yarn contact member is simplified.

[0014] According to a fifth aspect of the invention, the yarn heater of the fourth aspect is arranged such that the at least one heat insulation member includes a first heat insulation member provided at the opposing area of the at least one concave groove and a second heat insulation member which is provided to be aligned with the first heat insulation member in the width direction, a gap between the first heat insulation member and the second heat insulation member constitutes the yarn guide passage, and when there is at least one virtual straight line extending along the orthogonal direction and passing through the center in the width direction of the at least one concave groove, when viewed in the extending direction, an opposing surface of the first heat insulation member, which opposes the second heat insulation member, is tilted relative to the at least one virtual straight line, and relative to the at least one virtual straight line, an end portion of the opposing surface on the one side in the orthogonal direction is on the second heat insulation member side whereas an end portion of the opposing surface on the other side in the orthogonal direction is on the side opposite to the second heat insulation member.

[0015] For example, assume that the opposing surface of the first heat insulation member opposing the second heat insulation member is a surface orthogonal to the width direction and the opposing surface is on the second heat insulation member side of the virtual straight line extending along the orthogonal direction and passing through the center of the concave groove in the width direction. In this case, when the yarn is guided through the yarn guide passage to the yarn contact member attached to the concave groove, the end portion of the first heat insulation member, which is on the other side (concave groove side) in the orthogonal direction, interferes with the yarn. On the other hand, the farther the opposing surface is from the second heat insulation member, the smaller a part of the concave groove opposing the first heat insulation member is. According to the aspect of the present invention, the interference between the end portion on the other side (concave groove side) in the orthogonal direction of the first heat insulation member and the yarn is suppressed when the yarn is guided through the yarn guide passage. At the same time, the part of the concave groove opposing the first heat insulation member has a sufficient size, and the dissipation of heat to the outside through the internal space of the concave groove is reliably suppressed.

[0016] According to a sixth aspect of the invention, the yarn heater of the fourth or fifth aspect is arranged such that plural concave grooves are aligned in the width direction, and one heat insulation member of the at least one heat insulation member is provided to stretch across two opposing areas opposing, in the orthogonal direction, the respective two concave grooves neighboring each other in the width direction.

[0017] According to this aspect of the present invention, when one heat insulation member is detached, the two opposing areas opposing the respective two concave grooves in the orthogonal direction are exposed, and the yarn contact members attached to these two concave grooves become detachable in the orthogonal direction. Therefore the detachment of the yarn contact members is simplified. Furthermore, when one heat insulation member is detached, a relatively large area stretching across the two opposing areas opposing the respective two concave grooves in the orthogonal direction becomes exposed. On this account, the detachment of the yarn contact member can be easily done in the large area.

[0018] According to a seventh aspect of the invention, the yarn heater of the sixth aspect is arranged such that the at least one heat insulation member includes: one central heat insulation member provided to stretch across the two opposing areas opposing, in the orthogonal direction, the respective two concave grooves neighboring each other in the width direction; and two lateral heat insulation members which are provided on the respective sides of the one central heat insulation member in the width direction, each of gaps between the one central heat insulation member and the two lateral heat insulation members constitutes the yarn guide passage through which the yarn is guided to the at least one yarn contact member attached to the two concave grooves, and the one central heat insulation member has a trapezoidal shape that is widened from the other side toward the one side in the orthogonal direction, when viewed in the extending direction, and when viewed in the extending direction, an end portion of the one central heat insulation member, which is on the other side in the orthogonal direction, is positioned between two virtual straight lines extending along the orthogonal direction and passing through centers of the two concave grooves relative to the width direction, respectively.

[0019] It is noted that "an end portion of the one central heat insulation member, which is on the other side in the orthogonal direction" indicates a portion equivalent to the bottom line on the other side in the orthogonal direction of a central heat insulation member that has a trapezoidal shape widened from the other side toward one side in

the orthogonal direction, when viewed in the extending direction.

[0020] According to the aspect of the present invention, when the yarn is guided through the yarn guide passage to the yarn contact member attached to the concave groove, the end portion of the central heat insulation member, which is on the other side (concave groove side) in the orthogonal direction, is less likely to interfere with the yarn.

[0021] According to an eighth aspect of the invention, the yarn heater of the seventh aspect is arranged such that, when viewed in the extending direction, the end portion of the one central heat insulation member, which is on the other side in the orthogonal direction, opposes the two concave grooves in the orthogonal direction.

[0022] According to this aspect of the present invention, when the yarn is guided through the yarn guide passage to the yarn contact member attached to the concave groove, the yarn is less likely to be hooked by the edge of the concave groove. The yarn is therefore smoothly guided from the yarn guide passage to the concave groove.

[0023] According to a ninth aspect of the invention, the yarn heater of the seventh or eighth aspect is arranged such that, when viewed in the extending direction, an end portion of the one central heat insulation member, which is on the one side in the orthogonal direction, extends to reach the outside of the two opposing areas.

[0024] According to this aspect of the present invention, the space formed between the two lateral heat insulation members after the central heat insulation member provided between the two lateral heat insulation members is detached extends to reach at least the outside of the two opposing areas. On this account, the space where the detachment of the yarn contact member is performed is large, and hence the detachment can be easily done.

[0025] According to a tenth aspect of the invention, the yarn heater of any one of the seventh to ninth aspects is arranged such that two surfaces of the respective two lateral heat insulation members, which oppose the one central heat insulation member in the width direction, are arranged so that an interval in the width direction between end portions on the other side in the orthogonal direction is shorter than an interval in the width direction between end portions on the one side in the orthogonal direction.

[0026] According to this aspect of the present invention, after the central heat insulation member provided between the two lateral heat insulation members is detached, a space widening away from the concave groove appears between the two lateral heat insulation members. On this account, the detachment of the yarn contact member in the orthogonal direction can be easily done.

[0027] According to an eleventh aspect of the invention, the yarn heater of any one of the first to tenth aspects comprises a supporting member capable of supporting the at least one heat insulation member, the supporting member being switchable between a supporting position where the at least one heat insulation member is supported and a non-supporting position where the at least one heat insulation member is not supported.

[0028] It is noted that, in the present invention, "the heat insulation member is supported" indicates not only a case where the heat insulation member is directly supported by the supporting member that is in contact with the heat insulation member but also a case where the heat insulation member is indirectly supported by the supporting member that is in contact with a member attached to the heat insulation member.

[0029] According to the aspect of the present invention, as the supporting member is moved from the supporting position to the non-supporting position, the heat insulation member becomes easily detachable.

[0030] According to a twelfth aspect of the invention, the yarn heater of the eleventh aspect comprises a biasing member which is capable of applying biasing force to the supporting member in a direction from the non-supporting position toward the supporting position.

[0031] This aspect of the present invention makes it possible avoid unintentional movement of the supporting member from the supporting position to the non-supporting position.

[0032] A false-twist texturing machine according to a thirteenth aspect comprises the yarn heater of any one of the first to twelfth aspects of the invention.

[0033] According to this aspect of the present invention, the power consumption of the yarn heater can be reduced by the heat insulation member. Furthermore, the operations are simplified because a complicated operation is not needed to detach the yarn contact member from the concave groove.

[0034] According to a fourteenth aspect of the invention, the false-twist texturing machine of the thirteenth comprises: a yarn supplying unit which is configured to supply a yarn; a processing unit which includes devices including the yarn heater and which is configured to false-twist the yarn supplied from the yarn supplying unit; and a winding device which is configured to wind the yarn processed by the processing unit, the winding device being fixed to a winding base, the devices of the processing unit being attached to a main base opposing the winding base over a working space and a supporting frame connecting an upper part of the winding base with an upper part of the main base, and the yarn heater heating the yarn running in the at least one concave groove which extends in the extending direction and has a mouth that opposes the working space in a direction orthogonal to the extending direction.

[0035] According to this aspect of the present invention, when the yarn contact member is detached from the concave groove, the yarn contact member does not interfere with other devices. Therefore the detachment of the yarn contact member can be done easily. Furthermore, when the yarn contact member is detached, it is unnecessary to move members and devices on the yarn path or to rotate the yarn heater. On this account, a de-

viation of the yarn path due to the detachment of the yarn contact member is less likely to occur.

[0036] According to a fifteenth aspect of the invention, the false-twist texturing machine of the thirteenth aspect comprises: a first yarn path forming member which is provided upstream of the yarn heater in a yarn running direction and is able to support the yarn to be runnable; and a second yarn path forming member which is provided downstream of the yarn heater in the yarn running direction and is able to support the yarn to be runnable, and a yarn path at the concave groove is formed by the first yarn path forming member and the second yarn path forming member.

[0037] According to this aspect of the present invention, it is possible to guide the yarn to the concave groove by threading the yarn to the first yarn path forming member and the second yarn path forming member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038]

FIG. 1 is a side view of a false-twist texturing machine related to an embodiment of the present invention.

FIG. 2 is a schematic diagram of the false-twist texturing machine, expanded along paths of the yarns.

FIG. 3 shows a first heater.

FIG. 4 is a cross section of the first heater of FIG. 3, which is cut along a IV-IV line.

FIG. 5 is a cross section of the first heater of FIG. 4, which is cut along a V-V line.

FIG. 6(a) shows the heating unit of FIG. 4, and FIG. 6(b) is a cross section taken along a b-b line in FIG. 6(a).

FIG. 7(a) and FIG. 7(b) show the heating unit viewed in the extending direction. FIG. 7(a) shows a state in which fixing plates are at a contact position, whereas FIG. 7(b) shows a state in which the fixing plates are at a retracted position.

FIG. 8 shows the first heater viewed in the extending direction.

FIG. 9 is a cross section of an end portion on one side in the extending direction of the first heater in which a door is at an open position, which is cut along a direction orthogonal to a base longitudinal direction.

FIG. 10 shows the heating unit, the lateral heat insulation members, and the central heat insulation member of FIG. 4.

FIG. 11 is an exploded perspective view of a central plate, the central heat insulation member, and an end portion plate.

FIG. 12 (a) to FIG. 12 (c) illustrate the movement of the door and states of the heating unit, the lateral heat insulation members, and the central heat insulation member. FIG. 12 (a) shows a state in which the door is at a closed position. FIG. 12(b) shows a state in which the door is at the open position. FIG. 12 (c) shows a state in which the central heat insulation member is detached.

FIG. 13 shows a heating unit, a first heat insulation member, and a second heat insulation member of a modification of the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0039] The following will describe a false-twist texturing machine 1 of a preferred embodiment of the present invention with reference to FIG. 1. A vertical direction to the sheet of FIG. 1 is defined as a base longitudinal direction, and a left-right direction to the sheet is defined as a base width direction. The direction orthogonal to the base longitudinal direction and the base width direction is defined as the up-down direction in which the gravity acts. In this regard, the base longitudinal direction and the base width direction are substantially in parallel to the horizontal direction.

(Overall Structure of False-Twist Texturing Machine 1)

[0040] The false-twist texturing machine 1 can perform false twisting of yarns Y made of, for example, synthetic fibers such as nylon (polyamide fibers) and polyester. The false-twist texturing machine 1 includes a yarn supplying unit 2 for supplying the yarns Y, a processing unit 3 which performs the false twisting of the yarns Y supplied from the yarn supplying unit 2, and a winding unit 4 which winds the yarns Y processed by the processing unit 3 onto a winding bobbins Bw. Components of the yarn supplying unit 2, the processing unit 3, and the winding unit 4 are aligned to form plural lines (see FIG. 2) in the base longitudinal direction. The base longitudinal direction is a direction orthogonal to a yarn running surface (i.e., sheet of FIG. 1) on which yarn paths from the yarn supplying unit 2 to the winding unit 4 through the processing unit 3 are provided.

[0041] The yarn supplying unit 2 includes a creel stand 5 retaining yarn supply packages Ps. The yarn supplying unit 2 supplies yarns Y to a processing unit 3. The processing unit 3 is configured to false-twist the yarns Y supplied from the yarn supply packages Ps. In the processing unit 3, the following members are provided in this order from the upstream in a yarn running direction: first feed rollers 11; a twist-stopping guide 12; a first heater 13 (equivalent to a yarn heater of the present invention); a cooler 14; a false-twisting device 15; second feed rollers 16; an interlacing device 17; third feed rollers 18; a second heater 19; and fourth feed rollers 20. The winding unit 4 includes plural winding devices 21. Each winding device 21 winds a corresponding yarn Y which has been false-twisted by the processing unit 3 onto a winding bobbin Bw and forms a wound package Pw.

[0042] The false-twist texturing machine 1 includes a main base 8 and a winding base 9 that are spaced apart from each other in the base width direction. The main base 8 and the winding base 9 are provided to be sub-

stantially identical in length in the base longitudinal direction. The main base 8 and the winding base 9 oppose each other in the base width direction. An upper part of the main base 8 is connected to an upper part of the winding base 9 by a supporting frame 10. Each device forming the processing unit 3 is mainly attached to the main base 8 or the supporting frame 10. The devices constituting the winding unit 4 are attached to the winding base 9. The main base 8, the winding base 9, and the supporting frame 10 form a working space A in which an operator performs operations such as yarn threading to each device. The yarn paths are formed so that the yarns Y are able to run mainly around the working space A.

[0043] The draw texturing machine 1 includes units which are termed spans each of which includes a pair of the main base 8 and the winding base 9 placed to oppose each other. In one span, process units (which are also termed spindles) in which yarn paths are formed to pass the devices constituting the processing unit 3 are lined up in the base longitudinal direction. With this arrangement, in one span, yarns Y running while being lined up in the base longitudinal direction can be simultaneously false-twisted. In the false-twist texturing machine 1, the spans are placed in a left-right symmetrical manner to the sheet, with a center line C of the base width direction of the main base 8 as a symmetry axis. The main base 8 is shared between the left span and the right span.

(Structure of Processing Unit 3)

[0044] The structure of the processing unit 3 will be described with reference to FIG. 1 and FIG. 2. Each first feed roller 11 is configured to unwind one yarn Y from one yarn supply package Ps attached to the yarn supplying unit 2, and to feed the yarn Y to a corresponding first heater 13. As shown in FIG. 2, for example, each first feed roller 11 is configured to feed one yarn Y to a corresponding first heater 13. Each first feed roller 11 may be able to feed adjacent yarns Y to the downstream side in the yarn running direction. The twist-stopping guide 12 is able to support the yarn Y to be runnable. The twist-stopping guide 12 is provided to prevent twist of the yarn Y formed by the false-twisting device 15 from being propagated to the upstream in the yarn running direction of the twist-stopping guide 12.

[0045] The first heater 13 is configured to heat the yarns Y supplied from some first feed rollers 11 to a predetermined processing temperature. As shown in FIG. 1, the first heater 13 is provided above the working space A. As shown in FIG. 2, for example, the first heater 13 is able to heat two yarns Y. The first heater 13 will be detailed later.

[0046] The cooler 14 is configured to cool the yarn Y heated at the first heater 13. As shown in FIG. 2, for example, each cooler 14 is configured to cool one yarn Y. The cooler 14 may be arranged to be able to simultaneously cool plural yarns Y.

[0047] The false-twisting device 15 is placed downstream of the cooler 14 in the yarn running direction. The false-twisting device 15 is able to support the yarn Y to be runnable. The false-twisting device 15 is configured to twist the yarn Y. The false-twisting device 15 is a so-called disc-friction-type false-twisting device, for example. The disclosure, however, is not limited to this arrangement.

[0048] Each second feed roller 16 is configured to feed the yarn Y processed by the false-twisting device 15 to a corresponding interlacing device 17. The conveyance speed of conveying the yarn Y by each second feed roller 16 is higher than the conveyance speed of conveying the yarn Y by each first feed roller 11. With this arrangement, the yarn Y is therefore drawn and false-twisted between each first feed roller 11 and each second feed roller 16.

[0049] The interlacing device 17 is configured to interlace the yarn Y. The interlacing device 17 has, for example, a known interlace nozzle configured to interlace the yarn Y by means of an airflow.

[0050] Each third feed roller 18 is configured to feed the yarn Y running downstream of the interlacing device 17 in the yarn running direction, to the second heater 19. As shown in FIG. 2, for example, each third feed roller 18 is configured to feed one yarn Y to the second heater 19. Each third feed roller 18 may be able to feed adjacent yarns Y to the downstream side in the yarn running direction. The conveyance speed of conveying the yarn Y by each third feed roller 18 is lower than the conveyance speed of conveying the yarn Y by each second feed roller 16. The yarn Y is therefore relaxed between each second feed roller 16 and each third feed roller 18.

[0051] The second heater 19 is configured to heat the yarns Y fed from some third feed rollers 18. The second heater 19 extends along the vertical direction, and one second heater 19 is provided in one span.

[0052] Each fourth feed roller 20 is configured to feed the yarn Y heated by the second heater 19 to the winding device 21. As shown in FIG. 2, for example, each fourth feed roller 20 is able to feed one yarn Y to the winding device 21. Each fourth feed roller 20 may be able to feed adjacent yarns Y to the downstream side in the yarn running direction. The conveyance speed of conveying the yarn Y by each fourth feed roller 20 is lower than the conveyance speed of conveying the yarn Y by each third feed roller 18. The yarn Y is therefore relaxed between each third feed roller 18 and each fourth feed roller 20.

[0053] In the processing unit 3 arranged as described above, the yarn Y drawn between the first feed rollers 11 and the second feed rollers 16 is twisted by the false-twisting device 15. The twist formed by the false-twisting device 15 propagates to the twist-stopping guide 12 but does not propagate to the upstream of the twist-stopping guide 12 in the yarn running direction. The yarn Y which is twisted and drawn is heated by a corresponding first heater 13 and thermally set. After that, the yarn Y is cooled by a corresponding cooler 14. The yarn Y is untwisted on the downstream side of the false-twisting device 15 in the yarn running direction. However, the yarn

Y is maintained to be wavy in shape on account of the thermal setting described above (i.e., the crimp contraction of the yarn Y is maintained).

[0054] The false-twisted yarn Y is interlaced by the interlacing device 17 while being relaxed between a corresponding second feed roller 16 and a corresponding third feed roller 18. After that, the yarn Y is guided toward the downstream side in the yarn running direction. Subsequently, the yarn Y is thermally set by the second heater 19 while being relaxed between the third feed rollers 18 and the fourth feed rollers 20. Finally, the yarn Y which is fed by the fourth feed rollers 20 is wound by a corresponding winding device 21.

(Structure of Winding Unit 4)

[0055] The structure of the winding unit 4 will be described with reference to FIG. 2. The winding unit 4 includes the winding devices 21. Each winding device 21 is able to wind one yarn Y onto one winding bobbin Bw. The winding device 21 includes a fulcrum guide 31, a traverse device 32, and a cradle 33. The fulcrum guide 31 is a guide which is a fulcrum when the yarn Y is traversed. The traverse device 32 is able to traverse the yarn Y by means of a traverse guide 34. The cradle 33 is configured to rotatably support the winding bobbin Bw. A contact roller 35 is provided in the vicinity of the cradle 33. The contact roller 35 is configured to apply a contact pressure by making contact with the surface of one wound package Pw. In the winding unit 4 structured as above, the yarn Y which is fed by the fourth feed roller 20 described above is wound onto the winding bobbin Bw by the winding device 21, and forms the wound package Pw.

(Structure of First Heater 13)

[0056] A specific structure of the first heater 13 will be described with reference to FIGs. 3 to 12. As shown in FIG. 3, the first heater 13 extends along a predetermined extending direction that is orthogonal to the base longitudinal direction. In the present embodiment, the extending direction is in parallel to the base width direction. The extending direction may be tilted relative to the base width direction.

[0057] As shown in FIG. 6(b), the first heater 13 has a concave groove 53 extending along the extending direction. The first heater 13 is configured to heat the yarn Y running in the concave groove 53 from one side toward the other side in the extending direction. In the concave groove 53, the yarn Y supported by the twist-stopping guide 12 and the false-twisting device 15 (see FIG. 1) to be runnable. In other words, the yarn path at the concave groove 53 is formed by the twist-stopping guide 12 and the false-twisting device 15. In the present embodiment, the first heater 13 is able to heat two yarns Y (yarn Ya and Yb; see FIG. 4).

[0058] As shown in FIG. 4 and FIG. 5, the first heater 13 mainly includes a heating unit 50, lateral heat insulation members 71 and 73, and a central heat insulation member 72. The heating unit 50, the lateral heat insulation members 71 and 73, and the central heat insulation member 72 are accommodated in a heat retaining box 60. In the heat retaining box 60, areas where the heating unit 50, the lateral heat insulation members 71 and 73, and the central heat insulation member 72 are not provided are filled with a heat insulating material 70. The heat insulating material 70 is made of, for example, rock wool or ceramic fibers.

[0059] As shown in FIG. 6(a), the heating unit 50 mainly includes a heat source 51, two heating members 52 (52a and 52b) and two yarn contact members 54 (54a and 54b). The heat source 51 is, e.g., a sheathed heater. As shown in FIG. 5, the heat source 51 extends along the extending direction. The heating members 52 are arranged to be heated by heat generated by the heat source 51. The yarn contact members 54 are arranged to be heated by the heating members 52. The heating members 52 and the yarn contact members 54 extend in the extending direction along the heat source 51.

[0060] The heating member 52a and the yarn contact member 54a are members for heating the yarn Ya. The heating member 52b and the yarn contact member 54b are members for heating the yarn Yb. The members for heating the yarn Ya oppose the members for heating the yarn Yb over the heat source 51 in the base longitudinal direction.

[0061] The following will describe the members configured to heat the yarn Ya. The heating member 52a is, for example, made of a metal material such as brass having a high specific heat. The heating member 52a is provided to be in contact with the heat source 51. The heating member 52a is provided on one side of the heat source 51 in the base longitudinal direction (on the left side in the sheet of FIG. 6(a)). As shown in FIG. 6, the heating member 52a has a concave groove 53 (53a) that is open downward (equivalent to "on one side in an orthogonal direction" in the present invention). In other words, the mouth of the concave groove 53a is on a side close to the working space A (see FIG. 1). The concave groove 53a extends along the extending direction. In the present embodiment, the concave groove 53 (53a) is entirely defined by the heating member 52a. The concave groove 53 (53a) is required to be at least partially defined by the heating member 52a.

[0062] The yarn contact member 54a is a long member made of, e.g., SUS. The yarn contact member 54a is detachably attached to the concave groove 53a formed in the heating member 52a. In the present embodiment, one yarn contact member 54a is attached to one concave groove 53a. Alternatively, plural yarn contact members 54a may be attached to one concave groove 53a. The yarn contact member 54a is in contact with the heating member 52a. The yarn contact member 54a is heated by heat transmitted from the heat source 51 via the heating member 52a, so as to be increased in temperature.

[0063] As shown in FIG. 6(a) and FIG. 6(b), the yarn contact member 54a has a yarn contact surface 55 (55a) capable of making contact with the yarn Ya. The yarn contact member 54a is provided in the concave groove 53a so that the yarn contact surface 55a faces down. In other words, in the internal space of the concave groove 53a, a space below the yarn contact surface 55a functions as a yarn running space 57 (57a) where the yarn Ya runs.

[0064] As shown in FIG. 6(a), when viewed in the extending direction, the yarn contact surface 55a is curved to protrude upward. The yarn contact member 54a has two regulating surfaces 56 (56a) that regulates the movement of the yarn Ya in the base longitudinal direction. The two regulating surfaces 56 (56a) are connected to the respective end portions of the yarn contact surface 55a in the base longitudinal direction. The regulating surfaces 56 (56a) are surfaces orthogonal to the base longitudinal direction. As shown in FIG. 6(b), in a cross section orthogonal to the base longitudinal direction, the yarn contact surface 55a is curved to protrude downward.

[0065] The following will describe the members configured to heat the yarn Yb. The heating member 52b is provided on the other side of the heat source 51 in the base longitudinal direction (on the right side in the sheet of FIG. 6(a)). The heating member 52b is in contact with the heat source 51. The heating member 52b is provided with a concave groove 53b which is identical in shape with the concave groove 53a. In the concave groove 53b, a yarn contact member 54b that is structurally identical with the yarn contact member 54a is detachably attached. The yarn contact member 54b includes a yarn contact surface 55b identical in shape with the yarn contact surface 55a and a regulating surface 56b. A part of the internal space of the concave groove 53b functions as a yarn running space 57b that is identical with the yarn running space 57a. Further details are omitted.

[0066] As described above, in the heating member 52, two concave grooves 53a and 53b each of which extends along the extending direction are provided to be side by side in the base longitudinal direction (equivalent to a width direction of the present invention). The two yarn contact members 54a and 54b are attached to the two concave grooves 53a and 53b, respectively.

[0067] A yarn Y (Ya, Yb) sent into the first heater 13 runs in the concave groove 53 (53a, 53b) while being in contact with the yarn contact surface 55 (55a, 55b). Because of this, the yarn Y (Ya, Yb) receives heat from the heating member 52 (52a, 52b) through the yarn contact surface 55 (55a, 55b) and is heated. The temperature of the yarn Y is increased to an appropriate heating temperature by properly setting the type, brand (thickness), and running speed of the yarn Y and the heating temperature.

[0068] The following will describe a mechanism for attaching the yarn contact members 54 to the concave grooves 53. As indicated by two-dot chain lines in FIG. 6(b), the yarn contact member 54 extends substantially linearly, before it is attached to the concave groove 53. In this state, the yarn contacted surface 55 also extends substantially linearly in the direction in which the yarn contact member 54 extends. The length in the longitudinal direction of the yarn contact member 54 is longer than the length in the extending direction of the concave groove 53. The both end portions in the longitudinal direction of the yarn contact member 54 jut out from the respective end portions in the extending direction of the concave groove 53.

[0069] As shown in FIG. 6(b) and FIG. 7, to the both end portions in the extending direction of each of the two heating members 52a and 52b, fixing plates 41 are attached, respectively. The two fixing plates 41 attached to the respective end portions in the extending direction of the heating member 52a fix the yarn contact member 54a. The two fixing plates 41 attached to the respective end portions in the extending direction of the heating member 52b fix the yarn contact member 54b. As shown in FIG. 7, each fixing plate 41 is arranged to be swingable about a swing axis 42 extending along the extending direction. Each fixing plate 41 has a contact portion 43 that is able to make contact with a lower end face of a part of the yarn contact member 54 jutting out from the concave groove 53. As the fixing plate 41 is swung about the swing axis 42, the fixing plate 41 is movable between a contact position (shown in FIG. 7(a)) where the contact portion 43 is in contact with the yarn contact member 54 and a retracted position (shown in FIG. 7(b)) where the contact portion 43 is not in contact with the yarn contact member 54.

[0070] As shown in FIG. 6(b), plural warping units 45 are provided in the concave groove 53. The warping units 45 are provided to be spaced apart from one another in the extending direction. Each warping unit 45 is substantially cylindrical in shape. Each warping unit 45 is disposed so that its axial direction is in parallel to the base longitudinal direction. Each warping unit 45 is attached to the heating member 52. Among the warping units 45, a warping unit 45 substantially at the center in the extending direction of the concave groove 53 is positionally the lowermost. The warping units 45 are disposed so that, the farther a warping unit 45 is from the center in the extending direction of the concave groove 53, the higher the position of the warping unit 45 is.

[0071] To attach the yarn contact member 54 to the concave groove 53, to begin with, the yarn contact member 54 is lifted upward and the yarn contact member 54 is pressed onto the warping units 45. Thereafter, the fixing plates 41 are moved from the retracted position (shown in FIG. 7(b)) to the contact position (shown in FIG. 7(a)), with the result that the contact portion 43 of each fixing plate 41 makes contact with the lower surface of each of the end portions in the extending direction of the yarn contact member 54. At this stage, a downward force is exerted to the yarn contact member 54 by the warping units 45, whereas an upward force is exerted to the contact portion 43 of each fixing plate 41. As a result,

the yarn contact member 54 is attached to the concave groove 53 in a state of being curved to be substantially U-shaped and protruding downward to form a concave. As the yarn contact member 54 is warped, the yarn contacted surface 55 is also curved to be substantially U-shaped and protrudes downward to form a concave. As the fixing plates 41 are moved from the contact position (shown in FIG. 7(a)) to the retracted position (shown in FIG. 7(b)), the detachment of the yarn contact member 54 from the concave groove 53 becomes possible.

[0072] As shown in FIG. 8, the heat retaining box 60 mainly includes a main body 61, a door 62, side plates 63a and 63b, and a central plate 64. The heat retaining box 60 has entrances 66 of a yarn into the heat retaining box 60. In the heat retaining box 60, the entrances 66 are provided at parts opposing the respective ends in the extending direction of the yarn running space 57 (57a, 57b). The heat retaining box 60 has a slit 67 that is connected to each entrance 66 at one end and is open at the other end.

[0073] The main body 61 is a hollow member which is substantially rectangular parallelepiped in shape and which is long in the extending direction. As shown in FIG. 4, in a lower wall 61a of the main body 61, an opening 68 is formed. The opening 68 is provided along the entire length of the main body 61 in the extending direction. As shown in FIG. 5, an opening 69 is formed at each of both side walls 61b of the main body 61 in the extending direction. Each opening 69 is provided at the center of a corresponding side wall 61b in the base longitudinal direction. Each opening 69 is open downward.

[0074] The door 62 is a plate-shaped member extending along the extending direction. The door 62 is attached to the bottom surface of the lower wall 61a of the main body 61. The door 62 is able to swing about a shaft 62a extending along the extending direction. The axis 62a is provided at an end portion of the door 62, which is on the other side in the base longitudinal direction (i.e., on the right side in the sheet of FIG. 4). As indicated by solid lines in FIG. 4, when the door 62 is at the closed position, the opening 68 of the main body 61 is closed by the door 62. When the door 62 at the closed position swings downward about the shaft 62a (swings counterclockwise in FIG. 4) so that the door 62 is switched to an open position indicated by broken lines in FIG. 4, the opening 68 of the main body 61 is open. That is, the door 62 is movable between the closed position where the opening 68 of the main body 61 is closed and the open position where the opening 68 is open.

[0075] As shown in FIG. 8, to the door 62, the other end of a spring 65 is fixed. One end of the spring 65 is fixed to the main body 61. The door 62 is biased by the spring 65 in a direction from the open position toward the closed position. At the closed position, the door 62 is biased upward by the spring 65.

[0076] Three plates constituted by the side plates 63a and 63b and the central plate 64 are attached to each of the outer surfaces of the side walls 61b at the respective ends in the extending direction of the main body 61. The central plates 64 are provided on the respective sides in the extending direction of the later-described central heat insulation member 72. The central plates 64 are able to support the central heat insulation member 72 from the respective sides in the extending direction. Each central plates 64 is equivalent to a supporting member of the present invention.

[0077] The side plate 63a is provided at around one side in the base longitudinal direction of the opening 69 (left side in the sheet of FIG. 8) in the side wall 61b of the main body 61. The side plate 63b is provided at around the other side in the base longitudinal direction of the opening 69 (right side in the sheet of FIG. 8) in the side wall 61b of the main body 61. The side plates 63a and 63b are provided to partially overlap the opening 69. The side plates 63a and 63b are spaced apart from each other in the base longitudinal direction. The central plate 64 is attached by a bolt 82 to a part of the side wall 61b of the main body 61, which is above the opening 69. The central plate 64 is provided to partially overlap the opening 69. The central plate 64 is provided between the side plates 63a and 63b in the base longitudinal direction. The central plate 64 is spaced apart from the side plates 63a and 63b in the base longitudinal direction.

[0078] The entrances 66 (66a, 66b) of the yarns Y (Ya, Yb) into the heat retaining box 60 are constituted by a gap between the side plate 63a and the central plate 64 and a gap between the side plate 63b and the central plate 64. At a part opposing the end portion of the yarn running space 57a in the extending direction, the entrance 66a constituted by the gap between the side plate 63a and the central plate 64 is formed. At a part opposing the end portion of the yarn running space 57b in the extending direction, the entrance 66b constituted by the gap between the side plate 63b and the central plate 64 is formed.

[0079] The slits 67 (67a, 67b) are constituted by a gap between the side plate 63a and the central plate 64 and a gap between the side plate 63b and the central plate 64. Each of the two slits 67a and 67b extends in a plane orthogonal to the extending direction. The slit 67a is connected to the entrance 66a at the upper end and is open at the lower end. The slit 67b is connected to the entrance 66b at the upper end and is open at the lower end.

[0080] At an upper end portion of the central plate 64, two holes 64a are formed to allow the bolts 82 to penetrate them. The two holes 64a are aligned in the base longitudinal direction. As shown in FIG. 9, between the central plate 64 attached to the side wall 61b on one side in the extending direction and a head 82a of a bolt 82 inserted into a hole 64a of the central plate 64, a biasing member 83 is provided. In the present embodiment, the biasing member 83 is a coil spring. The biasing member 83 may be made of rubber. The biasing member 83 may not be provided. The central plate 64 is pressed onto the main body 61 by the biasing force of the biasing member 83.

[0081] At a part of the central plate 64 which overlaps the opening 69, an opening 64b is formed to be long along the up-down direction. In the opening 64b, a protrusion 78 formed on a later-described end portion plate 79 is provided.

[0082] The lateral heat insulation members 71 and 73 and the central heat insulation member 72 are formed by, for example, plaster boards. The lateral heat insulation members 71 and 73 and the central heat insulation member 72 extend along the extending direction. As shown in FIG. 4, the lateral heat insulation members 71 and 73 and the central heat insulation member 72 are provided below the heating unit 50. The lateral heat insulation members 71 and 73 and the central heat insulation member 72 are provided between the heating unit 50 and an opening 68 formed in the main body 61 of the heat retaining box 60. Between the heating unit 50 and the lower wall 61a of the main body 61, the lateral heat insulation members 71 and 73 and the central heat insulation member 72 are aligned in the base longitudinal direction.

[0083] The central heat insulation member 72 is detachably attached to the first heater 13 as described below. The lateral heat insulation members 71 and 73 are not detachable from the first heater 13. For example, the lateral heat insulation members 71 and 73 are fixed to the heating unit 50 and the heat retaining box 60 by a screw, an adhesive, etc. In short, the lateral heat insulation members 71 and 73 are not moved in accordance with the detachment of the central heat insulation member 72.

[0084] The lateral heat insulation members 71 and 73 are provided on the respective sides of the central heat insulation member 72 in the base longitudinal direction. The lateral heat insulation member 71 is provided on one side in the base longitudinal direction of the central heat insulation member 72. The lateral heat insulation member 73 is provided on the other side in the base longitudinal direction of the central heat insulation member 72. As shown in FIG. 10, gaps between the central heat insulation member 72 and the lateral heat insulation members 71 and 73 function as yarn guide passages 58 (58a, 58b) used when the yarns Y are set in the first heater 13. The gap between the lateral heat insulation member 71 and the central heat insulation member 72 functions as a yarn guide passage 58a through which the yarn Ya is guided to the yarn contact surface 55a of the yarn contact member 54a attached to the concave groove 53a. The gap between the lateral heat insulation member 73 and the central heat insulation member 72 functions as a yarn guide passage 58b through which the yarn Yb is guided to the yarn contact surface 55b of the yarn contact member 54b attached to the concave groove 53b.

[0085] The width (length in the base longitudinal direction) of the yarn guide passage 58 is narrowed away from the concave groove 53 (i.e., narrowed downward) when viewed in the extending direction. As described below, the central heat insulation member 72 is arranged to be movable in the up-down direction in accordance with the movement of the door 62. When the door 62 is at the closed position, the width W1 (length in the base longitudinal direction) of a yarn guide port (i.e., an end portion on the side opposite to the concave groove 53 side) that is an inlet of the yarn Y in the yarn guide passage 58 (58a, 58b) is shorter than the width W2 (length in the base longitudinal direction) of the concave groove 53 (53a, 53b).

[0086] The central heat insulation member 72 is provided across two opposing areas 59a and 59b (indicated by two-dot chain lines in FIG. 10) which oppose, in the up-down direction, the respective concave grooves 53 (53a and 53b) neighboring to each other in the base longitudinal direction. A part of the central heat insulation member 72 is provided in the opposing area 59a opposing the concave groove 53a, whereas another part of the central heat insulation member 72 is provided in an opposing area 59b opposing the concave groove 53b. The lateral heat insulation members 71 and 73 are provided entirely outside the opposing areas 59a and 59b. In other words, the lateral heat insulation members 71 and 73 are provided at neither the opposing area 59a nor the opposing area 59b.

[0087] When viewed in the extending direction, the central heat insulation member 72 has a substantially trapezoidal shape that is widened downward (i.e., away from the concave groove 53).

[0088] Assume that a straight line which extends along the up-down direction and passes through the center in the base longitudinal direction of the concave groove 53a is a virtual straight line S1 (indicated by a one-dot chain line in FIG. 10). Further assume that a straight line which extends along the up-down direction and passes through the center in the base longitudinal direction of the concave groove 53b is a virtual straight line S2 (indicated by a one-dot chain line in FIG. 10) . In this case, as shown in FIG. 10, when viewed in the extending direction, an upper end portion of the central heat insulation member 72 (i.e., a portion corresponding to the upper side of the trapezoidal central heat insulation member 72) is positioned between the virtual straight lines S1 and S2. The upper end portion of the central heat insulation member 72 stretches across the two opposing areas 59a and 59b. In other words, when viewed in the extending direction, the upper end portion of the central heat insulation member 72 opposes the two concave grooves 53a and 53b in the up-down direction.

[0089] When viewed in the extending direction, a lower end portion of the central heat insulation member 72 reaches the outside of each of the two opposing areas 59a and 59b. Assume that the length along the base longitudinal direction of the lower end portion of the central heat insulation member 72 when viewed in the extending direction is a length L1. The length L1 of the lower end portion of the central heat insulation member 72 is longer than an interval L2 in the base longitudinal direction between (i) an end portion on one side (left side in the sheet

of FIG. 10) in the base longitudinal direction of the concave groove 53a that is provided on the one side in the base longitudinal direction and (ii) an end portion on the other side (right side in the sheet of FIG. 10) in the base longitudinal direction of the concave groove 53b provided on the other side in the base longitudinal direction.

[0090] Surfaces 72a and 72b (equivalent to opposing surfaces of the present invention) of the central heat insulation member 72, which oppose the lateral heat insulation members 71 and 73, are tilted relative to a vertical surface orthogonal to the base longitudinal direction. When viewed in the extending direction, the surface 72a of the central heat insulation member 72 on one side in the base longitudinal direction (left side in the sheet of FIG. 10) is tilted so that, relative to the virtual straight line S1, the lower end portion is on the lateral heat insulation member 71 side whereas the upper end portion is on the side opposite to the lateral heat insulation member 71. When viewed in the extending direction, the surface 72b of the central heat insulation member 72 on the other side in the base longitudinal direction (right side in the sheet of FIG. 10) is tilted so that, relative to the virtual straight line S2, the lower end portion is on the lateral heat insulation member 73 side whereas the upper end portion is on the side opposite to the lateral heat insulation member 73.

[0091] When viewed in the extending direction, each of the lateral heat insulation members 71 and 73 has a substantially trapezoidal shape that is widened toward the concave groove 53. A surface 71a on the other side in the base longitudinal direction of the lateral heat insulation member 71 that is on one side (left side in the sheet of FIG. 10) in the base longitudinal direction among the lateral heat insulation members 71 and 73 is tilted relative to a vertical surface that is orthogonal to the base longitudinal direction. The surface 71a of the lateral heat insulation member 71 is tilted so that the upper end is on the other side (right side in the sheet of FIG. 10) in the base longitudinal direction of the lower end. A surface 73a on one side in the base longitudinal direction of the lateral heat insulation member 73 that is on the other side (right side in the sheet of FIG. 10) in the base longitudinal direction among the lateral heat insulation members 71 and 73 is tilted relative to a vertical surface that is orthogonal to the base longitudinal direction. The surface 73a of the lateral heat insulation member 73 is tilted so that the upper end is on one side (left side in the sheet of FIG. 10) in the base longitudinal direction of the lower end.

[0092] The surface 71a of the lateral heat insulation member 71 and the surface 73a of the lateral heat insulation member 73 oppose the central heat insulation member 72 in the base longitudinal direction. Assume that the interval in the base longitudinal direction between the end portions on the concave groove 53 side (i.e., the upper end portions) of the two surfaces 71a and 73a is an interval L3. Further assume that the interval in the base longitudinal direction between the end portions on the side opposite to the concave groove 53 side (i.e., the lower end portions) of the two surfaces 71a and 73a is an interval L4. In this case, the interval L3 is shorter than the interval L4.

[0093] As shown in FIG. 5, the end portion plate 79 is attached to each of the both end portions in the extending direction of the central heat insulation member 72. The end portion plate 79 is attached to the central heat insulation member 72 such that the thickness direction of the end portion plate 79 is in parallel to the extending direction.

[0094] As shown in FIG. 11, on a surface of the end portion plate 79, which is on the side opposite to the central heat insulation member 72 side in the extending direction, the protrusion 78 is formed. The protrusion 78 extend along the up-down direction. As shown in FIG. 8, the protrusion 78 is provided in the opening 64b of the central plate 64. The protrusion 78 provided in the opening 64b has side surfaces 78a which are in contact with the edge portions of the opening 64b extending in the up-down direction. The protrusion 78 is slidable and can move up and down in the opening 64b.

[0095] As shown in FIG. 4, when the door 62 is at the closed position, the central heat insulation member 72 is pressed upward by the door 62. After the door 62 moves from the closed position to the open position (indicated by dotted lines in FIG. 4), the central heat insulation member 72 is no longer pressed upward. As a result, the central heat insulation member 72 moves downward due to its own weight. As the door 62 moves from the open position to the closed position, the central heat insulation member 72 is pressed upward by the door 62 again. As a result, the central heat insulation member 72 moves upward.

[0096] As described above, the central heat insulation member 72 moves up or down relative to the central plate 64, in sync with the movement of the door 62. When the central heat insulation member 72 moves up or down, the protrusion 78 slides and moves up or down in the opening 64b formed in the central plate 64. The opening 64b guides the movement of the central heat insulation member 72 in the up-down direction.

[0097] When the door 62 is at the open position, as shown in FIG. 9, the lower end portion of the protrusion 78 of the end portion plate 79 attached to each of the both end portions in the extending direction of the central heat insulation member 72 is in contact with the lower end portion of the opening 64b formed in the central plate 64. At this stage, the central heat insulation member 72 is supported at the both ends in the extending direction by the central plates 64.

[0098] The central plate 64 attached to the side wall 61b on one side in the extending direction is switchable between a supporting position (indicated by solid lines in FIG. 9) where the central heat insulation member 72 is supported and a non-supporting position (indicated by dotted lines in FIG. 9) where the central heat insulation member 72 is not supported. To be more specific, as a force away from the central heat insulation member 72

in the extending direction is applied to the lower end portion, the central plate 64 is moved from the supporting position to the non-supporting position. At this stage, the upper end portion of the central plate 64 is biased by the biasing member 83 toward the central heat insulation member 72. On this account, at the non-supporting position, the position of the upper end portion of the central plate 64 is almost identical with the position when the plate is at the supporting position, and the central plate 64 is tilted relative to a plane orthogonal to the extending direction so that the lower end portion is far from the central heat insulation member 72 as compared to the upper end portion. To the central plate 64, the biasing member 83 applies a biasing force in a direction from the non-supporting position to the supporting position (i.e., a direction toward the central heat insulation member 72). On this account, when the force away from the central heat insulation member 72 is no longer applied to the central plate 64, the central plate 64 returns from the non-supporting position to the supporting position.

[0099] As the central plate 64 is moved from the supporting position to the non-supporting position, the central heat insulation member 72 becomes detachable from the first heater 13. As shown in FIG. 12(c), when the central heat insulation member 72 is detached, the two opposing areas 59a and 59b opposing the respective two concave grooves 53a and 53b in the up-down direction become entirely exposed. At this stage, when viewed in the extending direction, a substantially trapezoidal space that is widened downward (i.e., away from the concave groove 53) appears between the two lateral heat insulation members 71 and 73.

(Steps of Detaching Yarn Contact Members 54)

[0100] The following will describe the steps of detaching the yarn contact members 54 from the first heater 13 with reference to FIG. 12. To begin with, The operator moves the door 62 of the heat retaining box 60 from a closed position shown in FIG. 12(a) to an open position shown in FIG. 12(b). After the door 62 is moved to the open position, the central heat insulation member 72 is no longer pressed upward and moves down due to its own weight. At this stage, the central heat insulation member 72 is supported by the central plates 64 as shown in FIG. 9.

[0101] Subsequently, the operator moves the central plate 64 from the supporting position (indicated by solid lines in FIG. 9) to the non-supporting position (indicated by dotted lines in FIG. 9) and detaches the central heat insulation member 72 from the first heater 13 as shown in FIG. 12(c). As a result, the two opposing areas 59a and 59b opposing the respective two concave grooves 53a and 53b of the heating unit 50 in the up-down direction become entirely exposed. In other words, a space appears below the two concave grooves 53a and 53b. In this connection, as described above, the lateral heat insulation members 71 and 73 are not detachable from the first heater 13. The lateral heat insulation members 71 and 73 are therefore not detached from the first heater 13. In addition to the above, the operator moves the fixing plates 41 from the contact position (shown in FIG. 7(a)) to the retracted position (shown in FIG. 7(b)), and detaches the yarn contact members 54 downward.

(Characteristics of Embodiment)

[0102] As described above, the first heater 13 of the present embodiment includes the heating member 52, the yarn contact members 54a and 54b having the yarn contact surfaces 55a and 55b capable of making contact with the yarns Y, and the lateral heat insulation members 71 and 73 and the central heat insulation member 72 that are aligned in the base longitudinal direction. The yarn contact members 54a and 54b are detachably attached to the respective concave grooves 53a and 53b which are defined by the heating member 52, extend along the predetermined extending direction, and are open on one side (i.e., downward) in the up-down direction orthogonal to the extending direction. The gaps between the central heat insulation member 72 and the lateral heat insulation members 71 and 73 constitute the yarn guide passages 58a and 58b through which the yarns Ya and Yb are guided to the respective two yarn contact members 54a and 54b attached to the two concave grooves 53a and 53b. At the opposing areas 59a and 59b opposing the respective concave grooves 53a and 53b in the up-down direction, the central heat insulation member 72 is provided. The central heat insulation member 72 provided at the opposing areas 59a and 59b is detachable.

[0103] According to the arrangement above, the lateral heat insulation members 71 and 73 and the central heat insulation member 72 suppress the dissipation of heat to the outside through the internal spaces of the concave grooves 53a and 53b, with the result that the power consumption is decreased. Furthermore, when the yarns Ya and Yb are guided to the yarn contact members 54a and 54b attached to the concave grooves 53a and 53b in order to set the yarns Ya and Yb, it is possible to guide the yarns Ya and Yb through the yarn guide passages 58a and 58b without detaching the central heat insulation member 72. On this account, when the yarns Ya and Yb are set, the lateral heat insulation members 71 and 73 and the central heat insulation member 72 suppress the dissipation of heat to the outside, with the result that the power consumption is decreased. Furthermore, by detaching the central heat insulation member 72 provided at the opposing areas 59a and 59b, the opposing areas 59a and 59b opposing the concave grooves 53a and 53b in the up-down direction are exposed. Consequently, it becomes possible to detach the yarn contact members 54a and 54b attached to the concave grooves 53a and 53b, in the downward direction. On this account, being different from the case where the yarn contact members 54a and 54b are detached in the extending direction, tiresome operations such as moving members such as

a guide on the yarn path and rotating the first heater 13 are not necessary. Therefore the detachment of the yarn contact members 54a and 54b can be easily done. Furthermore, a deviation of the yarn path due to the detachment of the yarn contact members 54a and 54b is less likely to occur.

[0104] In the first heater 13 of the present embodiment, the lateral heat insulation members 71 and 73 are provided outside the opposing areas 59a and 59b and are arranged not to be detachable. Furthermore, the lateral heat insulation members 71 and 73 do not move in accordance with the detachment of the central heat insulation member 72 provided in the opposing areas 59a and 59b. These arrangements prevent the lateral heat insulation members 71 and 73 from being erroneously and unnecessarily detached when the yarn contact members 54 are detached from the concave grooves 53.

[0105] Furthermore, in the first heater 13 of the present embodiment, the length in the base longitudinal direction of the yarn guide port that is an inlet of the yarn Y in the yarn guide passage 58 (i.e., the width W1 of the yarn guide port of the yarn guide passage 58) is shorter than the length in the base longitudinal direction of the concave groove 53 (i.e., the width W2 of the concave groove 53). According to this arrangement, the width W1 of the yarn guide port of the yarn guide passage 58 is arranged to be narrow. It is therefore possible to reliably suppress the dissipation of heat from the heat source 51 to the outside.

[0106] In the first heater 13 of the present embodiment, one central heat insulation member 72 is provided at one opposing area 59a (59b). In this arrangement, when one central heat insulation member 72 is detached, the opposing area 59a (59b) opposing at least one concave groove 53 is exposed, and the yarn contact member 54 attached to that concave groove 53 becomes detachable. Therefore the detachment of the yarn contact member 54 is simplified.

[0107] In addition to the above, the first heater 13 of the present embodiment includes the central heat insulation member 72 provided at the opposing areas 59a and 59b of the concave grooves 53a and 53b and the lateral heat insulation members 71 and 73 that are provided to be aligned with the central heat insulation member 72 in the base longitudinal direction. When viewed in the extending direction, the surface 72a of the central heat insulation member 72 opposing the lateral heat insulation member 71 is tilted so that, relative to the virtual straight line S1 that extends along the up-down direction and passes through the center in the base longitudinal direction of the concave groove 53a, the lower end portion is on the lateral heat insulation member 71 side whereas the upper end portion is on the side opposite to the lateral heat insulation member 71. When viewed in the extending direction, the surface 72b of the central heat insulation member 72 opposing the lateral heat insulation member 73 is tilted so that, relative to the virtual straight line S2 that extends along the up-down direction and passes through the center in the base longitudinal direction of the concave groove 53b, the lower end portion is on the lateral heat insulation member 73 side whereas the upper end portion is on the side opposite to the lateral heat insulation member 73.

[0108] For example, assume that the surface 72a of the central heat insulation member 72 opposing the lateral heat insulation member 71 is a surface orthogonal to the base longitudinal direction and the surface 72a is on the lateral heat insulation member 71 side of the virtual straight line S1. In this case, when the yarn Ya is guided through the yarn guide passage 58a to the yarn contact member 54a attached to the concave groove 53a, the upper end portion of the central heat insulation member 72 interferes with the yarn Ya. On the other hand, the farther the surface 72a is from the lateral heat insulation member 71, the smaller a part of the concave groove 53a opposing the central heat insulation member 72 is. The present embodiment suppresses the interference between the upper end portion of the central heat insulation member 72 and the yarn Y when the yarn Y is guided through the yarn guide passage 58. At the same time, the part of the concave groove 53 opposing the central heat insulation member 72 has a sufficient size, and the dissipation of heat from the heat source 51 to the outside is reliably suppressed.

[0109] In the first heater 13 of the present embodiment, one central heat insulation member 72 is provided to stretch across the two opposing areas 59a and 59b opposing the respective concave grooves 53a and 53b in the up-down direction. In this arrangement, when one central heat insulation member 72 is detached, the two opposing areas 59a and 59b opposing the respective two concave grooves 53a and 53b in the up-down direction are exposed, and the yarn contact members 54a and 54b attached to these two concave grooves 53a and 53b become detachable. Therefore the detachment of the yarn contact members 54a and 54b is simplified. When one central heat insulation member 72 is detached, a relatively large area stretching across the two opposing areas 59a and 59b opposing the respective two concave grooves 53a and 53b in the up-down direction becomes exposed. On this account, the detachment of the yarn contact members 54a and 54b can be easily done in the large area.

[0110] In addition to the above, in the first heater 13 of the present embodiment, when viewed in the extending direction, the central heat insulation member 72 has a substantially trapezoidal shape that is widened downward (i.e., away from the concave groove 53). Furthermore, when viewed in the extending direction, the upper end portion of the central heat insulation member 72 is positioned between the virtual straight lines S1 and S2. In this arrangement, when the yarns Ya and Yb are guided through the yarn guide passages 58a and 58b to the yarn contact members 54a and 54b attached to the concave grooves 53a and 53b, interference between the upper end portion (end portion on the concave groove 53

side) of the central heat insulation member 72 and the yarn Ya is less likely to occur.

[0111] In addition to the above, in the first heater 13 of the present embodiment, when viewed in the extending direction, the upper end portion of the central heat insulation member 72 opposes the two concave grooves 53a and 53b in the up-down direction. In this arrangement, when the yarns Ya and Yb are guided through the yarn guide passages 58a and 58b to the yarn contact members 54a and 54b attached to the concave grooves 53a and 53b, the yarns Ya and Yb are less likely to be hooked by the edges of the concave grooves 53a and 53b. The yarns Ya and Yb are therefore smoothly guided from the yarn guide passages 58a and 58b to the concave grooves 53a and 53b.

[0112] In addition to the above, in the first heater 13 of the present embodiment, when viewed in the extending direction, the lower end portion of the central heat insulation member 72 extends to reach the outside of the two opposing areas 59a and 59b. In this arrangement, the space formed between the two lateral heat insulation members 71 and 73 after the central heat insulation member 72 provided between the two lateral heat insulation members 71 and 73 is detached extends to reach at least the outside of the two opposing areas 59a and 59b. On this account, the space where the detachment of the yarn contact members 54 is performed is large, and hence the detachment can be easily done.

[0113] In the first heater 13 of the present embodiment, the two surfaces 71a and 73a of the two lateral heat insulation members 71 and 73, which oppose the central heat insulation member 72 in the base longitudinal direction, are arranged so that the interval L3 between the upper end portions in the base longitudinal direction is shorter than the interval L4 between the lower end portions in the base longitudinal direction. According to this arrangement, after the central heat insulation member 72 provided between the two lateral heat insulation members 71 and 73 is detached, a space widening away from the concave groove 53 appears between the two lateral heat insulation members 71 and 73. On this account, the detachment of the yarn contact members 54 downward can be easily done.

[0114] The first heater 13 of the present embodiment further includes the central plates 64 that are capable of supporting the central heat insulation member 72. The central plate 64 is switchable between the supporting position where the central heat insulation member 72 is supported and the non-supporting position where the central heat insulation member 72 is not supported. In this arrangement, as the central plate 64 is moved from the supporting position to the non-supporting position, the central heat insulation member 72 becomes easily detachable.

[0115] In addition to the above, the first heater 13 of the present embodiment further includes the biasing member 83 which is able to apply, to the central plate 64, a biasing force in a direction from the non-supporting position to the supporting position. This arrangement makes it possible avoid unintentional movement of the central plate 64 from the supporting position to the non-supporting position.

[0116] In addition to the above, the false-twist texturing machine 1 of the present embodiment includes: the yarn supplying unit 2 configured to supply the yarns Y; the processing unit 3 including devices including the first heater 13 and configured to false-twist the yarns Y supplied from the yarn supplying unit 2; and the winding device 21 configured to wind the yarns Y processed by the processing unit 3. The winding device 21 is attached to the winding base 9, devices of the processing unit 3 are attached to the main base 8 opposing the winding base 9 over the working space A and the supporting frame 10 connecting the upper part of the winding base 9 with the upper part of the main base 8, and the mouth of the concave groove 53 formed in the first heater 13 opposes the working space A.

[0117] According to the arrangement above, when the yarn contact members 54 are detached from the concave grooves 53, the yarn contact members 54 do not interfere with other devices. Therefore the detachment of the yarn contact members 54 can be done easily. Furthermore, when the yarn contact members 54 are detached, it is unnecessary to move members and devices on the yarn path or to rotate the first heater 13. On this account, a deviation of the yarn path due to the detachment of the yarn contact members 54 is less likely to occur.

[0118] The false-twist texturing machine 1 of the present embodiment includes: the twist-stopping guide 12 which is provided upstream of the first heater 13 in the yarn running direction and supports the yarn Y to be runnable; and the false-twisting device 15 which is provided downstream of the first heater 13 in the yarn running direction and supports the yarn Y to be runnable. The yarn path at the concave groove 53 is formed by the twist-stopping guide 12 and the false-twisting device 15. According to the embodiment, the yarn Y can be guided to the concave groove 53 by threading the yarn Y to the twist-stopping guide 12 and the false-twisting device 15.

[0119] Thus, the embodiment of the present invention is described hereinabove. However, the specific structure of the present invention shall not be interpreted as to be limited to the above described embodiment. The scope of the present invention is defined not by the above embodiment but by claims set forth below, and shall encompass the equivalents in the meaning of the claims and every modification within the scope of the claims.

[0120] In the embodiment above, one yarn contact member 54 is detachably attached to each concave groove 53. The disclosure, however, is not limited to this arrangement. Plural yarn contact members 54 may be detachably attached to one concave groove 53.

[0121] In the embodiment above, one central heat insulation member 72 is provided to stretch across two opposing areas 59a and 59b. The disclosure, however, is not limited to this arrangement. Different heat insulation

members may be provided at the respective two opposing areas 59a and 59b. In this case, each of the heat insulation members provided at the opposing areas 59a and 59b is arranged to be detachable.

[0122] While in the embodiment above one heat insulation member is provided at one opposing area 59a (59b), plural heat insulation members may be provided at one opposing area 59a (59b). In this case, all of the heat insulation members provided at the opposing area 59a (59b) are arranged to be detachable.

[0123] In the embodiment above, a part of one central heat insulation member 72 is provided at one opposing area 59a (59b). The disclosure, however, is not limited to this arrangement. The entirety of one central heat insulation member 72 may be provided at one opposing area 59a (59b).

[0124] In addition to the above, in the embodiment above, the lateral heat insulation members 71 and 73 are provided outside the opposing areas 59a and 59b and are arranged not to be detachable. The disclosure, however, is not limited to this arrangement. When there are plural heat insulation members outside the opposing areas 59a and 59b, only at least one of the members is required not to be detachable. In other words, only one of the lateral heat insulation members 71 and 73 is required not to be detachable. Both of the lateral heat insulation members 71 and 73 may be detachable. Furthermore, no heat insulation member may be provided outside the opposing areas 59a and 59b.

[0125] In the embodiment above, the surface 72a of the central heat insulation member 72 is tilted so that, relative to the virtual straight line S1, the lower end portion is on the lateral heat insulation member 71 side whereas the upper end portion is on the side opposite to the lateral heat insulation member 71. Furthermore, in the embodiment above, the surface 72b of the central heat insulation member 72 is tilted so that, relative to the virtual straight line S2, the lower end portion is on the lateral heat insulation member 73 side whereas the upper end portion is on the side opposite to the lateral heat insulation member 73. However, the relationship between the surface 72a and the virtual straight line S1 and the relationship between the surface 72b and the virtual straight line S2 are not limited to these arrangements. For example, the surface 72a may be entirely on the lateral heat insulation member 71 side of the virtual straight line S1. Alternatively, the surface 72a may be entirely on the side opposite to the lateral heat insulation member 71 relative to the virtual straight line S1.

[0126] While in the embodiment above two concave grooves 53 are provided in the heating unit 50, the number of the concave grooves 53 in the heating unit 50 is not limited to this. In this regard, the number of the concave grooves 53 may be one. The number of the concave grooves 53 may be three or more.

[0127] The following will describe a modification of the embodiment above with reference to FIG. 13. A heating unit 150 shown in FIG. 13 is provided with one concave groove 53. At an opposing area 59 of the concave groove 53, a first heat insulation member 171 is provided. The first heat insulation member 171 is arranged to be detachable. A second heat insulation member 172 is provided to be aligned with the first heat insulation member 171 in the base longitudinal direction. The second heat insulation member 172 is provided on one side of the first heat insulation member 171 in the base longitudinal direction (i.e., on the left side in the sheet of FIG. 13). The second heat insulation member 172 is arranged not to be detachable. The gap between the first heat insulation member 171 and the second heat insulation member 172 functions as a yarn guide passage 58 through which a yarn Y is guided to a yarn contact member 54 attached to the concave groove 53.

[0128] As indicated by one-dot chain lines in FIG. 13, assume that a straight line extending along the up-down direction and passing through the center in the base longitudinal direction of the concave groove 53 is a virtual straight line S3. In this case, when viewed in the extending direction, a surface 171a of the first heat insulation member 171, which opposes the second heat insulation member heat insulation member 172, is tilted relative to the virtual straight line S3. Furthermore, when viewed in the extending direction, the surface 171a is arranged so that the lower end portion is on the second heat insulation member 172 side of the virtual straight line S3 and the upper end portion is on the side opposite to the second heat insulation member 172.

[0129] According to the modification shown in FIG. 13, being similar to the embodiment above, the yarn contact member 54 attached to the concave groove 53 can be detached downward after the first heat insulation member 171 is detached. Furthermore, the interference between the upper end portion of the first heat insulation member 171 and the yarn Y is suppressed when the yarn Y is guided through the yarn guide passage 58. At the same time, the part of the concave groove 53 opposing the first heat insulation member 171 has a sufficient size, and the dissipation of heat from the heat source 51 to the outside is reliably suppressed.

[0130] The embodiment above explained the case where three heat insulation members (the lateral heat insulation members 71 and 73 and the central heat insulation member 72) are aligned along the base longitudinal direction. Furthermore, the modification of the embodiment explained the case where two heat insulation members (the first heat insulation member 171 and the second heat insulation member 172) are aligned along the base longitudinal direction. The number of the heat insulation members, however, is not limited to them. The number of the heat insulation members is any number as long as it is two or more. Four or more heat insulation members may be aligned along the base longitudinal direction.

[0131] While in the embodiment above, when viewed in the extending direction, the central heat insulation member 72 has a trapezoidal shape that is widened downward, the disclosure is not limited to this arrange-

ment. For example, the central heat insulation member 72 may be rectangular in shape and is long in the up-down direction, when viewed in the extending direction. Alternatively, the central heat insulation member 72 may have a trapezoidal shape that is widened upward, when viewed in the extending direction.

[0132] While in the embodiment above, when viewed in the extending direction, the upper end portion of the central heat insulation member 72 is positioned between the virtual straight lines S1 and S2, the disclosure is not limited to this arrangement. The upper end portion of the central heat insulation member 72 may extend to reach the outside of the virtual straight lines S1 and S2.

[0133] While in the embodiment above, when viewed in the extending direction, the upper end portion of the central heat insulation member 72 opposes the two concave grooves 53a and 53b in the up-down direction, the disclosure is not limited to this arrangement. The upper end portion of the central heat insulation member 72 may oppose only one of the two concave grooves 53a and 53b in the up-down direction. The upper end portion of the central heat insulation member 72 may not oppose any of the two concave grooves 53a and 53b in the up-down direction.

[0134] While in the embodiment above, when viewed in the extending direction, the lower end portion of the central heat insulation member 72 extends to reach the outside of the two opposing areas 59a and 59b, the disclosure is not limited to this arrangement. For example, an end portion on one side (left side in the sheet of FIG. 10) in the base longitudinal direction of the lower end portion of the central heat insulation member 72 may be positioned at the opposing area 59a. An end portion on the other side (right side in the sheet of FIG. 10) in the base longitudinal direction of the lower end portion of the central heat insulation member 72 may be positioned at the opposing area 59b.

[0135] In the embodiment above, the length in the base longitudinal direction of the yarn guide port that is an inlet of the yarn Y in the yarn guide passage 58 (i.e., the width W1 of the yarn guide port of the yarn guide passage 58) is shorter than the length in the base longitudinal direction of the concave groove 53 (i.e., the width W2 of the concave groove 53). The disclosure, however, is not limited to this arrangement. Preferably, the yarn guide passage 58 is at least partially shorter than the concave groove 53 in the base longitudinal direction. In the entirety of the yarn guide passage 58, the yarn guide passage 58 may be longer than the concave groove 53 in the base longitudinal direction.

[0136] In the embodiment above, the surface 71a of the lateral heat insulation member 71 and the surface 73a of the lateral heat insulation member 73 are arranged so that the interval L3 between the upper end portions in the base longitudinal direction is shorter than the interval L4 between the lower end portions in the base longitudinal direction. The disclosure, however, is not limited to this arrangement. For example, the interval L3 may be identical with the interval L4. The interval L3 may be longer than the interval L4.

[0137] In the embodiment above, as the central plate 64 is moved from the supporting position to the non-supporting position, the central heat insulation member 72 becomes detachable from the first heater 13. The disclosure, however, is not limited to this arrangement. For example, the central heat insulation member 72 may be fixed to the first heater 13 by a detachable fixing member, and the central heat insulation member 72 may be detached from the first heater 13 by detaching the fixing member.

[0138] In the embodiment above, the yarn Y makes contact with the yarn contact surface 55 of the heating unit 50 and receives heat from the heating member 52 through the yarn contact surface 55. The disclosure, however, is not limited to this arrangement. The heating unit 50 may adopt contactless heating of the yarn Y by means of heated air. In this case, to each of the concave grooves 53a and 53b, yarn guides (equivalent to the yarn contact member of the present invention) capable of making contact with the yarn Y and configured to guide the yarn Y are detachably attached in place of each of the yarn contact members 54a and 54b having the yarn contact surfaces 55a and 55b.

[0139] In the embodiment above, the yarn path at the concave groove 53 of the first heater 13 is formed by the twist-stopping guide 12 and the false-twisting device 15. The disclosure, however, is not limited to this arrangement. As a member forming the yarn path at the concave groove 53, a member that is provided upstream of the first heater 13 in the yarn running direction and supports the yarn Y to be runnable may be provided in addition to the twist-stopping guide 12. As a member forming the yarn path at the concave groove 53, a member that is provided downstream of the first heater 13 in the yarn running direction and supports the yarn Y to be runnable may be provided in addition to the false-twisting device 15.

[0140] In the embodiment above, the yarn heater of the present invention is applied to the false-twist texturing machine 1 configured to false-twist the yarns Y. However, the disclosure is not limited to this. The yarn heater of the present invention is applicable to a processor configured to perform, for yarns formed of synthetic fibers, various processes such as yarn combining in addition to false twisting.

Claims

1. A yarn heater (13) which has at least one concave groove (53) in which a yarn (Y) runs and which is capable of heating the yarn (Y) running in the at least one concave groove (53), the concave groove (53) being open on one side in an orthogonal direction orthogonal to an extending direction in which the at least one concave groove (53) extends, the yarn

heater (13) comprising:

a heating member (52) which extends along the extending direction, defines at least part of the at least one concave groove (53), and is configured to heat the yarn (Y) running in the at least one concave groove (53);
at least one yarn contact member (54) which is detachably attached to each of the at least one concave groove (53) and is capable of making contact with the yarn (Y) running in the at least one concave groove (53); and
two or more heat insulation members which are provided to be aligned in a width direction which is orthogonal to both the extending direction and the orthogonal direction,
a gap between two neighboring heat insulation members constituting a yarn guide passage through which the yarn (Y) is guided to the yarn contact member (54) attached to the at least one concave groove (53),
at an opposing area (59a, 59b, 59) opposing each of the at least one concave groove (53) in the orthogonal direction, at least part of one or more heat insulation member (72, 171) of the at least two heat insulation members being provided, and
all of the one or more heat insulation member (72, 171) provided at the opposing area (59a, 59b, 59) being arranged to be detachable.

2. The yarn heater(13) according to claim 1, wherein, at least one of the two or more heat insulation members is provided outside the opposing area (59a, 59b, 59) and is arranged not to be detachable, and does not move in accordance with detachment of the heat insulation member provided in the opposing area (59a, 59b, 59).

3. The yarn heater (13) according to claim 1 or 2, wherein, the length in the width direction of a yarn guide port that is an inlet of the yarn (Y) into the yarn guide passage (58) is shorter than the length in the width direction of the at least one concave groove (53).

4. The yarn heater according to any one of claims 1 to 3, wherein, the number of heat insulation members (72, 171) provided at one opposing area (59a, 59b, 59) is one.

5. The yarn heater (13) according to claim 4, wherein,

the at least one heat insulation member (71 to 73, 171, 172) includes a first heat insulation member (72, 171) provided at the opposing area (59a, 59b, 59) of the at least one concave groove (53) and a second heat insulation member (71, 73, 172) which is provided to be aligned with the first heat insulation member (72, 171) in the width direction,
a gap between the first heat insulation member (72, 171) and the second heat insulation member (71, 73, 172) constitutes the yarn guide passage (58), and
when there is at least one virtual straight line (S1, S2, S3) extending along the orthogonal direction and passing through the center in the width direction of the at least one concave groove (58), when viewed in the extending direction, an opposing surface (72a, 72b, 171a) of the first heat insulation member (72, 171), which opposes the second heat insulation member (71, 73, 172), is tilted relative to the at least one virtual straight line (S1, S2, S3), and relative to the at least one virtual straight line (S1, S2, S3), an end portion of the opposing surface (72a, 72b, 171a) on the one side in the orthogonal direction is on the second heat insulation member (71, 73, 172) side whereas an end portion of the opposing surface (72a, 72b, 171a) on the other side in the orthogonal direction is on the side opposite to the second heat insulation member (71, 73, 172).

6. The yarn heater (13) according to claim 4 or 5, wherein,

plural concave grooves (53) are aligned in the width direction, and
one heat insulation member (72) of the at least one heat insulation member is provided to stretch across two opposing areas (59a, 59b) opposing, in the orthogonal direction, the respective two concave grooves (53) neighboring each other in the width direction.

7. The yarn heater (13) according to claim 6, wherein,

the at least one heat insulation member (71 to 73) includes: one central heat insulation member (72) provided to stretch across the two opposing areas (59a, 59b) opposing, in the orthogonal direction, the respective two concave grooves (53) neighboring each other in the width direction; and two lateral heat insulation members (71, 73) which are provided on the respective sides of the one central heat insulation member (72) in the width direction,
each of gaps between the one central heat insulation member (72) and the two lateral heat insulation members (71, 73) constitutes the yarn guide passage (58) through which the yarn is guided to the at least one yarn contact member (54) attached to the two concave grooves (53),
the one central heat insulation member (72) has a trapezoidal shape that is widened from the oth-

er side toward the one side in the orthogonal direction, when viewed in the extending direction, and
when viewed in the extending direction, an end portion of the one central heat insulation member (72), which is on the other side in the orthogonal direction, is positioned between two virtual straight lines (S1 and S2) extending along the orthogonal direction and passing through centers of the two concave grooves (53) relative to the width direction, respectively.

8. The yarn heater (13) according to claim 7, wherein, when viewed in the extending direction, the end portion of the one central heat insulation member (72), which is on the other side in the orthogonal direction, opposes the two concave grooves (53) in the orthogonal direction.

9. The yarn heater (13) according to claim 7 or 8, wherein, when viewed in the extending direction, an end portion of the one central heat insulation member (72), which is on the one side in the orthogonal direction, extends to reach the outside of the two opposing areas (59a, 59b).

10. The yarn heater (13) according to any one of claims 7 to 9, wherein, two surfaces (71a, 73a) of the respective two lateral heat insulation members (71, 73), which oppose the one central heat insulation member (72) in the width direction, are arranged so that an interval in the width direction between end portions on the other side in the orthogonal direction is shorter than an interval in the width direction between end portions on the one side in the orthogonal direction.

11. The yarn heater (13) according to any one of claims 1 to 10, comprising a supporting member (64) capable of supporting the at least one heat insulation member (72),
The supporting member (64) being switchable between a supporting position where the at least one heat insulation member (72) is supported and a non-supporting position where the at least one heat insulation member (72) is not supported.

12. The yarn heater (13) according to claim 11, comprising a biasing member (83) which is capable of applying biasing force to the supporting member (64) in a direction from the non-supporting position toward the supporting position.

13. A false-twist texturing machine (1) comprising the yarn heater (13) of any one of claims 1 to 12.

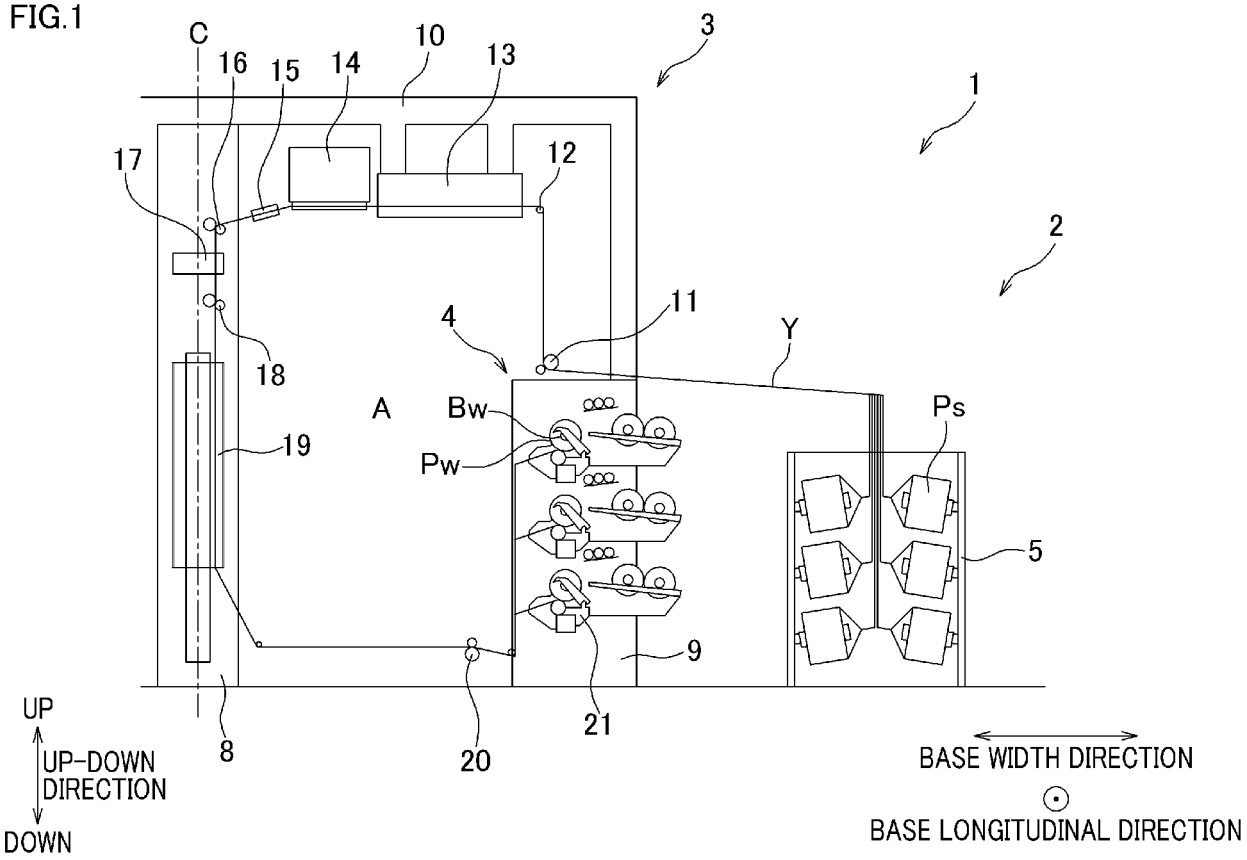
14. The false-twist texturing machine (1) according to claim 13, further comprising:

a yarn supplying unit (2) which is configured to supply a yarn (Y);
a processing unit (3) which includes devices including the yarn heater (13) and which is configured to false-twist the yarn (Y) supplied from the yarn supplying unit (2); and
a winding device (21) which is configured to wind the yarn (Y) processed by the processing unit (3),
the winding device (21) being fixed to a winding base (9),
the devices of the processing unit (3) being attached to a main base (8) opposing the winding base (9) over a working space (A) and a supporting frame (10) connecting an upper part of the winding base (9) with an upper part of the main base (8), and
the yarn heater (13) heating the yarn running in the at least one concave groove (53) which extends in the extending direction and has a mouth that opposes the working space (A) in a direction orthogonal to the extending direction.

15. The false-twist texturing machine (1) according to claim 13, further comprising:

a first yarn path forming member (12) which is provided upstream of the yarn heater (13) in a yarn running direction and is able to support the yarn (Y) to be runnable; and
a second yarn path forming member (15) which is provided downstream of the yarn heater (13) in the yarn running direction and is able to support the yarn (Y) to be runnable,
a yarn path at the concave groove (53) being formed by the first yarn path forming member (12) and the second yarn path forming member (15).

FIG.1


C
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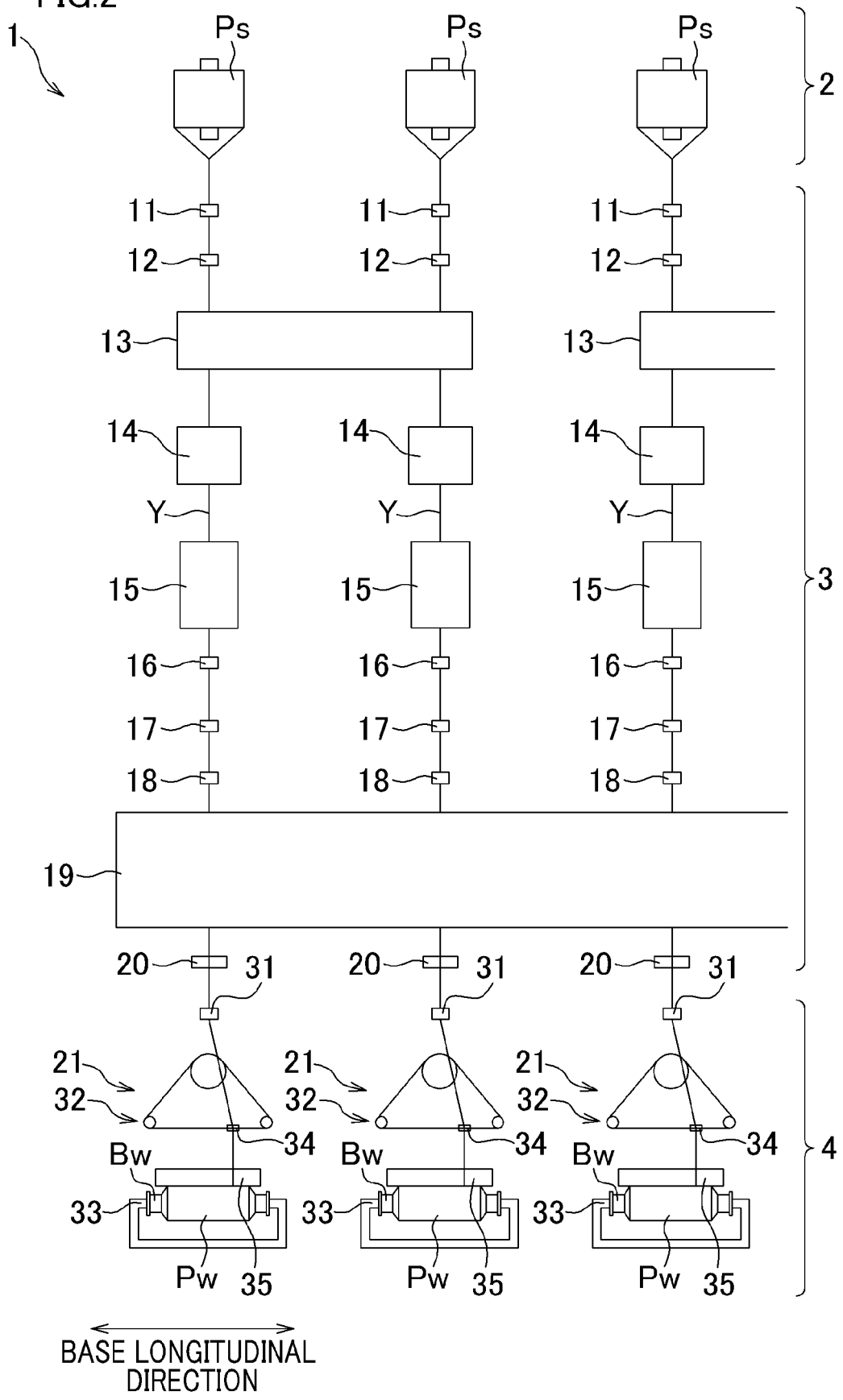
10
13
3
1
17
12
2
11
4
Y
18
A
Bw
Ps
19
Pw
5
9
21
UP
UP-DOWN DIRECTION
DOWN
8
20
BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION

FIG.2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Ps
2
11
12
13
14
Y
15
16
17
18
19
3
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31
21
32
34
Bw
33
Pw
35
4
BASE LONGITUDINAL DIRECTION

FIG.3

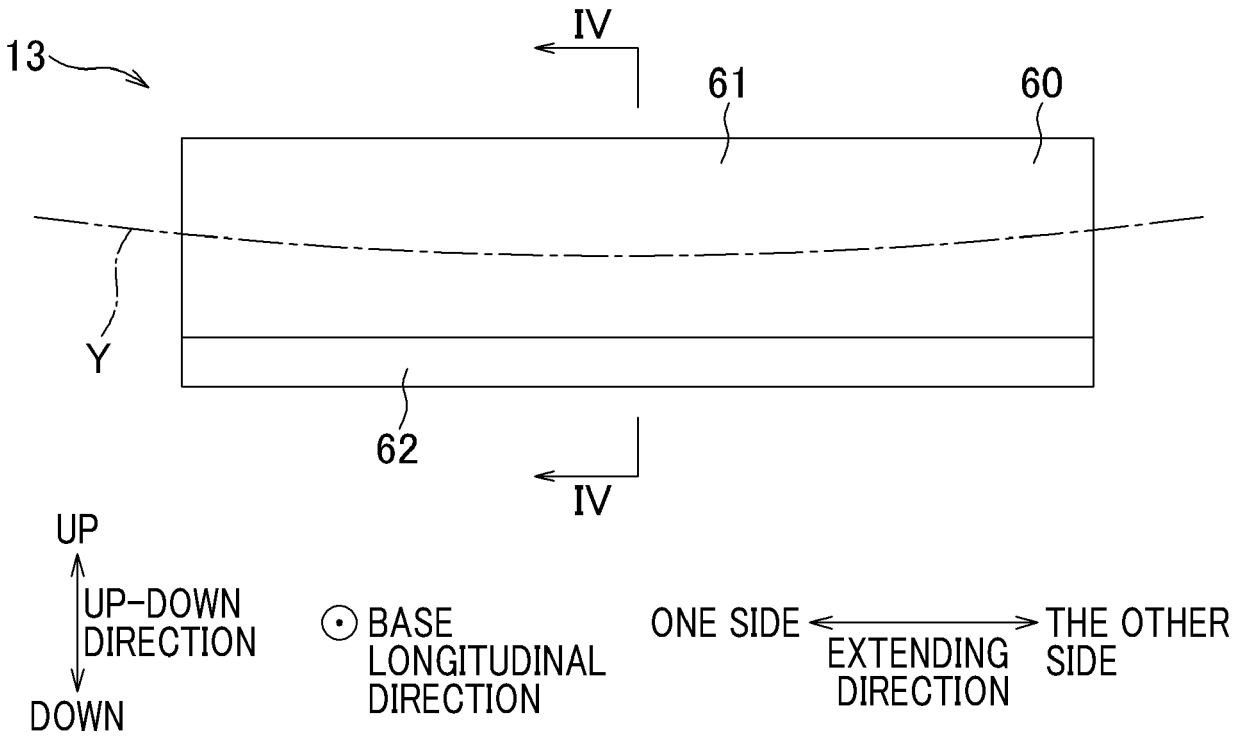
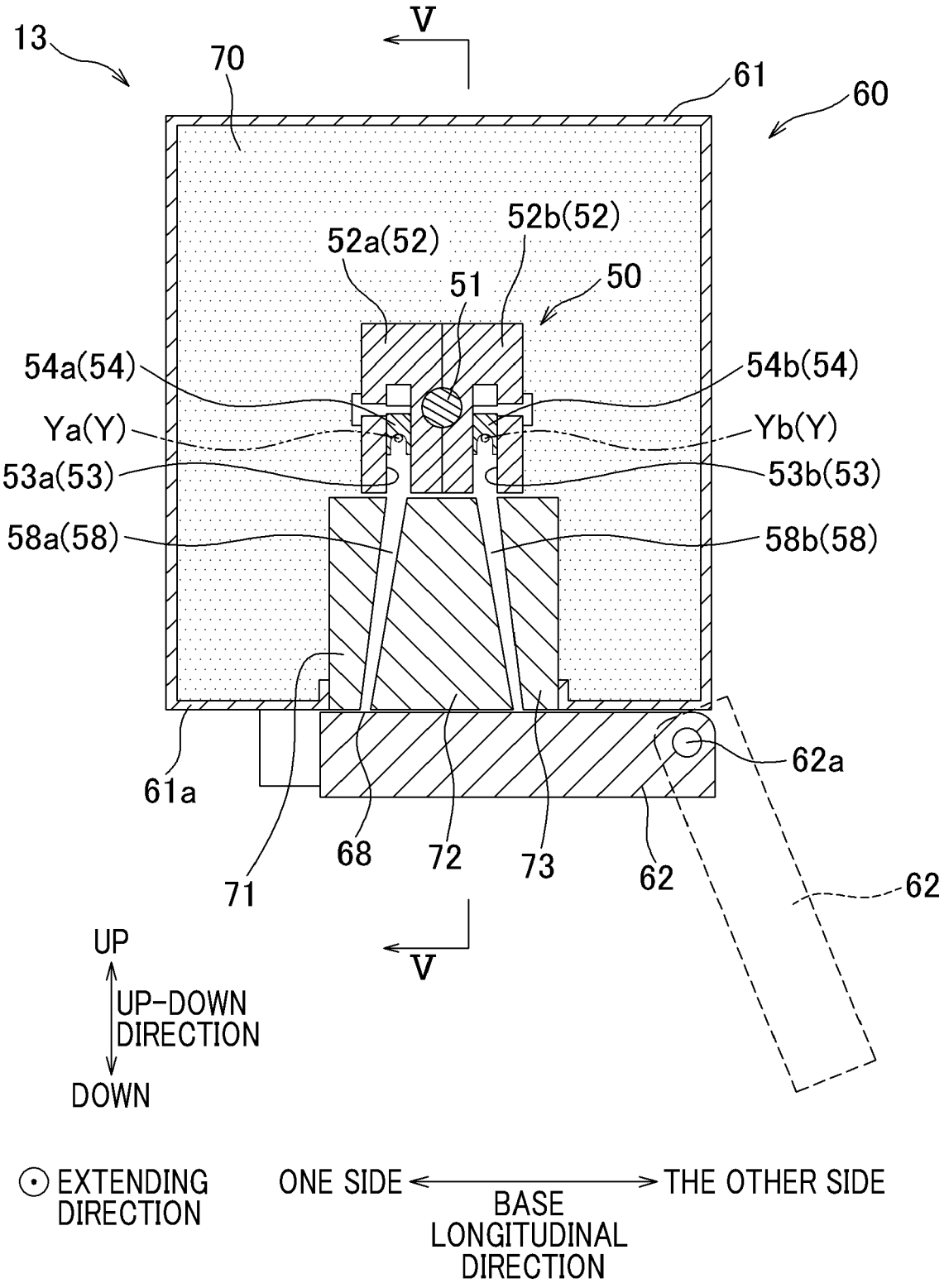

13
IV
61
60
Y
62
IV
UP
UP-DOWN DIRECTION
DOWN
BASE LONGITUDINAL DIRECTION
ONE SIDE
EXTENDING DIRECTION
THE OTHER SIDE

FIG.4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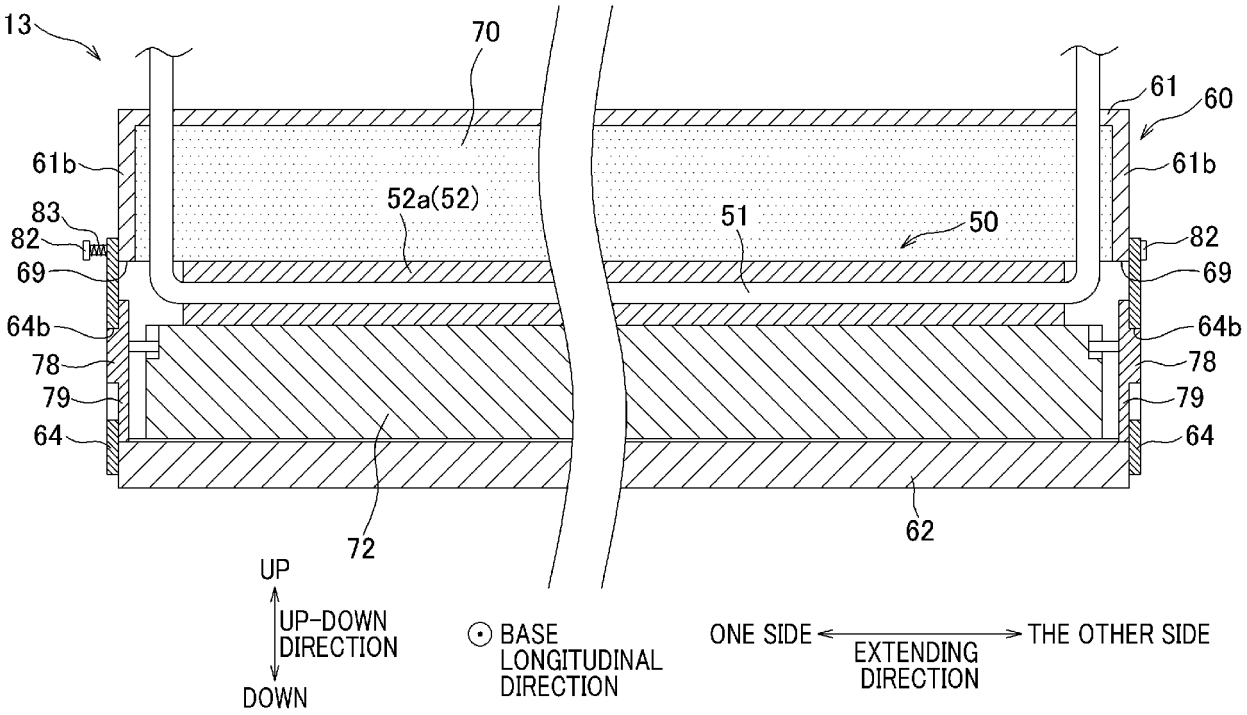
60
52b(52)
52a(52)
51
50
54a(54)
54b(54)
Ya(Y)
Yb(Y)
53a(53)
53b(53)
58a(58)
58b(58)
61a
62a
68
72
73
62
62
71
V
UP
UP-DOWN DIRECTION
DOWN
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION

FIG.5


13
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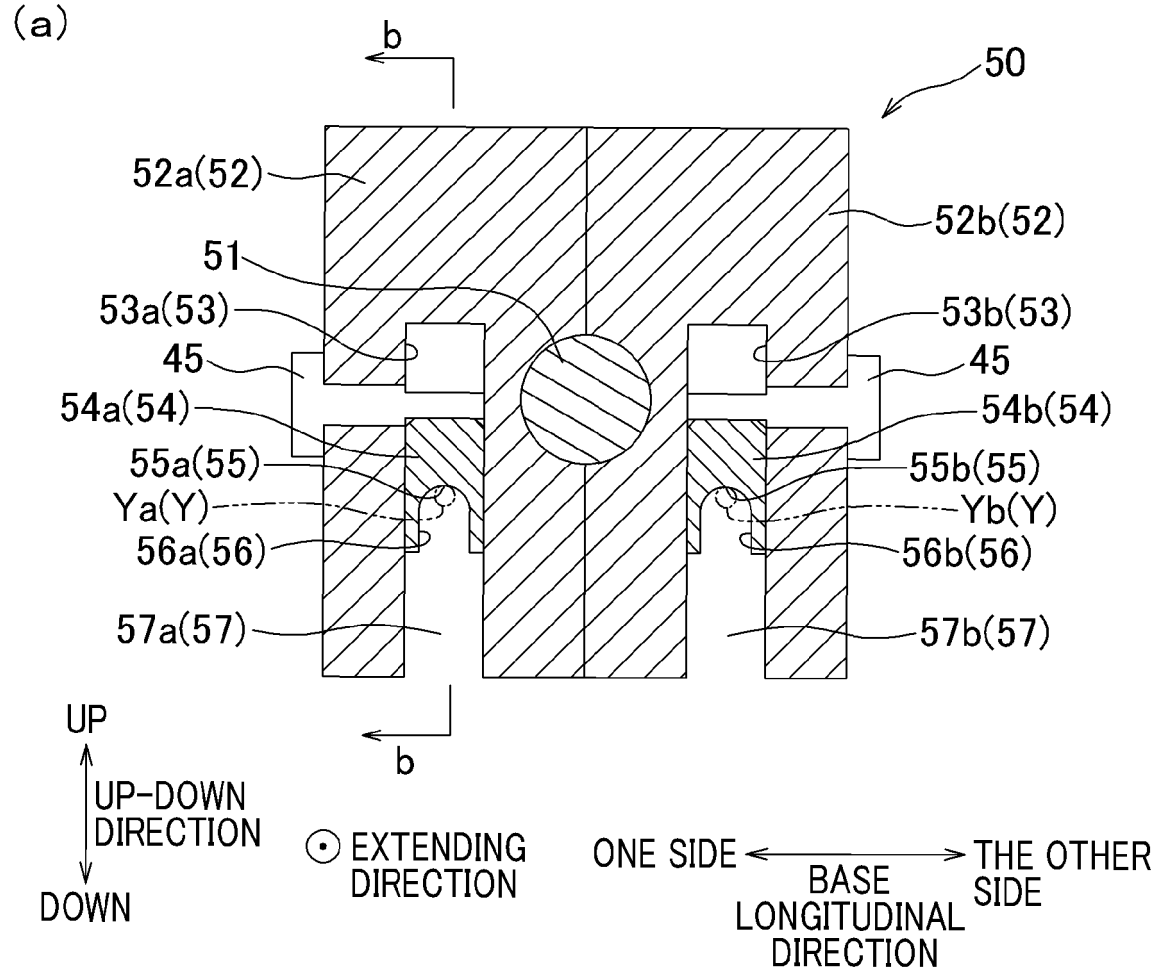
60
61b
61b
52a(52)
51
50
83
82
82
69
69
64b
64b
78
78
79
79
64
64
72
62
UP
UP-DOWN DIRECTION
DOWN
BASE LONGITUDINAL DIRECTION
ONE SIDE
EXTENDING DIRECTION
THE OTHER SIDE

FIG.6


(a)
b
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52b(52)
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53a(53)
53b(53)
45
45
54a(54)
54b(54)
55a(55)
55b(55)
Ya(Y)
Yb(Y)
56a(56)
56b(56)
57a(57)
57b(57)
b
UP
UP-DOWN DIRECTION
DOWN
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION

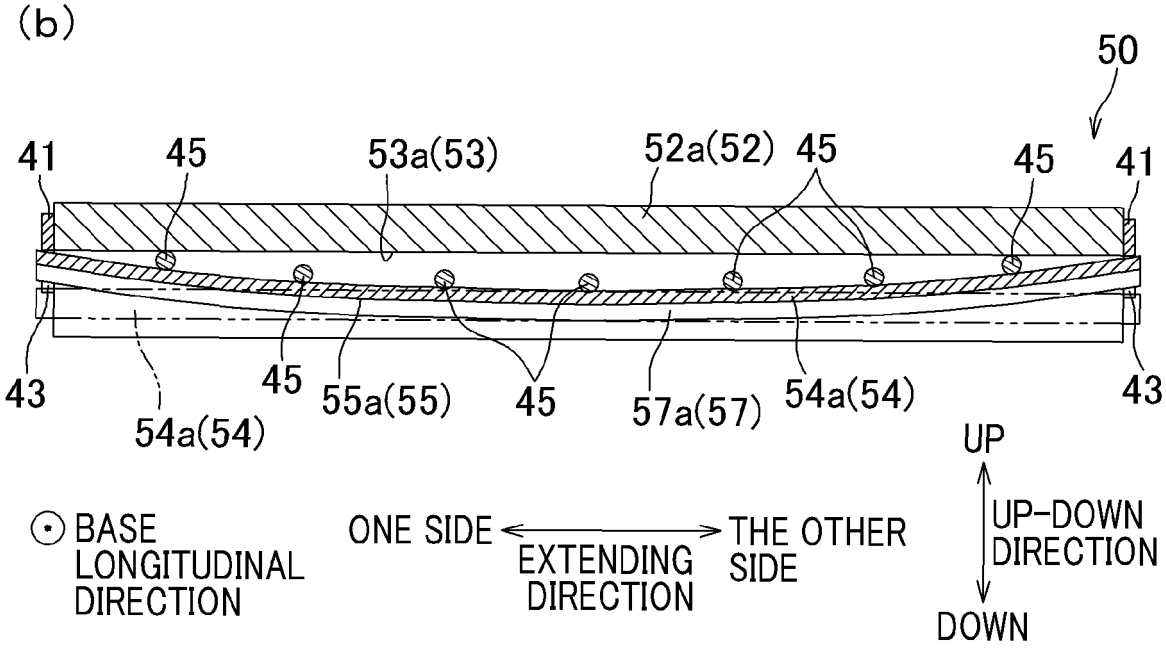

(b)
50
41
45
53a(53)
52a(52)
45
45
41
43
54a(54)
45
55a(55)
45
57a(57)
54a(54)
43
BASE LONGITUDINAL DIRECTION
ONE SIDE
EXTENDING DIRECTION
THE OTHER SIDE
UP
UP-DOWN DIRECTION
DOWN

FIG.7

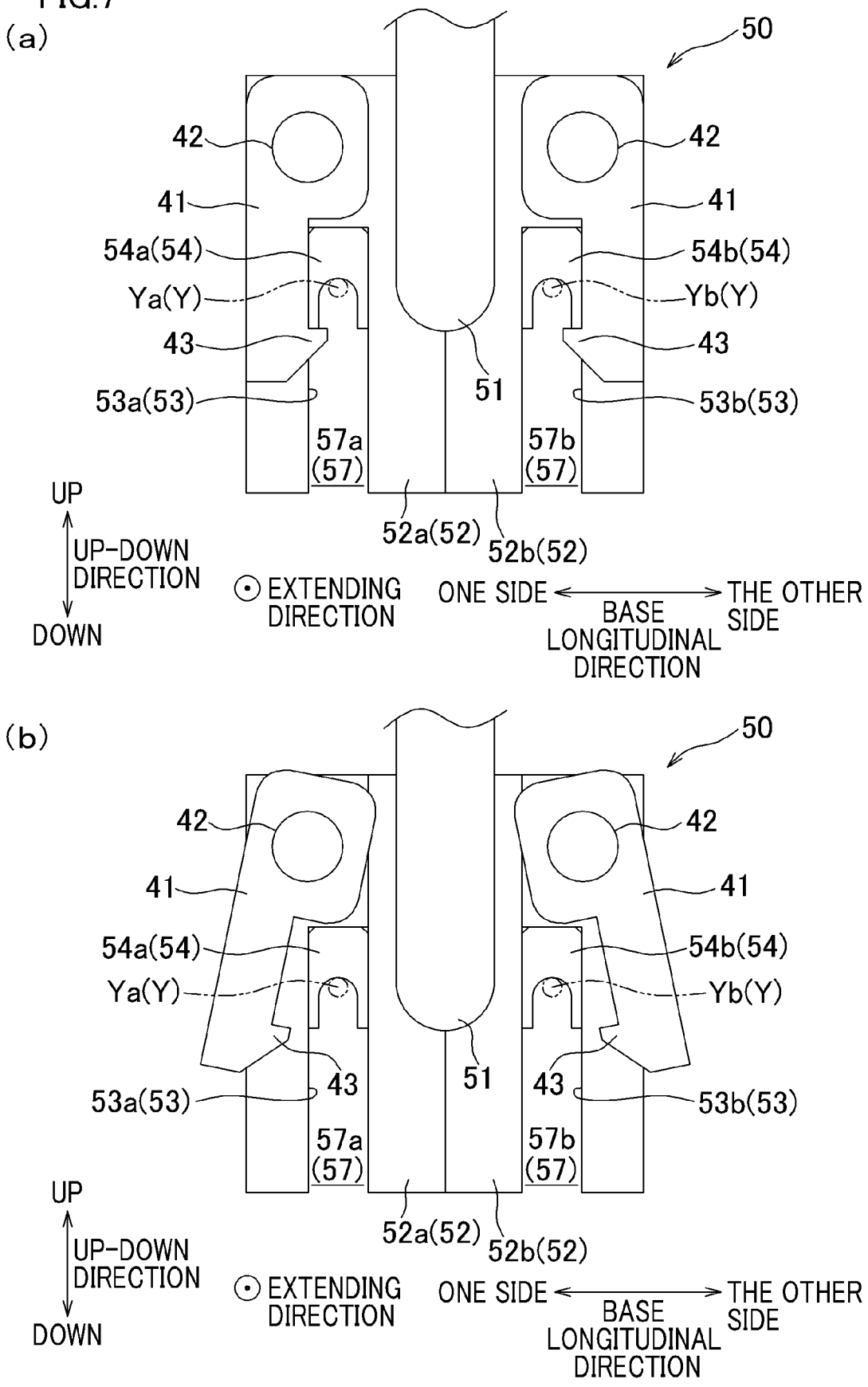

(a)
50
42
42
41
41
54a(54)
54b(54)
Ya(Y)
Yb(Y)
43
43
51
53a(53)
53b(53)
57a
(57)
57b
(57)
52a(52)
52b(52)
UP
UP-DOWN
DIRECTION
DOWN
EXTENDING
DIRECTION
ONE SIDE
THE OTHER
SIDE
BASE
LONGITUDINAL
DIRECTION
(b)
50
42
42
41
41
54a(54)
54b(54)
Ya(Y)
Yb(Y)
43
43
51
53a(53)
53b(53)
57a
(57)
57b
(57)
52a(52)
52b(52)
UP
UP-DOWN
DIRECTION
DOWN
EXTENDING
DIRECTION
ONE SIDE
THE OTHER
SIDE
BASE
LONGITUDINAL
DIRECTION

FIG.8

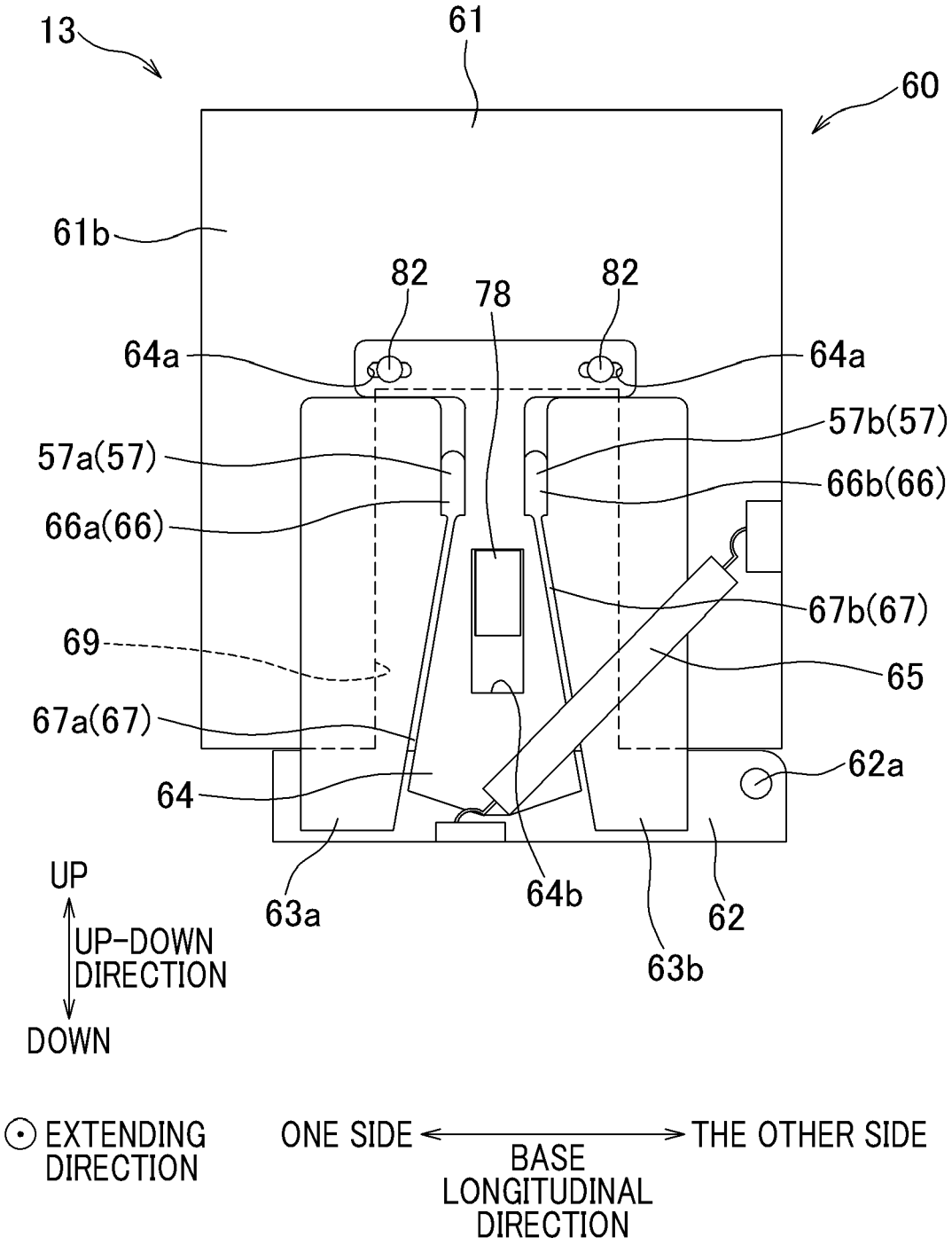

13
61
60
61b
82
78
82
64a
64a
57b(57)
57a(57)
66b(66)
66a(66)
67b(67)
69
65
67a(67)
62a
64
UP
UP-DOWN DIRECTION
DOWN
63a
64b
62
63b
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION

FIG.9

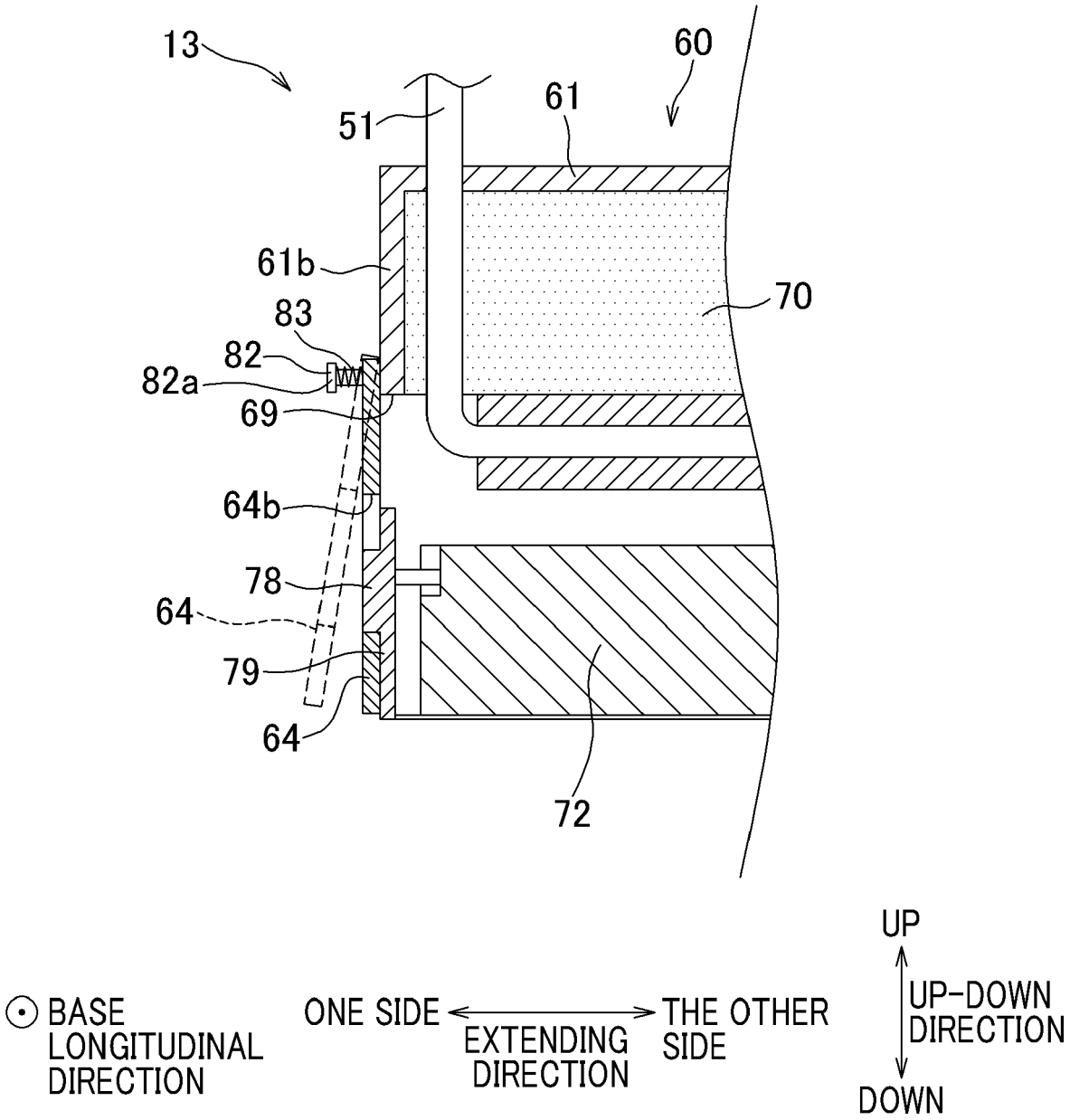

13
60
61
51
61b
70
83
82
82a
69
64b
78
64
79
64
72
BASE LONGITUDINAL DIRECTION
ONE SIDE
EXTENDING DIRECTION
THE OTHER SIDE
UP
UP-DOWN DIRECTION
DOWN

FIG.10

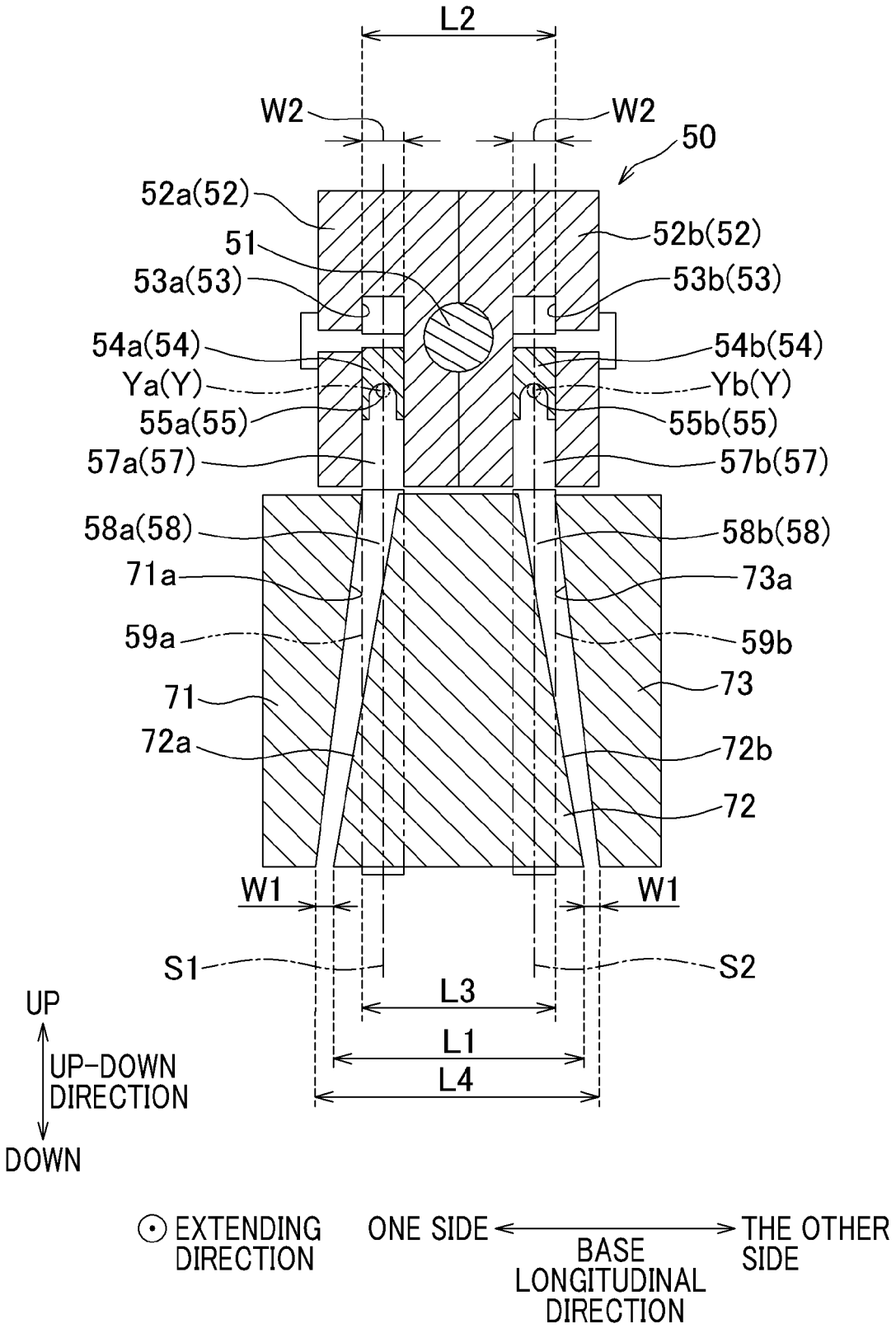

L2
W2
W2
50
52a(52)
51
52b(52)
53a(53)
53b(53)
54a(54)
54b(54)
Ya(Y)
Yb(Y)
55a(55)
55b(55)
57a(57)
57b(57)
58a(58)
58b(58)
71a
73a
59a
59b
71
73
72a
72b
72
W1
W1
S1
S2
L3
L1
L4
UP
UP-DOWN DIRECTION
DOWN
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION

FIG.11

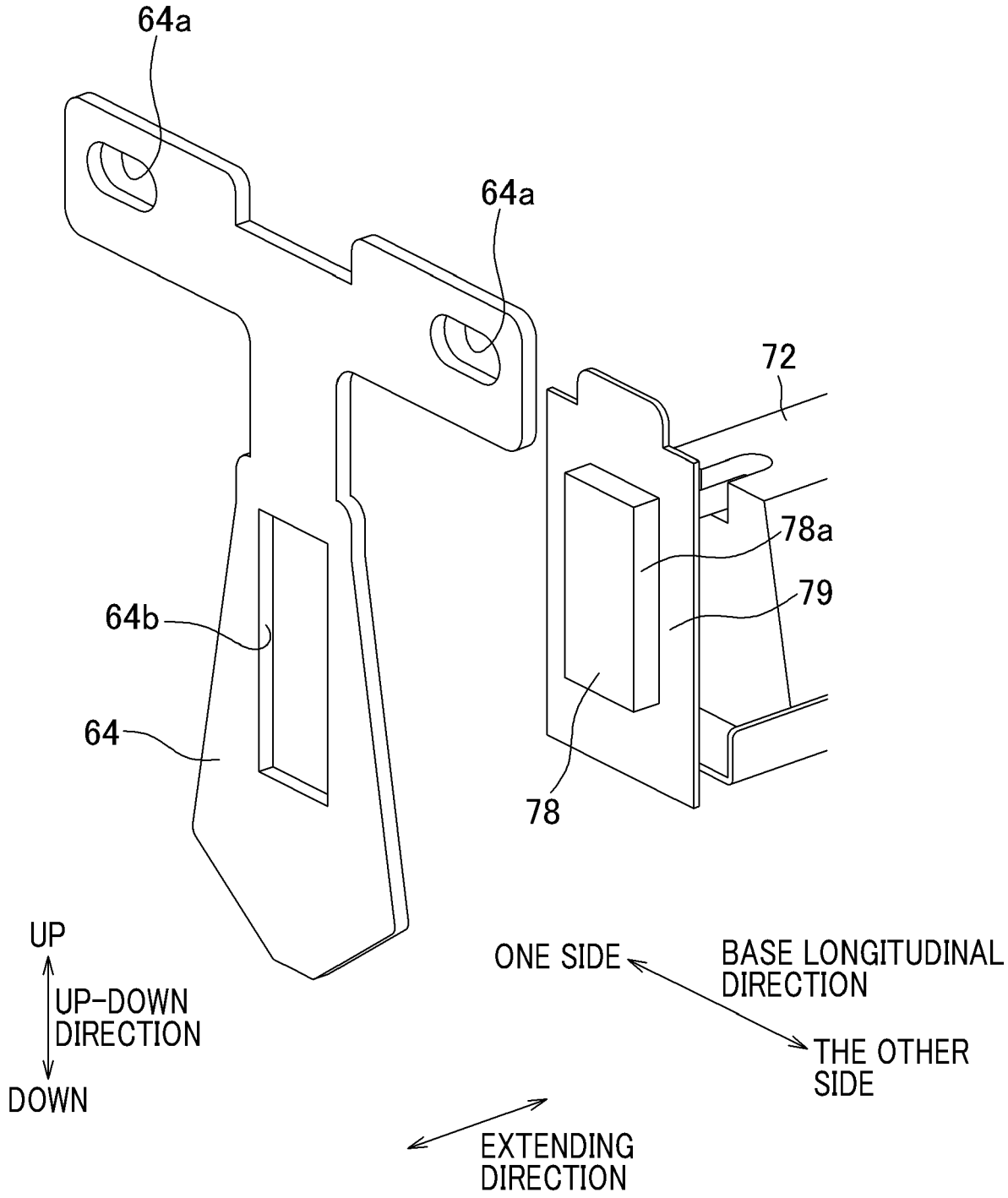

64a
64a
72
78a
79
64b
64
78
UP
UP-DOWN DIRECTION
DOWN
ONE SIDE
BASE LONGITUDINAL DIRECTION
THE OTHER SIDE
EXTENDING DIRECTION

FIG.12

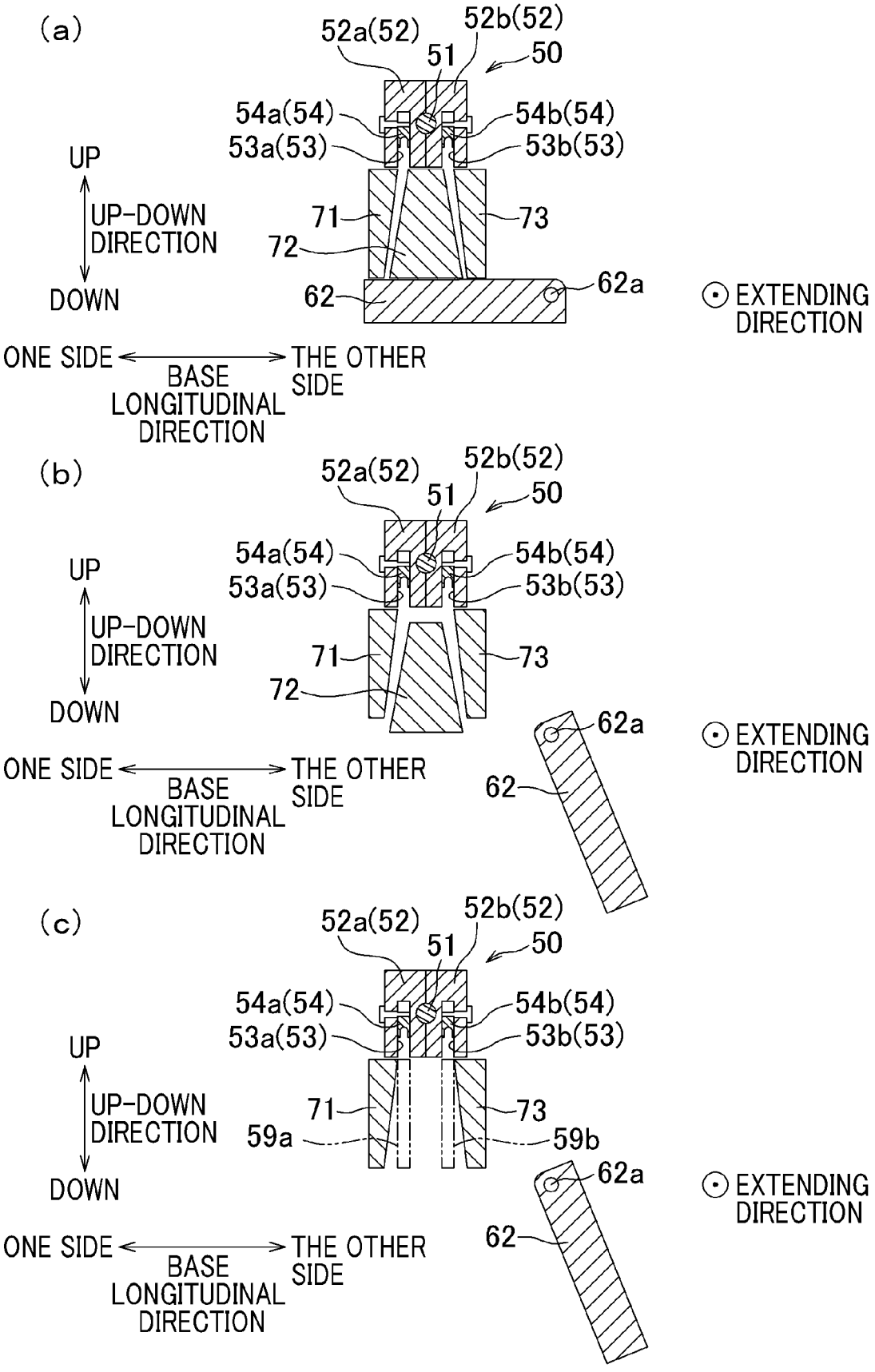
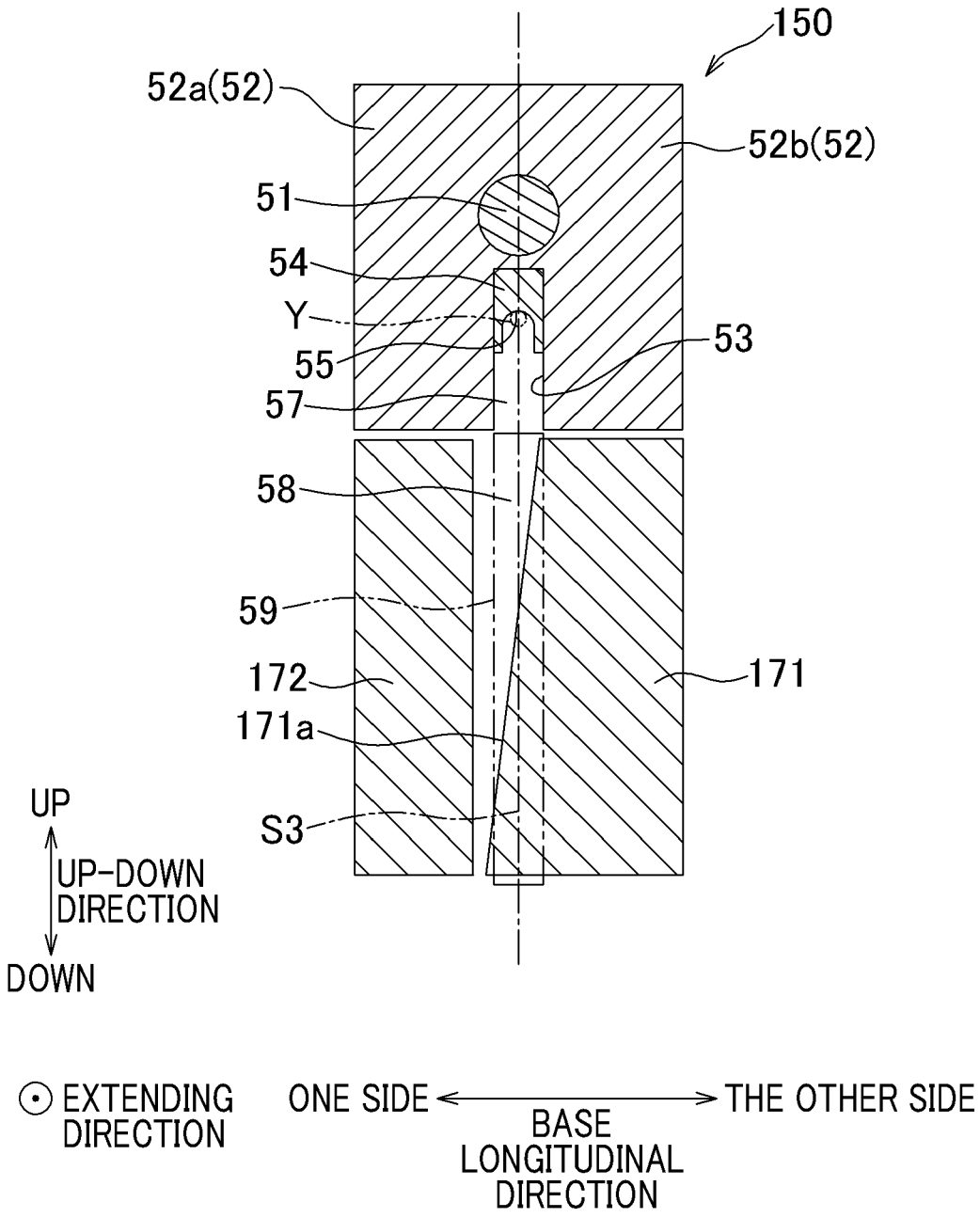

(a)
52a(52)
52b(52)
51
50
54a(54)
54b(54)
53a(53)
53b(53)
UP
UP-DOWN DIRECTION
DOWN
71
73
72
62
62a
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION
(b)
52a(52)
52b(52)
51
50
54a(54)
54b(54)
53a(53)
53b(53)
UP
UP-DOWN DIRECTION
DOWN
71
73
72
62a
62
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION
(c)
52a(52)
52b(52)
51
50
54a(54)
54b(54)
53a(53)
53b(53)
UP
UP-DOWN DIRECTION
DOWN
71
73
59a
59b
62a
62
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION

FIG.13


150
52a(52)
52b(52)
51
54
Y
55
53
57
58
59
172
171
171a
S3
UP
UP-DOWN DIRECTION
DOWN
EXTENDING DIRECTION
ONE SIDE
THE OTHER SIDE
BASE LONGITUDINAL DIRECTION

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 9337

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 A	EP 0 905 295 A1 (MURATA MACHINERY LTD [JP]) 31 March 1999 (1999-03-31) * paragraphs [0011], [0012], [0013], [0016], [0019]; claim 6; figures 1,2.1,2.2,4,5,6 *	1-6,8,9, 13-15 7,10-12	INV. D02G1/02 D02J13/00
A	WO 2018/007294 A1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 11 January 2018 (2018-01-11) * page 11, line 10 - page 13, line 23 * * page 17, line 24 - page 18, line 2 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

D02G
D02J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 April 2024	Van Beurden-Hopkins

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19-04-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0905295 A1	31-03-1999	EP 0905295 A1	31-03-1999
		JP 3358511 B2	24-12-2002
		JP H11107083 A	20-04-1999
		KR 19990030032 A	26-04-1999
		TW 500129 U	21-08-2002
		US 6138448 A	31-10-2000
WO 2018007294 A1	11-01-2018	NONE	

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Patent documents cited in the description

- JP 2002194631 A **[0002]**