



(11) **EP 4 108 817 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.12.2022 Bulletin 2022/52

(51) International Patent Classification (IPC):
D02G 1/02^(2006.01) D02G 1/08^(2006.01)

(21) Application number: **22174263.8**

(52) Cooperative Patent Classification (CPC):
D02G 1/0266; D02G 1/08

(22) Date of filing: **19.05.2022**

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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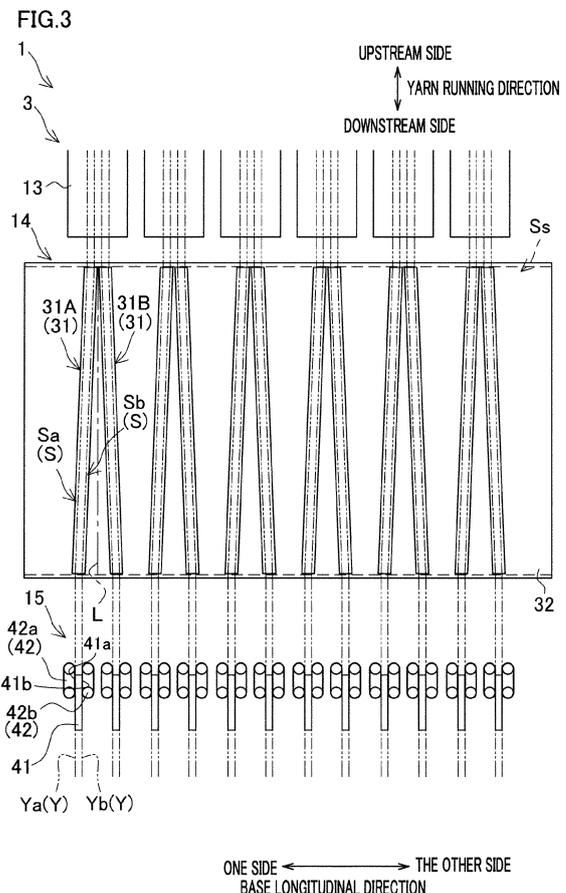
(30) Priority: **10.06.2021 JP 2021097084**

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(54) **FALSE-TWIST TEXTURING MACHINE**

(57) The loss of production efficiency and homogeneity are suppressed and a good yarn quality is achieved, even when thick yarns are subjected to false-twist texturing. A false-twist texturing machine 1 includes a false-twisting device 15 configured to twist a first yarn Ya and a second yarn Yb and a cooler 14 configured to cool the first yarn Ya and the second yarn Yb. The false-twisting device 15 includes a disc 41, a first belt unit 42a, and a second belt unit 42b. The disc 41 has a first contact surface 41a and a second contact surface 41b. The first yarn Ya is twisted by the first contact surface 41a and a first endless belt 46a of the first belt unit 42a. The second yarn Yb is twisted by the second contact surface 41b and a second endless belt 46b of the second belt unit 42b. The cooler 14 includes a cooling unit 31 in which a first cooling space Sa and a second cooling space Sb are formed and an intake duct 32 configured to supply cooling wind to the first cooling space Sa and the second cooling space Sb.



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a false-twist texturing machine configured to perform false-twist texturing for yarns.

[0002] Patent Literature 1 (Japanese Patent No. 4462751) discloses a false-twist texturing machine configured to perform false-twist texturing for yarns made of synthetic fibers. The false-twist texturing machine includes false-twisting devices configured to twist the respective yarns, a cooler provided upstream of the false-twisting devices in a yarn running direction in which the yarns run, and a heater provided upstream of the cooler in the yarn running direction. The running yarns having been twisted by the false-twisting devices are heated by the heater so as to be thermally set, and then the yarns are cooled by the cooler. The crimp of the yarns is fixed by this, with the result that yarns with loftiness are produced.

SUMMARY OF THE INVENTION

[0003] There have recently been demands for a false-twist texturing machine capable of performing false-twist texturing for yarns that are thicker than before. Meanwhile, it is necessary to take into account of the number of yarns to be simultaneously subjected to false-twist texturing (hereinafter, production efficiency) and suppression of increase of a difference in quality between yarns (hereinafter, homogeneity).

[0004] An object of the present invention is to suppress the loss of production efficiency and homogeneity and to achieve a good yarn quality, even when thick yarns are subjected to false-twist texturing.

[0005] According to a first aspect of the invention, a false-twist texturing machine is configured to be able to simultaneously perform false-twist texturing for a first yarn and a second yarn that are running, and includes: a false-twisting device which is configured to twist the first yarn and the second yarn; and a cooler which is provided upstream of the false-twisting device in a yarn running direction in which the first yarn and the second yarn run and is configured to cool the first yarn and the second yarn, the false-twisting device including: a disc rotatable about a rotational axis direction that is a predetermined direction; a first belt unit that is provided on one side in the predetermined direction of the disc; and a second belt unit that is provided on the other side in the predetermined direction of the disc, the disc including: a first contact surface that is provided at an end on the one side in the predetermined direction; and a second contact surface that is provided at an end on the other side in the predetermined direction, the first belt unit including a first belt member that is in contact with the first yarn and is movable and being configured to twist the first yarn by sandwiching the first yarn between the first contact sur-

face and the first belt member, the second belt unit including a second belt member that is in contact with the second yarn and is movable and being configured to twist the second yarn by sandwiching the second yarn between the second contact surface and the second belt member, and the cooler including: a cooling unit in which a first cooling space for cooling the first yarn and a second cooling space which is provided to be side by side with the first cooling space and for cooling the second yarn are formed; and an intake duct which has an intake space connected to the first cooling space and the second cooling space and is provided to supply cooling wind to the first cooling space and the second cooling space.

[0006] In the false-twisting device of the false-twist texturing machine of the aspect of the invention, the first yarn is sandwiched between the first belt member and the first contact surface whereas the second yarn is sandwiched between the second belt member and the second contact surface. With this arrangement, the twisting of the first yarn and the second yarn is ensured. Furthermore, because the first contact surface and the second contact surface are formed on the same disc, the distance between the first yarn and the second yarn is short in the false-twisting device. It is therefore possible to twist a large number of yarns in a small space. Furthermore, in the false-twisting device, the position where the first yarn is false-twisted is advantageously close to the position where the second yarn is false-twisted. This makes it possible to suppress paths of the first yarn and the second yarn from being significantly different (and to suppress inconsistency in yarn quality between the first yarn and the second yarn due to the difference between the yarn paths).

[0007] In the cooler of the false-twist texturing machine of the aspect of the invention, the first yarn and the second yarn are reliably cooled by cooling wind. Furthermore, because the first cooling space and the second cooling space are formed in the same cooling unit, the distance between the first yarn and the second yarn is advantageously short in the cooler. It is therefore possible to cool a large number of yarns in a small space. Furthermore, because the distance between the first yarn and the second yarn is short as described above, it is possible to suppress the yarn paths of the first yarn and the second yarn from being significantly different (and to suppress the above-described inconsistency in yarn quality due to the difference between the yarn paths).

[0008] As described above, it is possible to suppress the loss of production efficiency and homogeneity and to achieve a good yarn quality, even when thick yarns are subjected to false-twist texturing.

[0009] According to a second aspect of the invention, the false-twist texturing machine of the first aspect is arranged so that the first cooling space and the second cooling space are provided to be side by side in the predetermined direction.

[0010] According to this aspect of the invention, it is possible to maintain the first yarn and the second yarn

to be side by side in the predetermined direction when the first yarn and the second yarn are sent from the cooler to the false-twisting device. This makes it possible to further suppress the yarn paths of the first yarn and the second yarn from being different as compared to a case where, for example, the first cooling space predetermined direction and the second cooling space are aligned in a direction different from the predetermined direction. Therefore, the difference in quality can be effectively suppressed between the first yarn and the second yarn.

[0011] According to a third aspect of the invention, the false-twist texturing machine of the second aspect is arranged so that, when a distance between an upstream end in the yarn running direction of the first cooling space and an upstream end in the yarn running direction of the second cooling space in the predetermined direction is WC1 and a distance between a downstream end in the yarn running direction of the first cooling space and a downstream end in the yarn running direction of the second cooling space in the predetermined direction is WC2, a relationship of $WC2 \leq WC1$ is satisfied.

[0012] Because WC2 is small in this aspect, the bending of the first yarn and the second yarn is suppressed when the first yarn and the second yarn are supplied from the cooler to the false-twisting device. It is therefore possible to avoid the deterioration in yarn quality.

[0013] According to a fourth aspect of the invention, the false-twist texturing machine of the second or third aspect further includes: a heater which is provided upstream of the cooler in the yarn running direction; an upstream guide member which is provided between the heater and the cooler in the yarn running direction; and a downstream guide member which is provided between the cooler and the false-twisting device in the yarn running direction, the upstream guide member causing a distance between the first yarn and the second yarn in the predetermined direction to be equal to W1, the downstream guide member causing a distance between the first yarn and the second yarn in the predetermined direction to be equal to W2, and when a distance between an upstream end in the yarn running direction of the first cooling space and an upstream end in the yarn running direction of the second cooling space in the predetermined direction is WC1 and a distance between a downstream end in the yarn running direction of the first cooling space and a downstream end in the yarn running direction of the second cooling space in the predetermined direction is WC2, a relationship of $W2 \leq WC2 \leq WC1 \leq W1$ or $W1 \leq WC1 \leq WC2 \leq W2$ is satisfied.

[0014] In this aspect of the present invention, in threading to the cooling unit, the yarn threading can be done while maintaining both of the first yarn and the second yarn to be substantially linear. In other words, it is scarcely necessary to bend the first yarn and the second yarn in the yarn threading to the cooling unit. It is therefore easy to simultaneously thread the first yarn and the second yarn to the cooling unit.

[0015] According to a fifth aspect of the invention, the

false-twist texturing machine of any one of the second to fourth aspects is arranged so that the cooling unit includes a partition member which separates the first cooling space from the second cooling space in the predetermined direction.

[0016] The first cooling space and the second cooling space may not be separated from each other. In such a case, however, the first yarn and the second yarn may be entangled for some reason. The occurrence of such a problem is reliably avoided by the aspect of the present invention, because the first cooling space and the second cooling space are separated by the partition member.

[0017] According to a sixth aspect of the invention, the false-twist texturing machine of the fifth aspect is arranged so that the intake space extends in the predetermined direction, and each of the first cooling space and the second cooling space is connected to the intake space.

[0018] According to the aspect of the present invention, each of the first cooling space and the second cooling space is connected to the intake space extending in the predetermined direction (i.e., the spaces are connected in a parallel manner). It is therefore possible to substantially uniformly supply the cooling wind to the first cooling space and the second cooling space by a simple structure.

[0019] According to a seventh aspect of the invention, the false-twist texturing machine of the fifth or sixth aspect is arranged so that the partition member includes: a first partition portion having a first partition surface which is provided on the one side in the predetermined direction in order to form the first cooling space; and a second partition portion having a second partition surface which is provided on the other side in the predetermined direction in order to form the second cooling space, and the cooling unit includes: a first wall member which has a first wall surface that is provided on the one side in the predetermined direction of the first partition surface in order to form the first cooling space; and a second wall member which has a second wall surface that is provided on the other side in the predetermined direction of the second partition surface in order to form the second cooling space.

[0020] According to the aspect of the present invention, the first partition surface of the partition member and the first wall surface of the first wall member form the first cooling space. Furthermore, the second partition surface of the partition member and the second wall surface of the second wall member form the second cooling space. In this way, the first cooling space and the second cooling space can be formed by simple structures.

[0021] According to an eighth aspect of the invention, the false-twist texturing machine of the seventh aspect is arranged so that the first partition surface is provided to oppose the first wall surface in the predetermined direction, and the second partition surface is provided to oppose the second wall surface in the predetermined direction.

[0022] For example, when the first yarn is twisted by the false-twisting device and then makes contact with the wall surface forming the first cooling space, the first yarn may roll along the wall surface and drop off from the first cooling space. The possibility of the occurrence of this problem is high particularly when the entrance through which the first yarn enters the first cooling space is wide. The same applies to the second cooling space. According to the aspect of the present invention, the first partition surface is arranged to face the first wall surface in the predetermined direction (i.e., these surfaces are substantially in parallel to each other). This arrangement makes it possible to narrow the entrance of the first cooling space. The same applies to the second cooling space. It is therefore possible to prevent the first yarn from dropping off from the first cooling space and prevent the second yarn from dropping off from the second cooling space.

[0023] According to a ninth aspect of the invention, the false-twist texturing machine of the seventh or eighth aspect is arranged so that the cooling unit includes: a first yarn guide which is provided between the first partition surface and the first wall surface in the predetermined direction to guide the first yarn to the downstream side in the yarn running direction; and a second yarn guide which is provided between the second partition surface and the second wall surface in the predetermined direction to guide the second yarn to the downstream side in the yarn running direction.

[0024] For example, the cooling unit may be arranged to cool the yarn by the cooling wind and the wall surface and the partition surface cooled by the cooling wind. However, in the arrangement in which the yarn is intentionally made in contact with the wall surface and the partition surface, the yarn tends to roll along the wall surface or the partitioning surface when the yarn is twisted by the false-twisting device. As a result, the possibility of drop-off of the yarn from the cooling space is increased. In this regard, according to the aspect of the present invention, the first yarn is guided to the downstream side in the yarn running direction by the first yarn guide, whereas the second yarn is guided to the downstream side in the yarn running direction by the second yarn guide. To put it differently, the cooling unit is not arranged so that the yarn is intentionally made in contact with the partitioning surface and the wall surface. It is therefore possible to avoid the occurrence of the above-described problem.

[0025] According to a tenth aspect of the invention, the false-twist texturing machine of any one of the seventh to ninth aspects is arranged so that the first wall member and the second wall member are attached to the intake duct, and at least one of the first wall member or the second wall member is arranged to support the partition member.

[0026] The cooling unit can be designed such that the shorter the partition member in the predetermined direction, the shorter the distance in the predetermined direction between the first cooling space and the second cool-

ing space. In other words, it is possible to narrow the distance between the first yarn and the second yarn. However, when the partition member is very short in the predetermined direction, the partition member may not be able to be attached to (e.g., screwed to) the intake duct. According to the aspect of the present invention, the partition member can be supported by at least one of the first wall member or the second wall member. It is therefore possible to properly position the partition member even when the partition member cannot be attached to the intake duct.

[0027] According to an eleventh aspect of the invention, the false-twist texturing machine of the tenth aspect is arranged so that both of the first wall member and the second wall member are arranged to support the partition member.

[0028] According to the aspect of the present invention, the partition member is supported at both ends by the first wall member and the second wall member. It is therefore possible to stably support the partition member.

[0029] According to a twelfth aspect of the invention, the false-twist texturing machine of any one of the seventh to eleventh aspects is arranged so that at least the partition member is arranged to be movable relative to the first wall member and the second wall member.

[0030] Oil is typically applied to a yarn subjected to false-twist texturing, in order to facilitate smooth running of the yarn. When such oil is adhered to the cooling unit, the cooling unit is stained. Members constituting the cooling unit therefore need to be cleaned appropriately. According to the aspect of the present invention, at least the partition member is arranged to be movable relative to the first wall member and the second wall member. This relative movement encompasses a case where, for example, the first wall member and the second wall member are movable relative to the partition member. As a result, a wide space used for cleaning the members can be secured. The work efficiency of operations such as cleaning is therefore improved.

[0031] According to a thirteenth aspect of the invention, the false-twist texturing machine of the twelfth aspect is arranged so that one of the first wall member and the second wall member is positionally fixed relative to the intake duct, and the partition member and the other one of the first wall member and the second wall member are movable relative to the one of the first wall member and the second wall member.

[0032] One of the first wall member and the second wall member will be referred to as a fixed wall member for the sake of convenience. According to the aspect of the present invention, another cooling unit may be provided in the vicinity of the fixed wall member to be line-symmetrical with the above-described cooling unit about a linear line that is substantially in parallel to the longitudinal direction of the cooling unit. Even though such a cooling unit is provided, two fixed wall members neighboring each other do not move. On this account, interference between the members can be avoided when the

members are moved for cleaning.

[0033] According to a fourteenth aspect of the invention, the false-twist texturing machine of the twelfth or thirteenth aspect is arranged so that the partition member is arranged to be attachable to and detachable from the cooling unit.

[0034] According to the aspect of the present invention, because the partition member can be completely detached from the cooling unit, the work efficiency of operations such as cleaning is significantly improved.

[0035] According to a fifteenth aspect of the invention, the false-twist texturing machine of any one of the seventh to fourteenth aspects is arranged so that, when a direction orthogonal to both a longitudinal direction of the cooling unit and the predetermined direction is a height direction, the partition member includes: a first yarn insertion guiding portion which protrudes, in at least the height direction, toward a working space where yarn threading to the cooler is performed, relative to the first partition portion; and a second yarn insertion guiding portion which protrudes, in at least the height direction, toward the working space as compared to the second partition portion.

[0036] According to the aspect of the present invention, when the yarn threading is performed, the first yarn can be moved along the first yarn insertion guiding portion and the second yarn can be moved along the second yarn insertion guiding portion. This improves the success rate of the yarn threading.

[0037] According to a sixteenth aspect of the invention, the false-twist texturing machine of the fifteenth aspect is arranged to further comprise a heater which is provided upstream in the yarn running direction of the cooler and is configured to heat the first yarn and the second yarn, the false-twisting device, the cooler, and the heater being provided above the working space and an upstream end portion in the yarn running direction of the heater being distanced upward from the cooler in a vertical direction as compared to a downstream end portion in the yarn running direction of the heater.

[0038] According to the aspect of the present invention, because the upstream end portion in the yarn running direction of the heater is at a high position in the vertical direction, it is difficult for an operator to manually thread the yarn to the heater. In such a case, typically, the yarn is threaded to the false-twisting device, and then the yarn is threaded to the cooler and the heater at once by using an apparatus (e.g., an air injector) by which the yarn is moved upward. For such yarn threading, the improvement in the success rate of the yarn threading by the first yarn insertion guiding portion and the second yarn insertion guiding portion is particularly effective.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039]

FIG. 1 is a profile of a draw texturing machine related

to an embodiment.

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

FIG. 3 is a view of a winding unit, viewed along an arrow III in FIG. 1.

FIG. 4 is an enlarged view of a part of FIG. 3, which shows an end portion of a cooler on the upstream side in a yarn running direction and its surroundings. FIG. 5 is an enlarged view of a part of FIG. 3, which shows an end portion of the cooler on the downstream side in the yarn running direction and its surroundings.

FIG. 6 is an enlarged view of a part of FIG. 3, which shows a false-twisting device.

FIG. 7 is a profile of the false-twisting device.

FIG. 8 roughly illustrates members constituting a cooling unit.

FIG. 9 is a cross section taken along a line IX-IX in FIG. 8.

FIG. 10 shows a state in which a partition member has been detached from the cooling unit.

FIG. 11 further schematizes the cooling unit.

FIG. 12 shows a cooling unit of a modification.

FIG. 13 shows a cooling unit of another modification.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0040] The following will describe an embodiment of the present invention. A vertical direction to the sheet of FIG. 1 is defined as a base longitudinal direction (predetermined direction of the present invention). For the sake of convenience, each of the near side in the sheet of FIG. 1 and the left side in the sheet of FIG. 2 will be referred to as one side in the base longitudinal direction, whereas each of the far side in the sheet of FIG. 1 and the right side in the sheet of FIG. 2 will be referred to as the other side in the base longitudinal direction. Hereinafter, the left-right direction in the sheet of FIG. 1 will be referred to as a base width direction. A direction orthogonal to the base longitudinal direction and the base width direction is defined as the up-down direction (vertical direction) in which the gravity acts. A direction in which yarns Y (described later) run side by side will be referred to as a yarn running direction.

(Overall Structure of False-Twist Texturing Machine)

[0041] To begin with, the overall structure of a false-twist texturing machine 1 of the present embodiment will be described with reference to FIG. 1 and FIG. 2. FIG. 1 is a profile of the false-twist texturing machine 1. FIG. 2 is a schematic diagram of the false-twist texturing machine 1, expanded along paths of yarns Y (yarn paths).

[0042] The false-twist texturing machine 1 is capable of simultaneously performing false-twist texturing for yarns Y made of synthetic fibers (e.g., polyester). Each of the yarns Y is, for example, a multi-filament yarn

formed of filaments. Alternatively, each yarn Y may be formed of a single filament. The false-twist texturing machine 1 includes a yarn supplying unit 2, a processing unit 3, and a winding unit 4. The yarn supplying unit 2 is arranged to be able to supply the yarns Y. The processing unit 3 is configured to take the yarns Y out from the yarn supplying unit 2 and perform false-twist texturing for the yarns Y. The winding unit 4 is configured to wind the yarns Y processed by the processing unit 3 onto winding bobbins Bw. Component of the yarn supplying unit 2, the processing unit 3, and the winding unit 4 are aligned to form plural lines (as shown in FIG. 2) in the base longitudinal direction. The base longitudinal direction is a direction orthogonal to a running plane (plane of FIG. 1) of the yarns Y, which is formed by a yarn path extending from the yarn supplying unit 2 to the winding unit 4 through the processing unit 3.

[0043] The yarn supplying unit 2 includes a creel stand 7 retaining yarn supply packages Ps, and supplies the yarns Y to the processing unit 3. The processing unit 3 is configured to take the yarns Y out from the yarn supplying unit 2 and process the yarns Y. In the processing unit 3, the following members are placed in this order from the upstream in the yarn running direction: first feed rollers 11; twist-stopping guides 12; first heaters 13 (heaters of the present invention); a cooler 14; false-twisting devices 15; second feed rollers 16; combining units 17; third feed rollers 18; a second heater 19; and fourth feed rollers 20. The winding unit 4 includes a plurality of winding devices 21. Each winding device 21 winds the yarns Y subjected to the false-twist texturing in the processing unit 3 onto one or more winding bobbins Bw and forms one or more wound packages Pw.

[0044] The false-twist texturing machine 1 includes a main base 8 and a winding base 9 which are placed to be spaced apart from each other in the base width direction. The main base 8 and the winding base 9 are substantially identical in length in the base longitudinal direction. The main base 8 and the winding base 9 are arranged to face each other in the base width direction. Between the main frame 8 and the winding base 9, a working space Sw is formed to allow an operator to perform operations such as yarn threading (see FIG. 1). The false-twist 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. In one span, each device is placed so that the yarns Y running while being aligned in the base longitudinal direction can be subjected to false-twist texturing at the same time. 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 (main base 8 is shared between the left span and the right span). The spans are aligned in the base longitudinal direction.

(Processing Unit)

[0045] The structure of the processing unit 3 will be described with reference to FIG. 1 and FIG. 2. The first feed rollers 11 are arranged to unwind a yarn Y from a yarn supply package Ps attached to the yarn supplying unit 2 and feed the yarn Y to the first heater 13. For example, as shown in FIG. 2, each first feed roller 11 can send the two yarns Y to the first heater 13. However, the disclosure is not limited to this. 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.

[0046] The first heater 13 heats the yarns Y sent from the first feed rollers 11. The first heater 13 is obliquely provided so that the upstream end portion is provided above the downstream end portion in the yarn running direction (see FIG. 1). To put it differently, the upstream end portion in the yarn running direction of the first heater 13 is distanced upward from the cooler 14 in the up-down direction (vertical direction) as compared to the downstream end portion in the yarn running direction of the first heater 13. For example, as shown in FIG. 2, the first heater 13 can heat four yarns Y. However, the disclosure is not limited to this.

[0047] The cooler 14 is configured to cool the yarns Y heated at the first heater 13. The cooler 14 will be detailed later. The false-twisting device 15 is provided on the downstream side in the yarn running direction of the cooler 14 and is configured to twist two yarns Y (a first yarn Ya and a second yarn Yb). The false-twisting device 15 will be detailed later.

[0048] The second feed roller 16 is configured to send the yarns Y processed by the false-twisting device 15 to the combining unit 17. The conveyance speed of conveying the yarn Y by the second feed roller 16 is higher than the conveyance speed of conveying the yarn Y by the first feed rollers 11. The yarn Y is therefore drawn between the first feed roller 11 and the second feed roller 16.

[0049] The combining unit 17 is capable of combining the first yarn Ya and the second yarn Yb into a yarn Yc. The combining unit 17 includes two interlace nozzles 17a and 17b (as shown in FIG. 2). The combining unit 17 blows air onto the first yarn Ya and the second yarn Yb (as shown at the left part of the sheet of FIG. 2) which are, for example, passing through the inside of the interlace nozzle 17a, and the combining unit 17 combines the first yarn Ya and the second yarn Yb by air-interlace by which the first yarn Ya is interlaced with the second yarn Yb by airflow. The combining unit 17 can guide the first yarn Ya and the second yarn Yb to the downstream in the yarn running direction, without combining these yarns. In this case, the first yarn Ya passes through the inside of the interlace nozzle 17a, and the second yarn Yb passes through the inside of the interlace nozzle 17b (as shown on the right part of the sheet of FIG. 2). In

place of the combining unit 17 having the interlace nozzles 17a and 17b, for example, a combining unit (not illustrated) having an unillustrated guide or a feed roller may be provided. This combining unit may combine two yarns Y by the guide or the feed roller, or may guide the two yarns to the downstream side in the yarn running direction without combining them.

[0050] The third feed roller 18 is configured to feed the yarn Y running on the downstream side of the combining unit 17 in the yarn running direction to the second heater 19. For example, as shown in FIG. 2, the third feed roller 18 can send the two yarns Y to the second heater 19. However, the disclosure is not limited to this. The conveyance speed of conveying the yarn Y by the third feed roller 18 is lower than the conveyance speed of conveying the yarn Y by the second feed roller 16. The yarn Y is therefore relaxed between the second feed roller 16 and the third feed roller 18. The second heater 19 heats the yarns Y sent from the third feed rollers 18. The second heater 19 extends along the vertical direction, and one second heater 19 is provided in one span. The fourth feed roller 20 sends the yarns Y heated by the second heater 19 to the winding device 21. For example, as shown in FIG. 2, the fourth feed roller 20 can send two yarns Y to the winding device 21. However, the disclosure is not limited to this. The conveyance speed of conveying the yarns Y by the fourth feed roller 20 is lower than the conveyance speed of conveying the yarns Y by the third feed roller 18. The yarns Y are therefore relaxed between the third feed roller 18 and the fourth feed roller 20.

[0051] In the processing unit 3 arranged as described above, the yarn Y drawn between the first feed roller 11 and the second feed roller 16 is twisted by the false-twisting device 15. The twist formed by the false-twisting devices 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 at the first heater 13 and thermally set. After that, the yarn Y is cooled at the cooler 14. The yarn Y is untwisted at the downstream 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. Subsequently, after the false-twisted two yarns Y (the first yarn Ya and the second yarn Yb) are combined by the combining unit 17 while being relaxed between the second feed roller 16 and the third feed roller 18, the two yarns Y are guided to the downstream side in the yarn running direction. Alternatively, the two false-twisted yarns Y are guided to the downstream side in the yarn running direction without being combined. Furthermore, the yarn Y is thermally processed at the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarn Y (the yarn Yc or the first and second yarns Ya and Yb) sent from the fourth feed roller 20 is wound by the winding device 21. As a result, one or two wound package Pw is formed at each winding device 21.

(Structure of Winding Unit)

[0052] The following will describe the structure of the winding unit 4 with reference to FIG. 2. The winding unit 4 includes a plurality of winding devices 21. For example, each winding device 21 can wind the yarn Y or the yarns Y onto one winding bobbin Bw or two winding bobbins Bw. The winding device 21 includes fulcrum guides 22, a traverse unit 23, and a cradle 24. Each of the fulcrum guides 22 is a guide about which a yarn Y is traversed. For example, three fulcrum guides 22 are provided for each winding device 21 (see FIG. 2). For example, when one yarn Yc formed by yarn combination at the combining unit 17 is guided, the yarn Yc is threaded to the central one among the three fulcrum guides 22 (as shown at the left part of the sheet of FIG. 2). When two yarns Y which are sent without being combined are guided, the two yarns Y are threaded to two fulcrum guides 22 at both ends among the three fulcrum guides 22, respectively (as shown in the right part of the sheet of FIG. 2). The traverse unit 23 is capable of traversing the yarn Y by the traverse guide 25. The number of the traverse guides 25 is changeable in accordance with the number of traversed yarns Y. The cradle 24 is arranged to support one or two winding bobbin Bw to be freely rotatable. A contact roller 26 is provided in the vicinity of the cradle 24. The contact roller 26 makes contact with the surface of one or two wound package Pw and applies contact pressure thereto. In the winding unit 4 structured as above, the yarn Y which is sent from the fourth feed roller 20 described above is wound onto the one or two winding bobbin Bw by each winding device 21, and forms one or two wound package Pw. The winding device 21 may not be structured as described above. For example, the winding device 21 may be structured to be able to simultaneously form three or more wound packages Pw. Alternatively, the winding unit 4 may have winding devices (not illustrated) that are identical in number with the yarns Y supplied from the yarn supplying unit 2. Each of these winding devices may be able to wind one yarn Y.

[0053] There have recently been demands for performing false-twist texturing for yarns Y that are thicker than before. Meanwhile, it is necessary to take into account of the number of yarns Y to be simultaneously subjected to false-twist texturing (hereinafter, production efficiency) and suppression of increase of a difference in quality between yarns Y (hereinafter, homogeneity). In the present embodiment, in order to suppress the loss of production efficiency and homogeneity and to achieve a good yarn quality, even when thick yarns Y are subjected to false-twist texturing, the processing unit 3 is structured as described below.

(Details of Structure of Processing Unit)

[0054] The following will detail the structure of the processing unit 3. To begin with, the layout of the first heater 13, the cooler 14, and the false-twisting device 15

and their surroundings will be detailed with reference to FIG. 3 to FIG. 5. FIG. 3 is a drawing viewed along an arrow III in FIG. 1. FIG. 4 is an enlarged view of a part of FIG. 3, which shows an upstream end portion of the cooler 14 in the yarn running direction and its surroundings. FIG. 5 is an enlarged view of a part of FIG. 3, which shows a downstream end portion of the cooler 14 in the yarn running direction and its surroundings. In the present embodiment, the first heater 13, the cooler 14, and the false-twisting device 15 are provided above the working space Sw.

[0055] As shown in FIG. 3, the first heaters 13 are aligned in the base longitudinal direction. Each of the first heaters 13 is capable of, for example, simultaneously heating four yarns Y that run side by side in the base longitudinal direction. In the yarn running direction, a yarn guide G1 (see FIG. 4; an upstream guide member of the present invention) is provided between the first heater 13 and the cooler 14 (i.e., on the upstream side of the cooler 14 in the yarn running direction). The yarn guide G1 is arranged to guide the four yarns Y to the downstream side in the yarn running direction. The pitch (interval W1; see FIG. 4) in the base longitudinal direction of the four yarns Y guided by the yarn guide G1 is set at 14 mm, for example. The length of the interval W1 is not limited to this.

[0056] The cooler 14 is a contactless device configured to cool yarns Y by means of cooling wind (details will be given later). As shown in FIG. 3, the cooler 14 includes cooling units 31 and an intake duct 32 connected to the cooling units 31. The cooler 14 supplies cooling wind to cooling spaces S (see FIG. 4 and FIG. 5) formed in the respective cooling units 31, by using an unillustrated suction device configured to suck gas in the intake duct 32. The yarns Y are cooled by the cooling wind.

[0057] The cooling units 31 are aligned in the base longitudinal direction. The cooling units 31 are attached to the intake duct 32. Each of the cooling units 31 extends in a direction intersecting with (more or less orthogonal to) the base longitudinal direction. Each cooling unit 31 may or may not extend substantially linearly. (For example, each cooling unit 31 may be curved.) Each cooling unit 31 is configured to cool two yarns Y (a first yarn Ya and a second yarn Yb). Each cooling unit 31 has a first cooling space Sa for cooling the first yarn Ya and a second cooling space Sb for cooling the second yarn Yb (see FIG. 4 and FIG. 5). The cooling units 31 include two cooling units 31A and 31B that are provided side by side in the base longitudinal direction. The two cooling units 31A and 31B correspond to one first heater 13. For example, the interval in the base longitudinal direction between the cooling unit 31A and the cooling unit 31B increases toward the downstream side in the yarn running direction. The two cooling units 31A and 31B are arranged to be line symmetric about a predetermined linear line L (see FIG. 3). The cooling units 31 will be detailed later.

[0058] The intake duct 32 is configured to supply cool-

ing wind to the cooling units 31. The intake duct 32 extends in the base longitudinal direction. In the intake duct 32, an intake space Ss is formed to extend in the base longitudinal direction. The intake space Ss is connected to the cooling space S (see FIG. 4 and FIG. 5). To the intake duct 32, the cooling units 31 are attached.

[0059] As shown in FIG. 3, the false-twisting devices 15 are aligned in the base longitudinal direction. Each of the first false-twisting device 15 is capable of simultaneously heating two yarns Y (the first yarn Ya and the second yarn Yb) running side by side in the base longitudinal direction. In the yarn running direction, a yarn guide G2 (see FIG. 5; a downstream guide member of the present invention) is provided between the cooler 14 and the false-twisting device 15 (i.e., on the downstream side of the cooler 14 in the yarn running direction). The yarn guide G2 is arranged to guide the two yarns Y to the downstream side in the yarn running direction. The interval W2 (see FIG. 5) in the base longitudinal direction of the two yarns Y guided by the yarn guide G2 is set at, for example, 8 mm. The length of the interval W2 is not limited to this.

(Specific Details of False-Twisting Device)

[0060] The structure of the false-twisting device 15 will be detailed with reference to FIG. 6 and FIG. 7. FIG. 6 is an enlarged view of a part of FIG. 3, which shows the false-twisting device 15. FIG. 7 shows the false-twisting device 15 viewed from one side in the base longitudinal direction.

[0061] The false-twisting device 15 is, for example, a known false-twisting device recited in Japanese Laid-Open Patent Publication No. 2018-127731. As shown in FIG. 6, the false-twisting device 15 includes a disc 41 and two belt units 42 (a first belt unit 42a and a second belt unit 42b). The false-twisting device 15 is arranged to twist the first yarn Ya by sandwiching the first yarn Ya between a first contact surface 41a (described later) of the disc 41 and a first endless belt 46a (described later) of the first belt unit 42a. In addition to this, the false-twisting device 15 is arranged to twist the second yarn Yb by sandwiching the second yarn Yb between a second contact surface 41b (described later) of the disc 41 and a second endless belt 46b (described later) of the second belt unit 42b.

[0062] The disc 41 is a member rotatable about a rotational axis direction that is the base longitudinal direction. The disc 41 is, for example, fixed to a common rotational shaft 43 extending in the base longitudinal direction. The common rotational shaft 43 is arranged to connect the discs 41 provided for the respective false-twisting devices 15. The common rotational shaft 43 is, for example, rotationally driven by a motor which is not illustrated. In this way, the disc 41 is rotationally driven. At one end face in the base longitudinal direction of the disc 41, the first contact surface 41a with which the first yarn Ya makes contact is formed. At the other end face in the

base longitudinal direction of the disc 41, the second contact surface 41b with which the second yarn Yb makes contact is formed.

[0063] The first belt unit 42a is provided on one side of the disc 41 in the base longitudinal direction. The first belt unit 42a includes a first driving pulley 44a, a first driven pulley 45a, and a first endless belt 46a (a first belt member of the present invention). The first endless belt 46a is wound on the first driving pulley 44a and the first driven pulley 45a. The first yarn Ya is provided to be sandwiched between the first endless belt 46a and the first contact surface 41a. The rotational axis of the first driving pulley 44a and the rotational axis of the first driven pulley 45a extend in a direction substantially orthogonal to the base longitudinal direction. The rotational axis of the first driving pulley 44a and the rotational axis of the first driven pulley 45a are substantially in parallel to each other. The first driving pulley 44a and the first driven pulley 45a are aligned in a direction substantially orthogonal to the common rotational shaft 43.

[0064] The second belt unit 42b is provided on the other side of the disc 41 in the base longitudinal direction. The second belt unit 42b includes a second driving pulley 44b, a second driven pulley 45b, and a second endless belt 46b (a second belt member of the present invention). The second endless belt 46b is wound on the second driving pulley 44b and the second driven pulley 45b. The second yarn Yb is provided to be sandwiched between the second endless belt 46b and the second contact surface 41b. The rotational shaft of the second driving pulley 44b and the rotational shaft of the second driven pulley 45b extend in a direction substantially in parallel to the rotational shaft of the first driving pulley 44a and the rotational shaft of the first driven pulley 45a. The second driving pulley 44b and the second driven pulley 45b are aligned in a direction substantially orthogonal to the common rotational shaft 43.

[0065] The first driving pulley 44a and the second driving pulley 44b are rotationally driven by a driving unit 47 (see FIG. 7). The driving unit 47 is arranged to rotationally drive the first driving pulley 44a and the second driving pulley 44b in opposite directions, respectively. The driving unit 47 includes an unillustrated driving source (e.g., a motor), an unillustrated first power transmission member configured to transmit power of the driving source to the first driving pulley 44a, and an unillustrated second power transmission member configured to transmit the power of the driving source to the second driving pulley 44b.

[0066] When viewed in the base longitudinal direction, the first belt unit 42a and the second belt unit 42b are substantially overlapped. Because of this, the yarn path of the first yarn Ya is arranged to substantially overlap the yarn path of the second yarn Yb in the false-twisting device 15, when viewed in the base longitudinal direction (see FIG. 7).

[0067] In the false-twisting device 15 arranged as described above, the first yarn Ya is twisted by the first

endless belt 46a and the first contact surface 41a. The second yarn Yb is twisted by the second endless belt 46b and the second contact surface 41b. In this way, the two yarns Y are simultaneously twisted. The first yarn Ya and the second yarn Yb are twisted in opposite directions. For example, the first yarn Ya is Z-twisted, whereas the second yarn Yb is S-twisted.

(Specific Details of Cooler)

[0068] The specific structure of the cooler 14 will be detailed mainly with reference to FIG. 8 to FIG. 11. FIG. 8 roughly illustrates members constituting a cooling unit 31 (cooling unit 31A), and shows the cooling unit 31A in the same direction as in FIG. 3. In other words, FIG. 8 shows the cooling unit 31A roughly from below. FIG. 9 is a cross section taken along a line IX-IX in FIG. 8. FIG. 10 shows a state in which a later-described partition member 53 has been detached from the cooling unit 31A. FIG. 11 further schematizes the cooling unit 31A in order to make it easy to see the cooling space S. As described above, the cooling unit 31A and a cooling unit 31B are arranged to be line-symmetrical (see FIG. 3). In the descriptions below, the cooling unit 31A will be mainly detailed, and the cooling unit 31B will be only briefly described.

[0069] Hereinafter, the direction perpendicular to the sheet of FIG. 8 will be referred to as a height direction. The height direction is in parallel to the up-down direction in the sheets of FIG. 9 and FIG. 10. The height direction is orthogonal to the base longitudinal direction. In the present embodiment, furthermore, the height direction has at least a component in the up-down direction. In the present embodiment, one side in the height direction is basically equivalent to an upper side. Meanwhile, the other side in the height direction is basically equivalent to a lower side. It is, however, noted that the relationship between the height direction and the up-down direction may be changed in accordance with the orientation of the cooler 14. In addition to the above, a direction orthogonal to both the base longitudinal direction and the height direction will be referred to as an orthogonal direction for the sake of convenience. The cooling unit 31A and the cooling unit 31B extend at least in the orthogonal direction. In the orthogonal direction, a side close to the first heater 13 will be referred to as one side, whereas a side close to the false-twisting device 15 will be referred to as the other side. In the present embodiment, each of the cooling unit 31A and the cooling unit 31B extend in a direction slightly tilted relative to the orthogonal direction.

[0070] As shown in FIG. 8 to FIG. 11, the cooling unit 31A includes a fixed wall plate 51 (a second wall member of the present invention), a movable wall plate 52 (a first wall member of the present invention), and a partition member 53. The fixed wall plate 51 is equivalent to one of the first wall member and the second wall member of the present invention. The movable wall plate 52 is equivalent to the other one of the first wall member and the

second wall member of the present invention. The fixed wall plate 51, the movable wall plate 52, and the partition member 53 are long members provided for forming the two cooling spaces S (the first cooling space Sa and the second cooling space Sb). As shown in FIG. 8, the fixed wall plate 51, the movable wall plate 52, and the partition member 53 are long in a direction orthogonal to the height direction and intersecting with the base longitudinal direction. In the cooling unit 31A, the movable wall plate 52, the partition member 53, and the fixed wall plate 51 are provided in this order from the one side in the base longitudinal direction. To put it differently, the movable wall plate 52 is provided on one side in the base longitudinal direction of the partition member 53 and the fixed wall plate 51. The partition member 53 is on the other side of the movable wall plate 52 in the base longitudinal direction, and is adjacent to the movable wall plate 52. The fixed wall plate 51 is on the other side of the partition member 53 in the base longitudinal direction, and is adjacent to the partition member 53. In the cooling unit 31B, these members are provided in the reversed order in the base longitudinal direction (see a fixed wall plate 56, a movable wall plate 57, and a partition member 58 shown in FIG. 4).

[0071] Now, the fixed wall plate 51 will be further detailed. As shown in FIG. 9 and FIG. 10, the fixed wall plate 51 is substantially C-shaped in cross section. That is to say, in cross sections shown in FIG. 9 and FIG. 10, the fixed wall plate 51 has a base end portion 61, an intermediate portion 62, and a leading end portion 63.

[0072] The base end portion 61 is provided at an end portion on one side in the height direction of the fixed wall plate 51 and extends in the base longitudinal direction. The base end portion 61 is fixed to the intake duct 32 by, for example, an unillustrated screw. To be more specific, a wall member 33 extending in the base longitudinal direction is formed at an end portion on the other side in the height direction of the intake duct 32. The base end portion 61 is screwed to the wall member 33. The intermediate portion 62 extends from an end portion on one side in the base longitudinal direction of the base end portion 61 toward the other side in the height direction. On one side in the base longitudinal direction of the intermediate portion 62, a wall surface 64 (a second wall surface of the present invention) is formed to extend in the height direction. The wall surface 64 is a surface for forming the second cooling space Sb in the cooling unit 31A. The wall surface 64 is provided with contact bodies 65 (see FIG. 10 and FIG. 11) that are separated from one another in the yarn running direction. Each contact body 65 is arranged so that a running yarn Y (the second yarn Yb in this case) is intentionally made in contact with the contact body 65. This prevents the second yarn Yb from unintentionally making contact with a part of the wall surface 64, where no contact body 65 is provided. In the intermediate portion 62, through holes 66 are formed to penetrate the portion in the base longitudinal direction (see FIG. 9 and FIG. 10). Each through hole 66 is a po-

sitioning hole into which a later-described positioning pin 97b is inserted. The leading end portion 63 extends from an end portion on the other side in the height direction of the intermediate portion 62 toward the other side in the base longitudinal direction.

[0073] Now, the movable wall plate 52 will be further detailed. As shown in FIG. 9 and FIG. 10, the movable wall plate 52 is substantially reverse C-shaped in cross section. That is to say, in cross sections shown in FIG. 9 and FIG. 10, the movable wall plate 52 has a base end portion 71, an intermediate portion 72, and a leading end portion 73.

[0074] The base end portion 71 is provided at an end portion on one side in the height direction of the movable wall plate 52 and extends in the base longitudinal direction. The intermediate portion 72 extends from an end portion on the other side in the base longitudinal direction of the base end portion 71 toward the other side in the height direction. On the other side in the base longitudinal direction of the intermediate portion 72, a wall surface 74 (the first wall surface of the present invention) is formed to extend in the height direction. The wall surface 74 is a surface for forming the first cooling space Sa in the cooling unit 31A. The wall surface 74 is provided with contact bodies 75 (see FIG. 10 and FIG. 11) that are separated from one another in the yarn running direction. Each contact body 75 is arranged so that the running first yarn Ya is intentionally made in contact with the contact body 75. This prevents the first yarn Ya from unintentionally making contact with a part of the wall surface 74, where no contact body 75 is provided. In the intermediate portion 72, through holes 76 are formed to penetrate the portion in the base longitudinal direction (see FIG. 9 and FIG. 10). Each through hole 76 is a positioning hole into which a later-described positioning pin 97a is inserted. The leading end portion 73 extends from an end portion on the other side in the height direction of the intermediate portion 72 toward the other side in the base longitudinal direction.

[0075] The movable wall plate 52 is, for example, attached to plural spring units 54 (see FIG. 4, FIG. 5, FIG. 9, and FIG. 10). With this arrangement, the movable wall plate 52 is movable at least in the base longitudinal direction relative to the fixed wall plate 51. The movable wall plate 52 is movable between an operation position (see solid lines in FIG. 4 and FIG. 5 and FIG. 9) and a detaching position (see two-dot chain lines in FIG. 4 and FIG. 5 and FIG. 10). The operation position is a position of the movable wall plate 52 when the false-twist texturing machine 1 is driven. The detaching position is a position of the movable wall plate 52 when the partition member 53 is to be detached from the cooling unit 31A (detailed later). In the cooling unit 31A, the spring units 54 are provided on one side in the base longitudinal direction of the movable wall plate 52. In the cooling unit 31B, spring units 59 (see FIG. 4) each having the same structure as the spring unit 54 are provided on the other side in the base longitudinal direction of the movable wall plate 57.

[0076] The structure of the spring unit 54 will be detailed with reference to FIG. 4, FIG. 9, and FIG. 10. The spring unit 54 is a force applying unit for applying force to the movable wall plate 52 toward the fixed wall plate 51. For example, as shown in FIG. 4, the spring unit 54 includes a torsion spring 81, a fixing member 82, and a regulating pin 83. The torsion spring 81 includes a coil portion (not illustrated), a fixed arm 84 provided at one end of the coil portion, and a movable arm 85 provided at the other end of the coil portion. The coil portion is fixed to the intake duct 32 by the fixing member 82. The movement of the fixed arm 84 is regulated by the regulating pin 83 fixed to the intake duct 32. The movable arm 85 is, for example, attached to the movable wall plate 52 and supports the movable wall plate 52.

[0077] Now, the partition member 53 will be further detailed with reference to FIG. 9 to FIG. 11. The partition member 53 is a member separating the first cooling space Sa from the second cooling space Sb in the base longitudinal direction. The partition member 53 is provided between the fixed wall plate 51 and the movable wall plate 52 in the base longitudinal direction. The partition member 53 is detachably attached to the cooling unit 31A (as detailed later). The partition member 53 includes, for example, a first partitioning plate 86a, a second partitioning plate 86b, and connection members 87. The first partitioning plate 86a is connected to the second partitioning plate 86b by the connection members 87. The first partitioning plate 86a and the movable wall plate 52 form the first cooling space Sa. The second partitioning plate 86b and the fixed wall plate 51 form the second cooling space Sb. The first cooling space Sa and the second cooling space Sb are provided to be side by side in the base longitudinal direction. Each of the first cooling space Sa and the second cooling space Sb is connected to the intake space Ss.

[0078] The first partitioning plate 86a is a long plate member extending at least in the orthogonal direction (see FIG. 11). The first partitioning plate 86a is provided at an end on one side in the base longitudinal direction of the partition member 53. The first partitioning plate 86a is fixed to the connection members 87 by, for example, unillustrated screws. The first partitioning plate 86a includes a first partition portion 88a for forming the first cooling space Sa and a first yarn insertion guiding portion 89a provided on the other side in the height direction of the first partition portion 88a (see FIG. 9 and FIG. 10).

[0079] In the first partition portion 88a, a first partition surface 90a is formed. The first partition surface 90a is provided on the other side in the base longitudinal direction of the wall surface 74 and opposes the wall surface 74 in the base longitudinal direction. The first partition surface 90a and the wall surface 74 form the first cooling space Sa. The first cooling space Sa is connected to the intake space Ss through a first intake slit 34a formed in the wall member 33 of the intake duct 32. On the first partition surface 90a, contact bodies 91a are provided to be separated from one another in the yarn running direc-

tion. The contact bodies 91a and the above-described contact bodies 75 are provided in a staggered manner when viewed in the height direction (see FIG. 11). Each contact body 91a is arranged so that the first yarn Ya is intentionally made in contact with the contact body 91a. This prevents the first yarn Ya from unintentionally making contact with a part of the first partition surface 90a, where no contact body 91a is provided. In addition, on one side in the base longitudinal direction of the first partition surface 90a, for example, a spacer 92a is provided to arrange the distance between the first partition surface 90a and the wall surface 74 to be equal to a predetermined distance (see FIG. 10). The first partition portion 88a has through holes 93a and 94a each penetrating the portion in the base longitudinal direction (see FIG. 9 and FIG. 10). Into the through hole 93a, a later-described first yarn guide 96a is inserted. Into the through hole 94a, a later-described positioning pin 97a is inserted.

[0080] The first yarn insertion guiding portion 89a is provided on the other side in the height direction of the first partition portion 88a. The first yarn insertion guiding portion 89a protrudes toward the other side in the height direction (i.e., toward the working space Sw) and protrudes toward the other side in the base longitudinal direction (i.e., toward the second partitioning plate 86b), as compared to the first partition portion 88a.

[0081] The second partitioning plate 86b is a long plate member extending at least in the orthogonal direction (see FIG. 11). The second partitioning plate 86b is provided at an end on the other side in the base longitudinal direction of the partition member 53. The second partitioning plate 86b is fixed to the connection members 87 by, for example, unillustrated screws. The second partitioning plate 86b includes a second partition portion 88b for forming the second cooling space Sb and a second yarn insertion guiding portion 89b provided on the other side in the height direction of the second partition portion 88b (see FIG. 9 and FIG. 10).

[0082] In the second partition portion 88b, a second partition surface 90b is formed. The second partition surface 90b is provided on one side in the base longitudinal direction of the wall surface 64 and opposes the wall surface 64 in the base longitudinal direction. The second partition surface 90b and the wall surface 64 form the second cooling space Sb. The second cooling space Sb is connected to the intake space Ss through a second intake slit 34b formed in the wall member 33 of the intake duct 32. On the second partition surface 90b, contact bodies 91b are provided to be separated from one another in the yarn running direction. The contact bodies 91b and the above-described contact bodies 65 are provided in a staggered manner when viewed in the height direction (see FIG. 11). Each contact body 91b is arranged so that the second yarn Yb is intentionally made in contact with the contact body 91b. This prevents the second yarn Yb from unintentionally making contact with a part of the second partition surface 90b, where no contact body 91b is provided. In addition, on one side in the

base longitudinal direction of the second partition surface 90b, a spacer 92b that is similar to the spacer 92a is provided (see FIG. 10). The second partition portion 88b has through holes 93b and 94b each penetrating the portion in the base longitudinal direction (see FIG. 9 and FIG. 10). Into the through hole 93b, a later-described second yarn guide 96b is inserted. Into the through hole 94a, a later-described positioning pin 97b is inserted.

[0083] The second yarn insertion guiding portion 89b is provided on the other side in the height direction of the second partition portion 88b. The second yarn insertion guiding portion 89b protrudes toward the other side in the height direction (i.e., toward the working space Sw) and protrudes toward one side in the base longitudinal direction (i.e., toward the first partitioning plate 86a), as compared to the second partition portion 88b.

[0084] The connection members 87 are arranged to connect the first partitioning plate 86a with the second partitioning plate 86b. The connection members 87 are provided between the first partitioning plate 86a and the second partitioning plate 86b in the base longitudinal direction. As shown in FIG. 9 to FIG. 11, each connection member 87 is provided with the first yarn guide 96a, the second yarn guide 96b, and the positioning pins 97a and 97b.

[0085] The first yarn guide 96a is arranged to guide the first yarn Ya to the downstream side in the yarn running direction. For example, the first yarn guide 96a is attached to a one side part in the base longitudinal direction of the connection member 87 through a spring 98a. The first yarn guide 96a is inserted into the through hole 93a of the first partitioning plate 86a and protrudes toward the one side in the base longitudinal direction. The first yarn guide 96a is arranged to be movable in the base longitudinal direction in accordance with the elongation and contraction of the spring 98a. To be more specific, when the first yarn guide 96a is pressed by the wall surface 74 of the movable wall plate 52, the spring 98a is contracted. When the first yarn guide 96a is separated from the wall surface 74, the spring 98a is in its initial state.

[0086] The second yarn guide 96b is arranged to guide the second yarn Yb to the downstream side in the yarn running direction. For example, the second yarn guide 96b is attached to the other side part in the base longitudinal direction of the connection member 87 through a spring 98b. The second yarn guide 96b is inserted into the through hole 93b of the second partitioning plate 86b and protrudes toward the other side in the base longitudinal direction. Being similar to the first yarn guide 96a, the second yarn guide 96b is arranged to be movable in the base longitudinal direction in accordance with the elongation and contraction of the spring 98b.

[0087] The positioning pin 97a is provided for positioning the connection member 87 with the movable wall plate 52. The positioning pin 97a is fixed to a surface on one side in the base longitudinal direction of the connection member 87, for example. The positioning pin 97a is in-

serted into the through hole 94a of the first partitioning plate 86a and protrudes toward the one side in the base longitudinal direction. The positioning pin 97a can be inserted into the through hole 76 of the movable wall plate 52. The positioning pin 97b is provided for positioning the connection member 87 with the fixed wall plate 51. The positioning pin 97b is fixed to a surface on the other side in the base longitudinal direction of the connection member 87, for example. The positioning pin 97b is inserted into the through hole 94b of the second partitioning plate 86b and protrudes toward the other side in the base longitudinal direction. The positioning pin 97b can be inserted into the through hole 66 of the fixed wall plate 51.

[0088] The partition member 53 structured as described above is supported by the fixed wall plate 51 and the movable wall plate 52 when the movable wall plate 52 is at the above-described operation position. To be more specific, when the positioning pin 97a is inserted into the through hole 76 and the positioning pin 97b is inserted into the through hole 66, the partition member 53 is supported at both ends by the fixed wall plate 51 and the movable wall plate 52 (see FIG. 9). To put it differently, being different from the fixed wall plate 51, the partition member 53 is not fixed to the intake duct 32. When the movable wall plate 52 is at the above-described detaching position, the partition member 53 is detachable from the cooling unit 31A (see FIG. 10). The partition member 53 is attachable to and detachable from the cooling unit 31A. To put it differently, the partition member 53 is movable relative to the fixed wall plate 51 and the movable wall plate 52.

[0089] In the cooling unit 31A having the structure described above, when the false-twist texturing machine 1 is driven, the first cooling space Sa and the second cooling space Sb that are slits in shape are formed to be side by side by the base longitudinal direction. In the present embodiment, the distance in the base longitudinal direction between the first cooling space Sa and the second cooling space Sb (i.e., the distance between the first yarn Ya and the second yarn Yb in the base longitudinal direction) is constant. In other words, in the present embodiment, the distance does not change depending on a position in the direction in which the cooling unit 31A extends. The distance at the upstream end in the yarn running direction of the cooling unit 31A is referred to as WC1 (see FIG. 4). In the strict sense, WC1 indicates the distance in the base longitudinal direction between (i) the center in the base longitudinal direction of an end of the first cooling space Sa on one side (first heater 13 side) in the orthogonal direction and (ii) the center in the base longitudinal direction of an end of the second cooling space Sb on one side in the orthogonal direction. In the present embodiment, in the orthogonal direction, the position of the end of the first cooling space Sa on one side is substantially identical with the position of the end of the second cooling space Sb on one side. In this case, it is preferable that WC1 is substantially identical with the above-described distance W1 (see FIG. 4) or shorter

than the distance $W1$. To put it differently, it is preferable that $WC1 \leq W1$. The distance at the downstream end in the yarn running direction of the cooling unit 31A is referred to as $WC2$ (see FIG. 5). In the strict sense, $WC2$ indicates the distance in the base longitudinal direction between (i) the center in the base longitudinal direction of an end of the first cooling space Sa on the other side (false-twisting device 15 side) in the orthogonal direction and (ii) the center in the base longitudinal direction of an end of the second cooling space Sb on the other side in the orthogonal direction. In the present embodiment, in the orthogonal direction, the position of the end of the first cooling space Sa on the other side is substantially identical with the end of the second cooling space Sb on the other side. In this case, it is preferable that $WC2$ is substantially identical with the above-described distance $W2$ (see FIG. 5) or longer than the distance $W2$. To put it differently, it is preferable that $W2 \leq WC2$. It is therefore possible to effectively suppress the bending of the yarn path. In the present embodiment, the following relationship holds true.

$$W2 < WC2 = WC1 < W1$$

[0090] In the arrangement above, in yarn threading (described later) to the cooling unit 31A, the yarn threading can be done while maintaining both of the first yarn Ya and the second yarn Yb to be substantially linear. In other words, it is scarcely necessary to bend the first yarn Ya and the second yarn Yb in the yarn threading to the cooling unit 31A. It is therefore easy to simultaneously thread the first yarn Ya and the second yarn Yb to the cooling unit 31A.

(Yarn Threading)

[0091] In the present embodiment, when the yarn threading to the false-twist texturing machine 1 is performed, the yarn Y is threaded to the false-twisting device 15 and then the yarn Y is threaded to the cooler 14 and the first heater 13. At the time of the yarn threading to the cooler 14 and the first heater 13, for example, an operator moves the yarn Y upward by using an unillustrated air injector. Alternatively, the yarn Y may be not manually but automatically moved upward by an air injection robot. This is because, in the false-twist texturing machine 1 of the present embodiment, the upstream end portion in the yarn running direction of the first heater 13 is positionally high in the vertical direction and a hand of the operator cannot easily reach the upstream end portion. When the yarn threading is performed by the above-described means, the first yarn Ya is guided along the first yarn insertion guiding portion 89a and enters the first cooling space Sa through a first entrance 95a. The second yarn Yb is guided along the second yarn insertion guiding portion 89b and enters the second cooling space Sb through a second entrance 95b. It is noted that the

operator needs not to operate the cooling unit 31A when the yarn threading is performed (i.e., the movable wall plate 52 and the partition member 53 need not to be moved).

[0092] In addition to the above, because $W2 < WC2 = WC1 < W1$ as described above, in yarn threading to the cooling unit 31A, the yarn threading can be done while maintaining both of the first yarn Ya and the second yarn Yb to be substantially linear. In other words, it is scarcely necessary to bend the first yarn Ya and the second yarn Yb in the yarn threading to the cooling unit 31A.

(Maintenance)

[0093] When maintenance such as cleaning of the cooler 14 is performed, for example, the operator moves the movable wall plate 52 from the operation position to the detaching position and detaches the partition member 53 from the cooling unit 31A. After the completion of the cleaning of the partition member 53, the operator attaches the partition member 53 to the cooling unit 31A. To be more specific, the operator inserts the positioning pin 97b of the partition member 53 into the through hole 66 while the movable wall plate 52 is at the detaching position. Thereafter, the operator moves the movable wall plate 52 to the operation position and inserts the positioning pin 97a into the through hole 76. As a result, the partition member 53 is supported at both ends by the fixed wall plate 51 and the movable wall plate 52.

[0094] As described above, in the false-twisting device 15 of the false-twist texturing machine 1 of the present embodiment, the first yarn Ya is sandwiched between the first endless belt 46a and the first contact surface 41a whereas the second yarn Yb is sandwiched between the second endless belt 46b and the second contact surface 41b. With this arrangement, the twisting of the first yarn Ya and the second yarn Yb is ensured. Furthermore, because the first contact surface 41a and the second contact surface 41b are formed on the same disc 41, the distance between the first yarn Ya and the second yarn Yb is short in the false-twisting device 15. It is therefore possible to twist a large number of yarns Y in a small space. Furthermore, in the false-twisting device 15, the position where the first yarn Ya is false-twisted is advantageously close to the position where the second yarn Yb is false-twisted. This makes it possible to suppress yarn paths of the first yarn Ya and the second yarn Yb from being significantly different (and to suppress inconsistency in yarn quality between the first yarn Ya and the second yarn Yb due to the difference between the yarn paths).

[0095] In the cooler 14 of the false-twist texturing machine 1 of the present embodiment, the first yarn Ya and the second yarn Yb are reliably cooled by cooling wind. Furthermore, because the first cooling space Sa and the second cooling space Sb are formed in the same cooling unit 31A, the distance between the first yarn Ya and the

second yarn Yb is advantageously short in the cooler 14. It is therefore possible to cool a large number of yarns Y in a small space. Furthermore, because the distance between the first yarn Ya and the second yarn Yb is short as described above, it is possible to suppress the yarn paths of the first yarn Ya and the second yarn Yb from being significantly different (and to suppress the above-described inconsistency in yarn quality due to the difference between the yarn paths).

[0096] As described above, it is possible to suppress the loss of production efficiency and homogeneity and to achieve a good yarn quality, even when thick yarns Y are subjected to false-twist texturing.

[0097] The first cooling space Sa and the second cooling space Sb are provided to be side by side in the base longitudinal direction. It is therefore possible to maintain the first yarn Ya and the second yarn Yb to be side by side in the base longitudinal direction when the first yarn Ya and the second yarn Yb are sent from the cooler 14 to the false-twisting device 15. This makes it possible to further suppress the yarn paths of the first yarn Ya and the second yarn Yb from being different as compared to a case where, for example, the first cooling space Sa and the second cooling space Sb are aligned in a direction different from the base longitudinal direction. Therefore, the difference in quality can be effectively suppressed between the first yarn Ya and the second yarn Yb.

[0098] In addition to the above, $WC2 = WC1$ (i.e., $WC2$ is small). On this account, the bending of the first yarn Ya and the second yarn Yb is suppressed when the first yarn Ya and the second yarn Yb are supplied from the cooler 14 to the false-twisting device 15. It is therefore possible to avoid the deterioration in yarn quality.

[0099] In the present embodiment, the relationship $W2 < WC2 = WC1 < W1$ holds true. On this account, in yarn threading to the cooling unit 31A, the yarn threading can be done while maintaining both of the first yarn Ya and the second yarn Yb to be substantially linear. In other words, it is scarcely necessary to bend the first yarn Ya and the second yarn Yb in the yarn threading to the cooling unit 31A. It is therefore easy to simultaneously thread the first yarn Ya and the second yarn Yb to the cooling unit 31A.

[0100] In addition to the above, the first cooling space Sa and the second cooling space Sb are separated by the partition member 53. It is therefore possible to reliably avoid entanglement of the first yarn Ya and the second yarn Yb for some reason, as compared to an arrangement in which the partition member 53 is not provided and the first cooling space Sa and the second cooling space Sb are not separated.

[0101] In addition to the above, each of the first cooling space Sa and the second cooling space Sb is connected to the intake space Ss extending in the base longitudinal direction (i.e., the spaces are connected in a parallel manner). It is therefore possible to substantially uniformly supply the cooling wind to the first cooling space Sa and

the second cooling space Sb by a simple structure.

[0102] In addition to the above, the first cooling space Sa is formed by the wall surface 74 of the movable wall plate 52 and the first partition surface 90a of the first partition portion 88a, and the second cooling space Sb is formed by the wall surface 64 of the fixed wall plate 51 and the second partition surface 90b of the second partition portion 88b. In this way, the first cooling space Sa and the second cooling space Sb can be formed by simple structures.

[0103] In addition to the above, the first partition surface 90a is provided to face the wall surface 74 in the base longitudinal direction and the second partition surface 90b is provided to face the wall surface 64 in the base longitudinal direction. This arrangement makes it possible to narrow the first entrance 95a and the second entrance 95b. It is therefore possible to prevent the first yarn Ya from dropping off from the first cooling space Sa and prevent the second yarn Yb from dropping off from the second cooling space Sb.

[0104] In addition to the above, the cooling unit 31A includes the first yarn guide 96a and the second yarn guide 96b. With this arrangement, the first yarn Ya is guided to the downstream side in the yarn running direction by the first yarn guide 96a, whereas the second yarn Yb is guided to the downstream side in the yarn running direction by the second yarn guide 96b. To put it differently, the cooling unit 31A is not arranged so that the yarn Y is intentionally made in contact with the partitioning surface and the wall surface. It is therefore possible to suppress the yarn Y from rolling along the wall surface or the partitioning surface when the yarn Y is twisted by the false-twisting device 15. As a result, the drop-off of the yarn Y from the cooling space S is suppressed.

[0105] In addition to the above, the fixed wall plate 51 and the movable wall plate 52 support the partition member 53. It is therefore possible to properly position the partition member 53 even when the partition member 53 cannot be attached to the intake duct 32. To be more specific, the partition member 53 is supported at both ends. It is therefore possible to stably support the partition member 53.

[0106] In addition to the above, the partition member 53 is attachable to and detachable from (i.e., movable relative to) the fixed wall plate 51 and the movable wall plate 52. As a result, a wide space used for cleaning the fixed wall plate 51, the movable wall plate 52, and the partition member 53 is secured. The work efficiency of operations such as cleaning is therefore improved. Furthermore, because the partition member 53 can be completely detached from the cooling unit 31A, the work efficiency of operations such as cleaning is significantly improved.

[0107] In addition to the above, the fixed wall plate 51 is positionally fixed relative to the intake duct 32, and the movable wall plate 52 and the partition member 53 are movable relative to the fixed wall plate 51. It is therefore possible to provide the cooling unit 31B to be line-sym-

metrical with the cooling unit 31A about the linear line L. Even though this cooling unit 31B is provided, two members (fixed wall plates 51 and 56) neighboring each other do not move. On this account, interference between the members can be avoided when the members are moved for cleaning.

[0108] In addition to the above, when the yarn threading is performed, the first yarn Ya can be moved along the first yarn insertion guiding portion 89a and the second yarn Yb can be moved along the second yarn insertion guiding portion 89b. This improves the success rate of the yarn threading.

[0109] When the upstream end portion in the yarn running direction of the first heater 13 is at a high position in the vertical direction as in the present embodiment, the yarn is threaded to the cooler 14 and the first heater 13 by using an apparatus (not illustrated) for moving the yarn Y upward. For such yarn threading, the improvement in the success rate of the yarn threading by the first yarn insertion guiding portion 89a and the second yarn insertion guiding portion 89b is particularly effective.

[0110] The following will describe modifications of the above-described embodiment. The members identical with those in the embodiment above will be denoted by the same reference numerals and the explanations thereof are not repeated.

(1) In the embodiment above, the partition member 53 is supported at both ends by the fixed wall plate 51 and the movable wall plate 52. However, the disclosure is not limited to this. The partition member 53 may be cantilevered by one of the fixed wall plate 51 and the movable wall plate 52.

(2) In the embodiment above, the partition member 53 is supported by at least one of the fixed wall plate 51 or the movable wall plate 52. However, the disclosure is not limited to this. The partition member 53 may be directly attached to the intake duct 32, for example.

(3) In the embodiment above, the partition member 53 is attachable to and detachable from the cooling unit 31A. However, the disclosure is not limited to this. For example, the partition member 53 supported by at least one of the fixed wall plate 51 or the movable wall plate 52 may be movable in the base longitudinal direction.

(4) In the embodiment above, the movable wall plate 52 and the partition member 53 are movable relative to the fixed wall plate 51 and the intake duct 32. However, the disclosure is not limited to this. For example, the partition member 53 may be fixed to the intake duct 32. In this case, a wall member (not illustrated) movable relative to the intake duct 32 and the partition member 53 may be provided in place of the fixed wall plate 51. The false-twist texturing machine (not illustrated) structured in this way is also equivalent to the false-twist texturing machine of the present invention in which the partition member is

movable relative to the first wall member and the second wall member.

(5) In the embodiment above, the partition member 53 is arranged to be movable relative to the first wall member and the second wall member of the present invention. However, the disclosure is not limited to this. These members may all be positionally fixed relative to the intake duct 32.

(6) In the embodiment above, the cooler 14 is a contactless device including the first yarn guide 96a and the second yarn guide 96b. However, the disclosure is not limited to this. For example, as in a cooler recited in Japanese Laid-Open Patent Publication No. H11-107084, the cooler 14 may cause the yarn Y to be intentionally made in contact with a wall surface (not illustrated). When this arrangement is employed, it is preferable to take a measure for preventing the yarn Y from dropping off from the cooler 14.

(7) In the embodiment above, the first partition surface 90a is provided to face the wall surface 74 in the base longitudinal direction and the second partition surface 90b is provided to face the wall surface 64 in the base longitudinal direction. In other words, the first partition surface 90a and the wall surface 74 are substantially in parallel to each other and the second partition surface 90b and the wall surface 64 are substantially in parallel to each other. However, the disclosure is not limited to this. For example, the first partition surface 90a and the wall surface 74 may be arranged so that the distance in the base longitudinal direction increases toward the other side in the height direction. The same applies to the second partition surface 90b and the wall surface 64.

(8) In the embodiment above, the cooling unit 31A includes the fixed wall plate 51, the movable wall plate 52, and the partition member 53. However, the disclosure is not limited to this. For example, in place of the fixed wall plate 51, the movable wall plate 52, and the partition member 53, a single member having functions of these members may be attached to the intake duct 32.

(9) While in the embodiment above the first cooling space Sa and the second cooling space Sb are separated by the partition member 53, the disclosure is not limited to this arrangement. For example, between the first cooling space Sa and the second cooling space Sb, pins (not illustrated) extending in the height direction may be provided to be aligned in the yarn running direction. These pins may be provided to be separated from one another in the yarn running direction. In this way, the movement of the first yarn Ya and the second yarn Yb in the base longitudinal direction may be restricted and entanglement of the first yarn Ya and the second yarn Yb may be avoided.

(10) In the embodiment above, each of the first cooling space Sa and the second cooling space Sb is connected to the intake space Ss extending in the base longitudinal direction (i.e., the spaces are con-

nected in a parallel manner). However, the disclosure is not limited to this. For example, in an intake direction in which the cooling wind is sucked into the intake space Ss, the first cooling space Sa and the second cooling space Sb may be connected in series. In other words, one of the first cooling space Sa and the second cooling space Sb may be provided on the upstream of the other one in the intake direction.

(11) In the embodiment above, the distance in the base longitudinal direction between the first cooling space Sa and the second cooling space Sb (i.e., the distance between the first yarn Ya and the second yarn Yb in the base longitudinal direction) is constant. In other words, in the cooling unit 31A, the first yarn Ya and the second yarn Yb are substantially in parallel (i.e., $WC1=WC2$). However, the disclosure is not limited to this. In the cooling unit 31A, the first yarn Ya and the second yarn Yb may not be substantially in parallel. For example, the distance at the downstream end in the yarn running direction of the cooling unit 31A may be narrower than the distance at the upstream end in the yarn running direction ($WC2 < WC1$). In other words, $WC2 \leq WC1$ may hold true. Alternatively, $WC1 < WC2$ may hold true.

In addition to the above, in the orthogonal direction, the position of the end of the first cooling space Sa on one side may not be substantially identical with the position of the end of the second cooling space Sb on one side. In the orthogonal direction, the position of the end of the first cooling space Sa on the other side may not be substantially identical with the position of the end of the second cooling space Sb on the other side. Also in this case, the strict definitions of WC1 and WC2 are identical with those described above.

(12) The relationship between W1, W2, WC1, and WC2 may be different from the relationship $W2 < WC2 = WC1 < W1$. For example, as described above, in order to facilitate simultaneous threading of the first yarn Ya and the second yarn Yb to the cooling unit 31A, the yarn guides G1 and G2 and the cooling unit 31A may be arranged to satisfy one of the relationships described below. In other words, $W2 \leq WC2 \leq WC1 \leq W1$ may hold true. Alternatively, $W1 \leq WC1 \leq WC2 \leq W2$ may hold true. In this case, being different from the embodiment above, W2 may be larger than W1.

Alternatively, when simultaneous threading of the first yarn Ya and the second yarn Yb to the cooling unit 31A is not taken into consideration, the relationship between W1, W2, WC1, and WC2 is not limited to the above.

(13) While in the embodiment above the first cooling space Sa and the second cooling space Sb are provided side by side in the base longitudinal direction, the disclosure is not limited to this arrangement. For example, a first cooling space (not illustrated) and a

second cooling space (not illustrated) may be provided side by side in the height direction as in a cooler (not illustrated) disclosed in Japanese Patent No. 4462751.

(14) In the embodiment above, each of the cooling units 31 is able to cool two yarns Y. However, the disclosure is not limited to this. The following will describe an alternative case with reference to FIG. 12. For example, in place of the cooling unit 31, a cooling unit 31M1 which is configured to cool three yarns Y running side by side in the base longitudinal direction may be provided as shown in FIG. 12. The cooling unit 31M1 includes, for example, the above-described fixed wall plate 51, the above-described partition member 53, a partition member 53A, and the above-described movable wall plate 52. The partition member 53A is provided to oppose the fixed wall plate 51 over the partition member 53 in the base longitudinal direction. In this modification, the movable wall plate 52 is provided to oppose the fixed wall plate 51 over the partition member 53 and the partition member 53A in the base longitudinal direction.

[0111] The partition member 53A is a member extending at least in the orthogonal direction. The partition member 53A is substantially U-shaped in a cross section (see FIG. 12) when viewed in the same direction as FIG. 9. The partition member 53A includes a partition portion 88c, a bottom portion 99, a partition portion 88d, a yarn insertion guide portion 89c, and a yarn insertion guide portion 89d. The partition portion 88c is a member extending in the height direction. The partition portion 88c includes a partition surface 90c that is provided to oppose the first partition surface 90a in the base longitudinal direction. Between the first partition surface 90a and the partition surface 90c, the above-described first cooling space Sa is formed. In the partition portion 88c, a through hole 94c that is substantially identical in shape and size with each of the through holes 94a and 94b is formed. The bottom portion 99 is connected to the partition portion 88c and in contact with the wall member 33. The partition portion 88d is connected to the bottom portion 99 and extends in the height direction. The partition portion 88d includes a partition surface 90d that is provided to oppose the wall surface 74 of the movable wall plate 52 in the base longitudinal direction. Between the wall surface 74 and the partition surface 90d, a cooling space Sd is formed to cool a yarn Yd that is different from the first yarn Ya and the second yarn Yb. In the partition portion 88d, a through hole 94d that is substantially identical in shape and size with the through hole 94c is formed. The yarn insertion guide portion 89c is connected to the partition portion 88c and extends away from the bottom portion 99 in the height direction. The yarn insertion guide portion 89d is connected to the partition portion 88d and extends away from the bottom portion 99 in the height direction.

[0112] In the cooling unit 31M1, for example, an intake slit 34d is formed in the wall member 33 to connect the intake space Ss with the cooling space Sd. A connection member 87A having the same structure as the connection member 87 is fixed to the movable wall plate 52. A spacer 92d determining the distance between the wall surface 74 and the partition surface 90d is provided between the wall surface 74 and the partition surface 90d in the base longitudinal direction. A yarn guide 96d having the same structure as the second yarn guide 96b is attached to the connection member 87A. A positioning pin 97d having the same structure as the positioning pin 97b is attached to the connection member 87A.

[0113] (15) As another modification, as shown in FIG. 13, a cooling unit 31M2 configured to cool four yarns Y running side by side in the base longitudinal direction may be provided. Although not detailed, in the cooling unit 31M2, for example, two partition members 53 may be provided, with the partition member 53A being provided therebetween in the base longitudinal direction. With this arrangement, in the cooling unit 31M2, a cooling space Se is formed to cool a yarn Ye different from the first yarn Ya and the second yarn Yb. In this modification, an intake slit 34e is formed in the wall member 33 to connect the intake space Ss with the cooling space Se. By using this modification and the above-described modification (13) each cooling unit (not illustrated) may be arranged to be able to simultaneously cool five or more yarns Y.

Claims

1. A false-twist texturing machine (1) configured to be able to simultaneously perform false-twist texturing for a first yarn (Ya) and a second yarn (Yb) that are running, comprising:

a false-twisting device (15) which is configured to twist the first yarn (Ya) and the second yarn (Yb); and

a cooler (14) which is provided upstream of the false-twisting device (15) in a yarn running direction in which the first yarn (Ya) and the second yarn (Yb) run and is configured to cool the first yarn (Ya) and the second yarn (Yb),

the false-twisting device (15) including: a disc (41) rotatable about a rotational axis direction that is a predetermined direction; a first belt unit (42a) that is provided on one side in the predetermined direction of the disc (41); and a second belt unit (42b) that is provided on the other side in the predetermined direction of the disc (41), the disc (41) including: a first contact surface (41a) that is provided at an end on the one side in the predetermined direction; and a second contact surface (41b) that is provided at an end on the other side in the predetermined direction,

the first belt unit (42a) including a first belt member (46a) that is in contact with the first yarn (Ya) and is movable and being configured to twist the first yarn (Ya) by sandwiching the first yarn (Ya) between the first contact surface (41a) and the first belt member (46a),

the second belt unit (42b) including a second belt member (46b) that is in contact with the second yarn (Yb) and is movable and being configured to twist the second yarn (Yb) by sandwiching the second yarn (Yb) between the second contact surface (41b) and the second belt member (46b), and

the cooler (14) including:

a cooling unit (31, 31A) in which a first cooling space (Sa) for cooling the first yarn (Ya) and a second cooling space (Sb) which is provided to be side by side with the first cooling space (Sa) and for cooling the second yarn (Yb) are formed; and

an intake duct (32) which has an intake space (Ss) connected to the first cooling space (Sa) and the second cooling space (Sb) and is provided to supply cooling wind to the first cooling space (Sa) and the second cooling space (Sb) .

2. The false-twist texturing machine (1) according to claim 1, wherein, the first cooling space (Sa) and the second cooling space (Sb) are provided to be side by side in the predetermined direction.

3. The false-twist texturing machine (1) according to claim 2, wherein, when a distance between an upstream end in the yarn running direction of the first cooling space (Sa) and an upstream end in the yarn running direction of the second cooling space (Sb) in the predetermined direction is WC1 and a distance between a downstream end in the yarn running direction of the first cooling space (Sa) and a downstream end in the yarn running direction of the second cooling space (Sb) in the predetermined direction is WC2, a relationship of $WC2 \leq WC1$ is satisfied.

4. The false-twist texturing machine (1) according to claim 2 or 3, further comprising:

a heater (13) which is provided upstream of the cooler (14) in the yarn running direction;

an upstream guide member (G1) which is provided between the heater (13) and the cooler (14) in the yarn running direction; and

a downstream guide member (G2) which is provided between the cooler (14) and the false-twisting device (15) in the yarn running direction, the upstream guide member (G1) causing a distance between the first yarn (Ya) and the second

- yarn (Yb) in the predetermined direction to be equal to W1,
the downstream guide member (G2) causing a distance between the first yarn (Ya) and the second yarn (Yb) in the predetermined direction to be equal to W2, and
when a distance between an upstream end in the yarn running direction of the first cooling space (Sa) and an upstream end in the yarn running direction of the second cooling space (Sb) in the predetermined direction is WC1 and a distance between a downstream end in the yarn running direction of the first cooling space (Sa) and a downstream end in the yarn running direction of the second cooling space (Sb) in the predetermined direction is WC2, a relationship of $W2 \leq WC2 \leq WC1 \leq W1$ or $W1 \leq WC1 \leq WC2 \leq W2$ is satisfied.
5. The false-twist texturing machine (1) according to any one of claims 2 to 4, wherein, the cooling unit (31A) includes a partition member (53) which separates the first cooling space (Sa) from the second cooling space (Sb) in the predetermined direction.
6. The false-twist texturing machine (1) according to claim 5, wherein,
the intake space (Ss) extends in the predetermined direction, and
each of the first cooling space (Sa) and the second cooling space (Sb) is connected to the intake space (Ss).
7. The false-twist texturing machine (1) according to claim 5 or 6, wherein,
the partition member (53) includes:
a first partition portion (88a) having a first partition surface (90a) which is provided on the one side in the predetermined direction in order to form the first cooling space (Sa); and
a second partition portion (88b) having a second partition surface (90b) which is provided on the other side in the predetermined direction in order to form the second cooling space (Sb), and
the cooling unit (31A) includes:
a first wall member (52) which has a first wall surface (64) that is provided on the one side in the predetermined direction of the first partition surface (90a) in order to form the first cooling space (Sa); and
a second wall member (51) which has a second wall surface (74) that is provided on the other side in the predetermined direction of the second partition surface (90b) in order to form the second cooling space (Sb).
8. The false-twist texturing machine (1) according to claim 7, wherein,
the first partition surface (90a) is provided to oppose the first wall surface (64) in the predetermined direction, and
the second partition surface (90b) is provided to oppose the second wall surface (74) in the predetermined direction.
9. The false-twist texturing machine (1) according to claim 7 or 8, wherein,
the cooling unit (31A) includes:
a first yarn guide (96a) which is provided between the first partition surface (90a) and the first wall surface (64) in the predetermined direction to guide the first yarn (Ya) to the downstream side in the yarn running direction; and
a second yarn guide (96b) which is provided between the second partition surface (90b) and the second wall surface (74) in the predetermined direction to guide the second yarn (Yb) to the downstream side in the yarn running direction.
10. The false-twist texturing machine (1) according to any one of claims 7 to 9, wherein,
the first wall member (52) and the second wall member (51) are attached to the intake duct (32), and
at least one of the first wall member (52) or the second wall member (51) is arranged to support the partition member (53).
11. The false-twist texturing machine (1) according to claim 10, wherein, both of the first wall member (52) and the second wall member (51) are arranged to support the partition member (53).
12. The false-twist texturing machine (1) according to any one of claims 7 to 11, wherein, at least the partition member (53) is arranged to be movable relative to the first wall member (52) and the second wall member (51).
13. The false-twist texturing machine (1) according to claim 12, wherein,
one of the first wall member (52) and the second wall member (51) is positionally fixed relative to the intake duct (32), and
the partition member (53) and the other one of the first wall member (52) and the second wall member (51) are movable relative to the one of the first wall member (52) and the second wall member (51).

14. The false-twist texturing machine (1) according to claim 12 or 13, wherein, the partition member (53) is arranged to be attachable to and detachable from the cooling unit (31A). 5
15. The false-twist texturing machine (1) according to any one of claims 7 to 14, wherein, 10
- when a direction orthogonal to both a longitudinal direction of the cooling unit (31A) and the predetermined direction is a height direction, the partition member (53) includes: 10
- a first yarn insertion guiding portion (89a) which protrudes, in at least the height direction, toward a working space (Sw) where yarn threading to the cooler (14) is performed, relative to the first partition portion (88a); and 15
- a second yarn insertion guiding portion (89b) which protrudes, in at least the height direction, toward the working space as compared to the second partition portion (88b). 20
16. The false-twist texturing machine (1) according to claim 15, further comprising 25
- a heater (13) which is provided upstream in the yarn running direction of the cooler (14) and is configured to heat the first yarn (Ya) and the second yarn (Yb), 30
- the false-twisting device (15), the cooler (14), and the heater (13) being provided above the working space (Sw) and 35
- an upstream end portion in the yarn running direction of the heater (13) being distanced upward from the cooler (14) in a vertical direction as compared to a downstream end portion in the yarn running direction of the heater (13). 40

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FIG.1

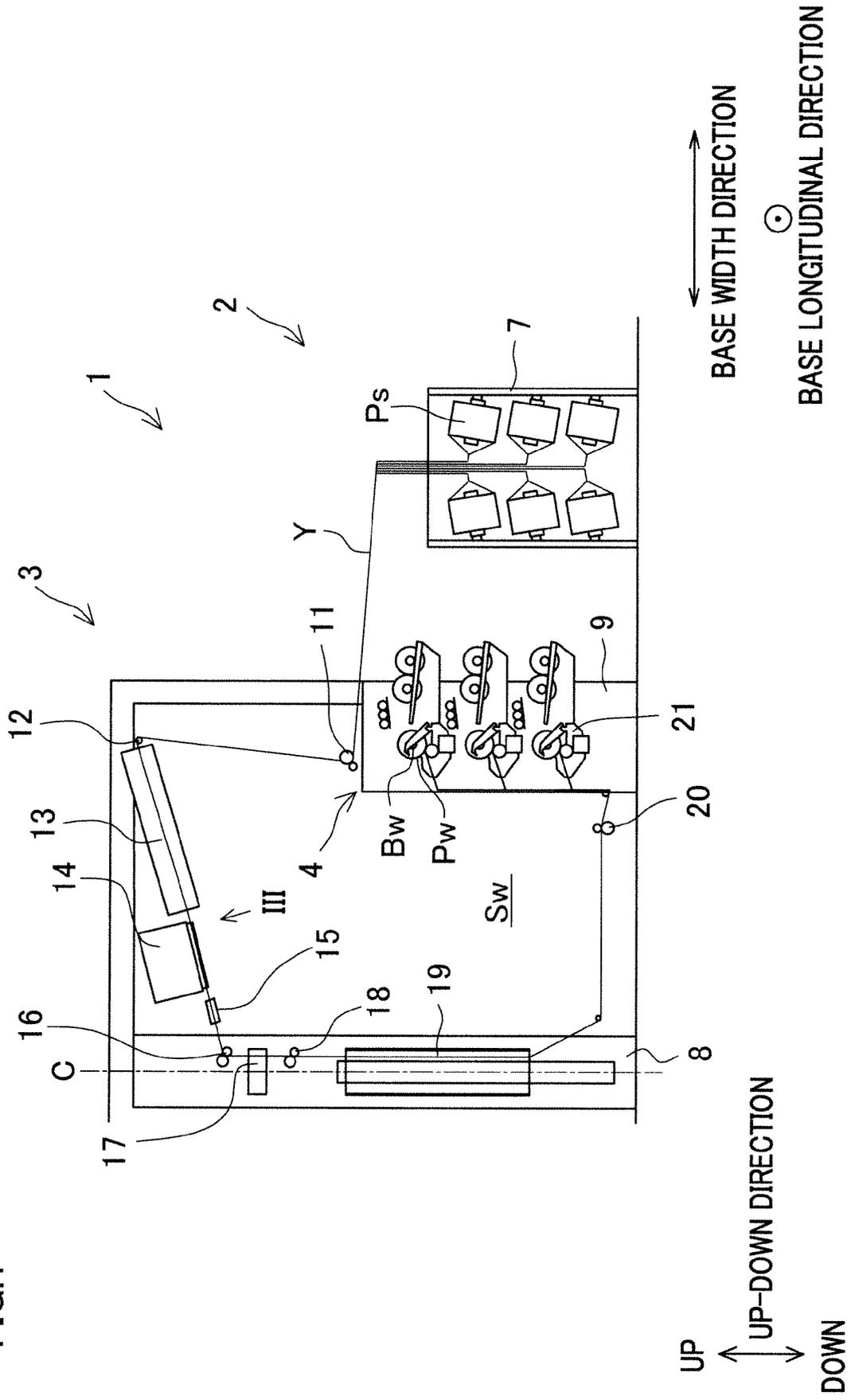


FIG.2

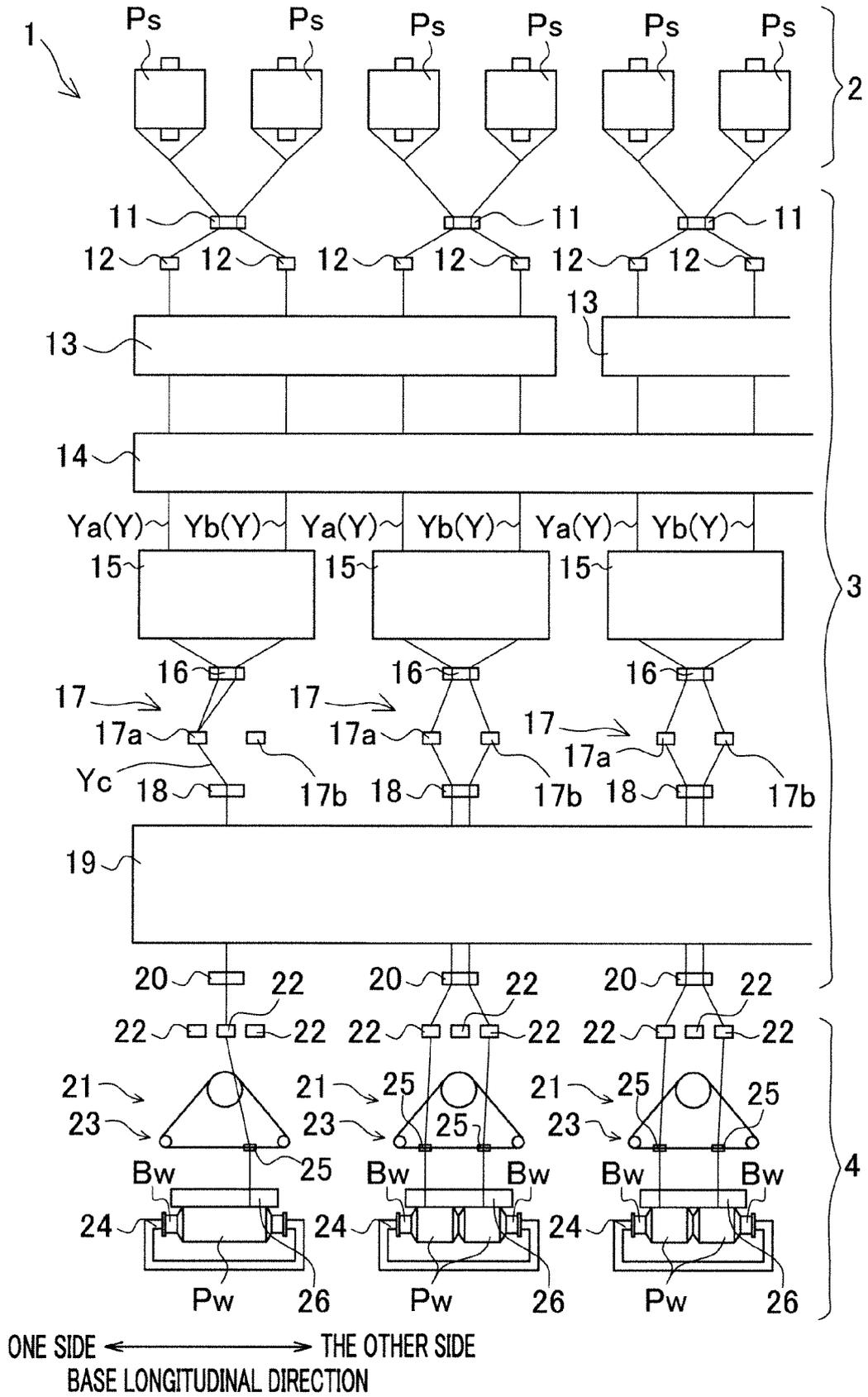


FIG.3

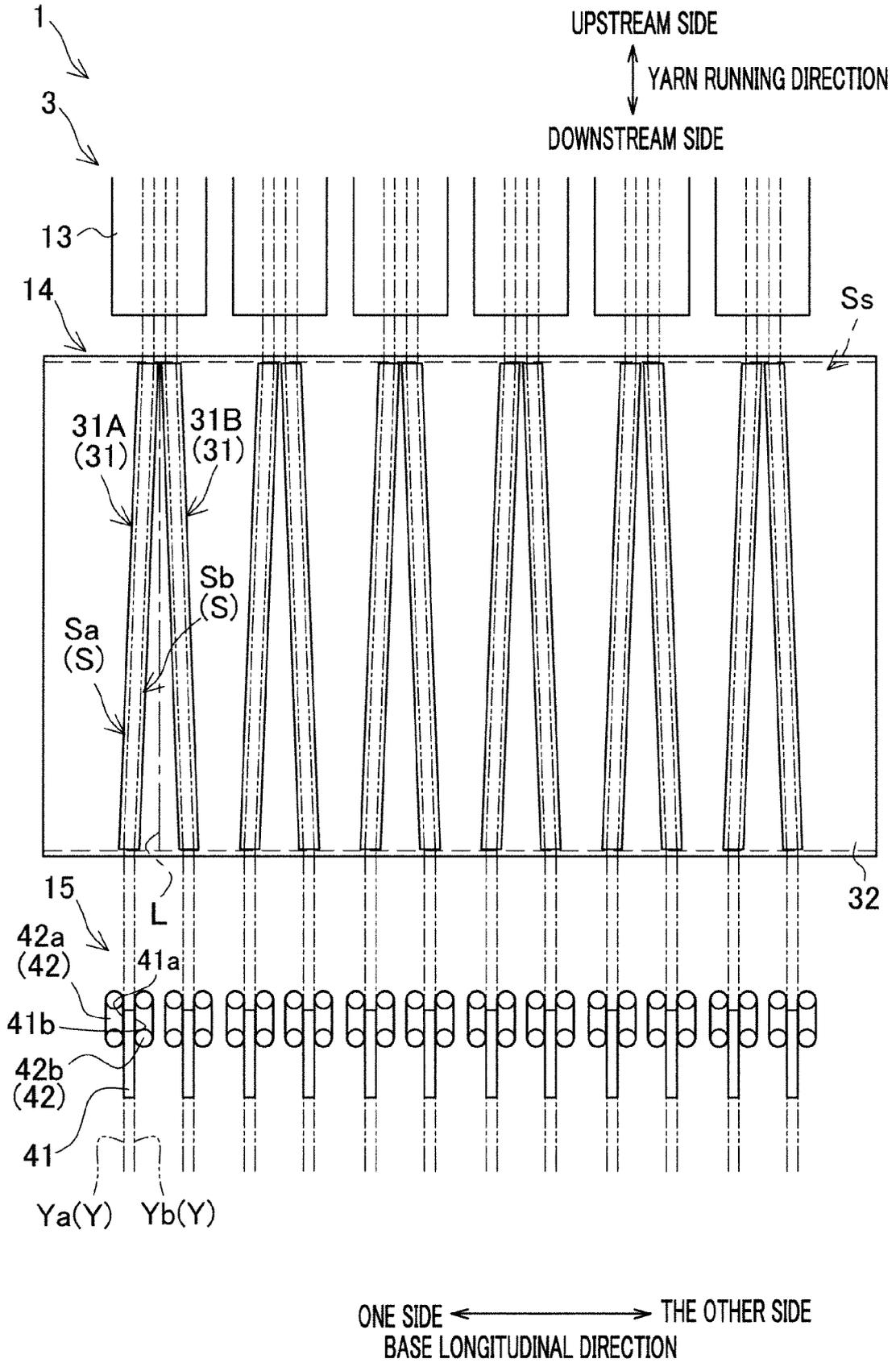


FIG.4

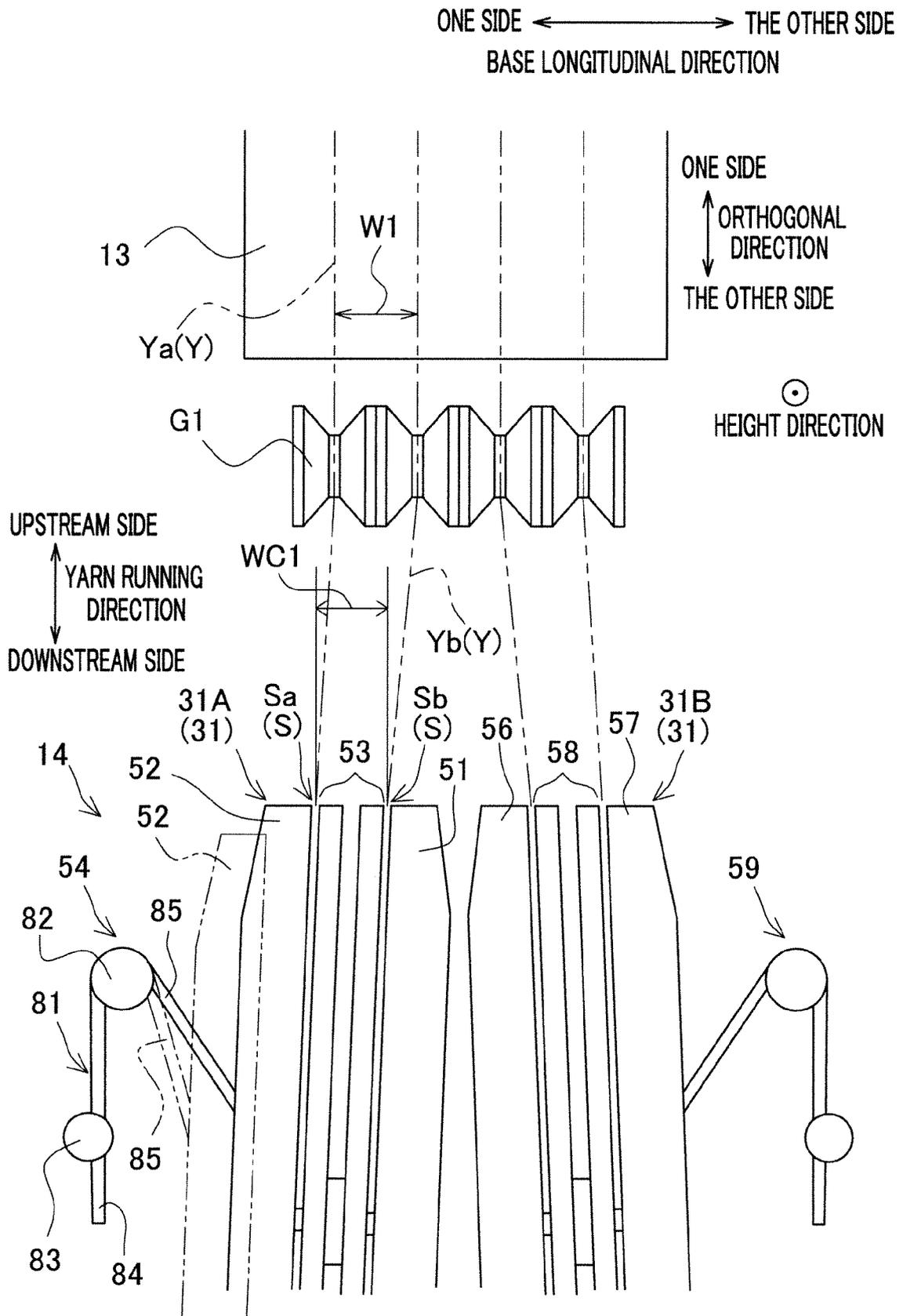


FIG.5

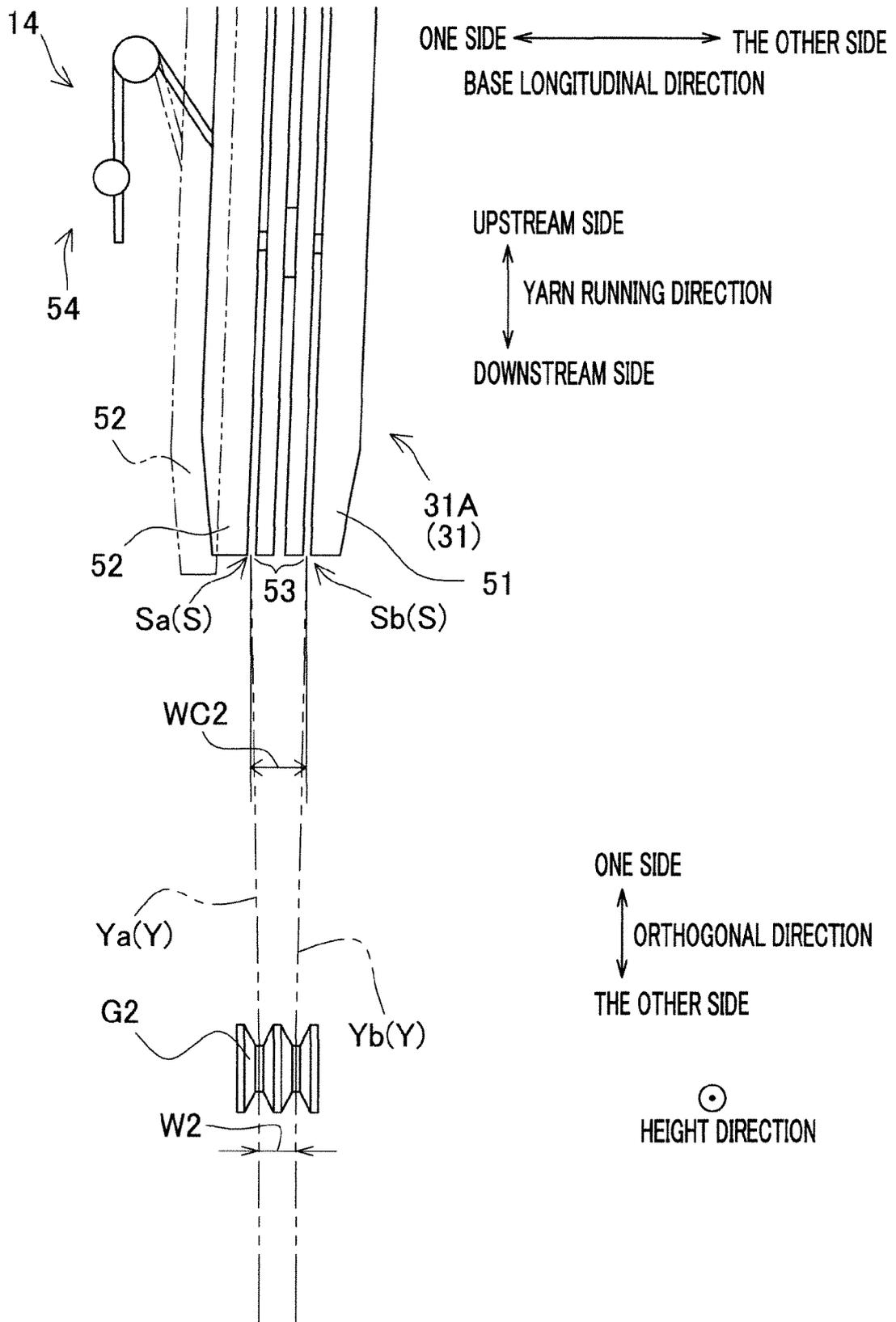


FIG.7

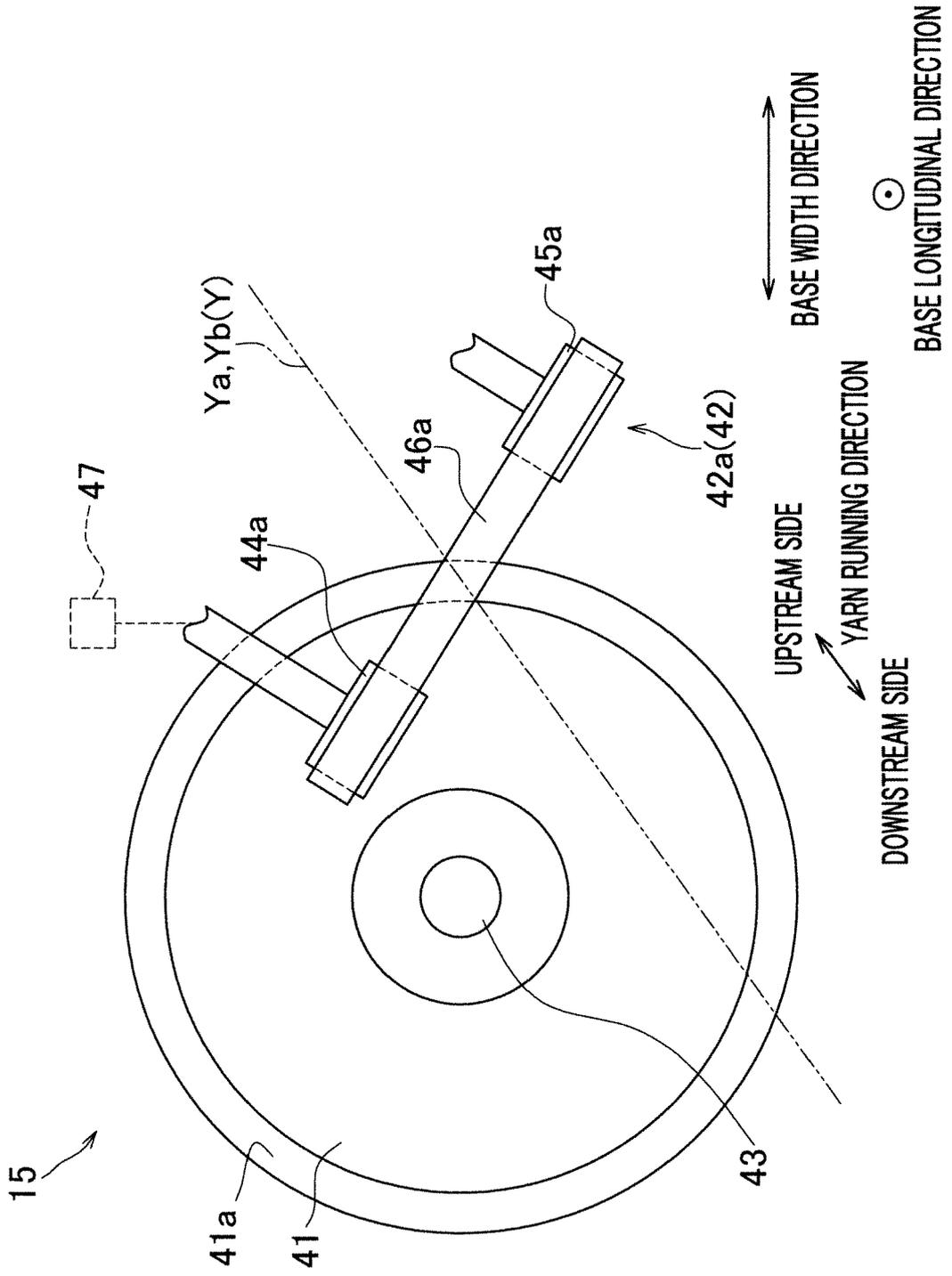


FIG.8

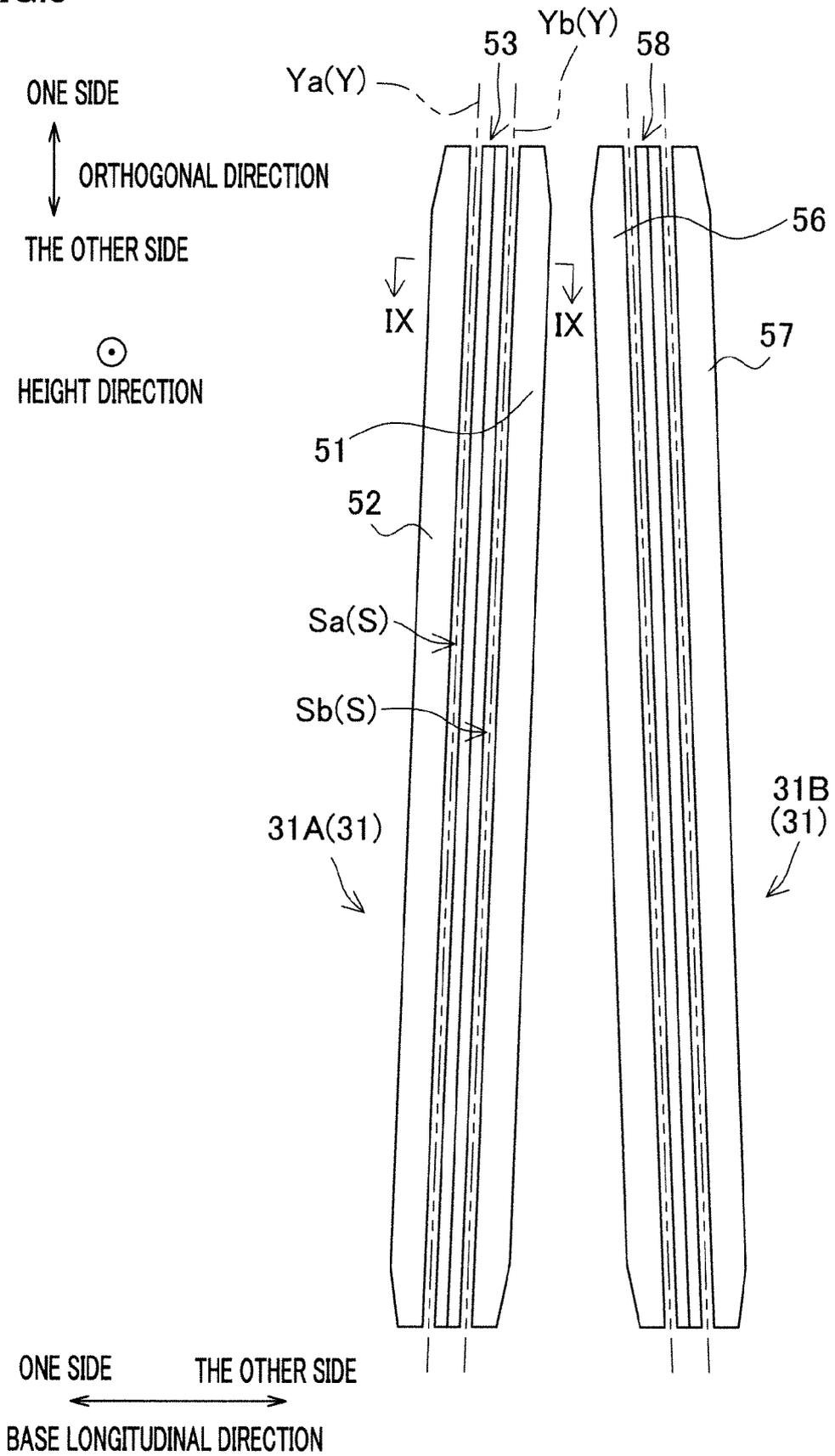


FIG.9

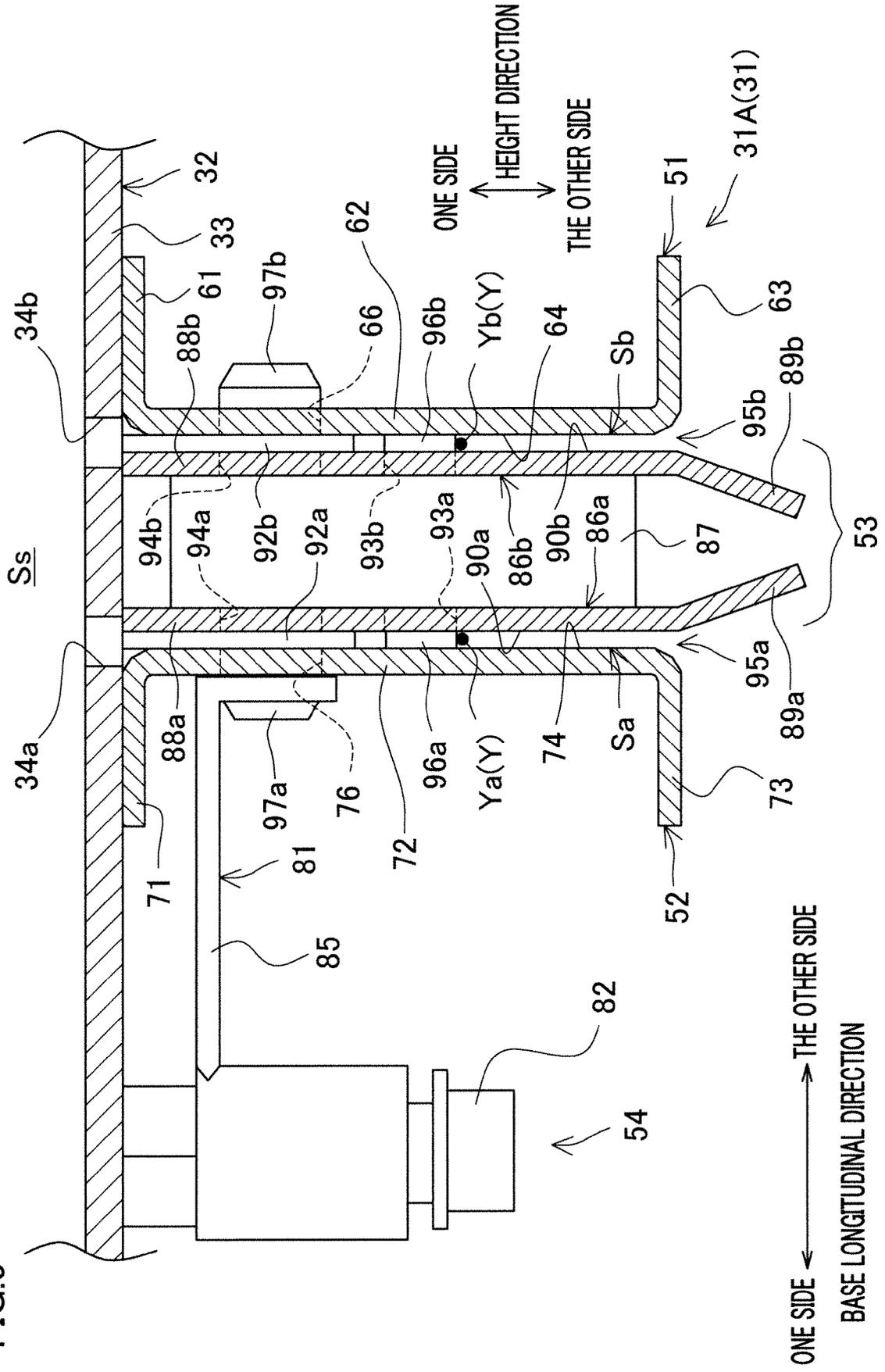


FIG.11

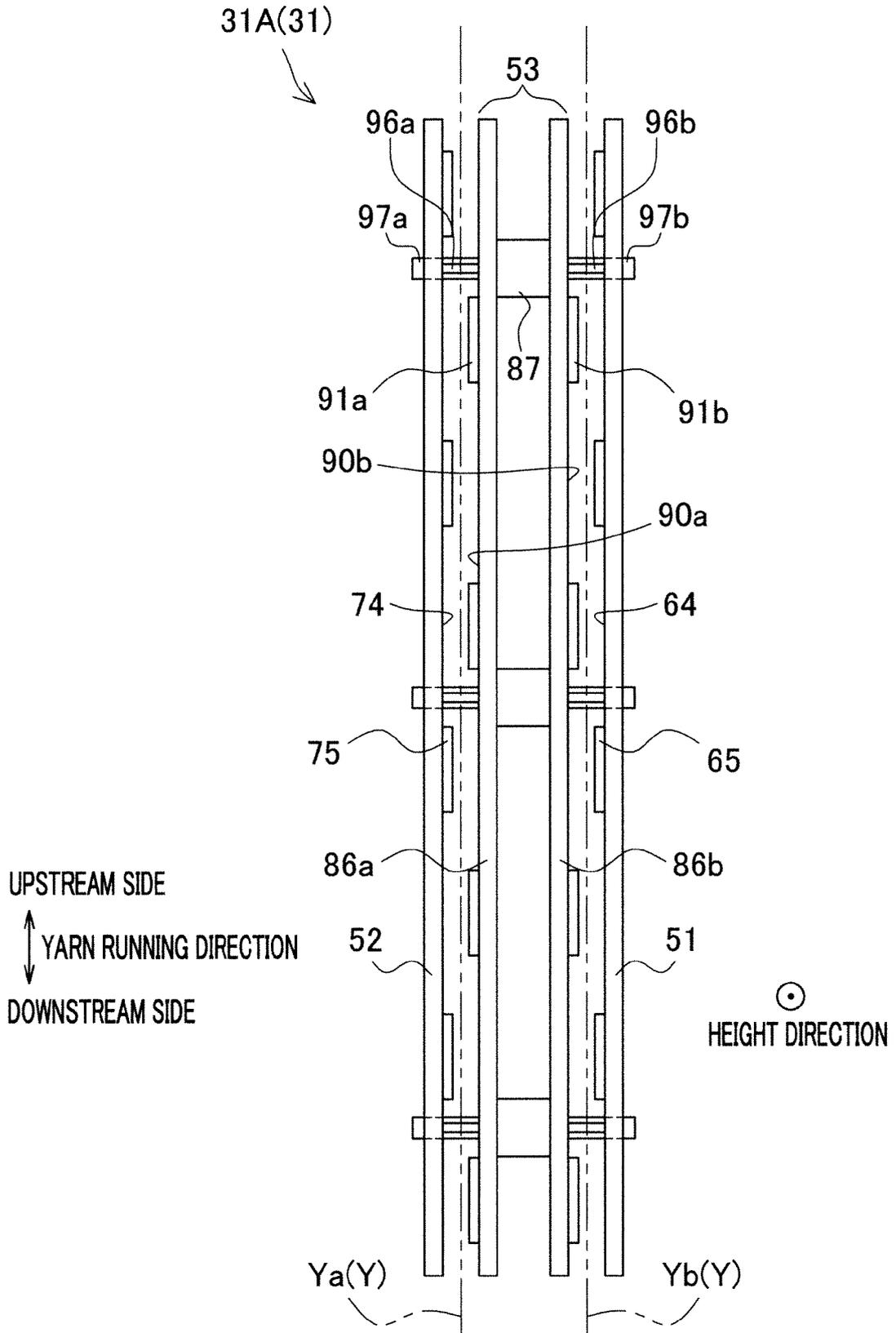
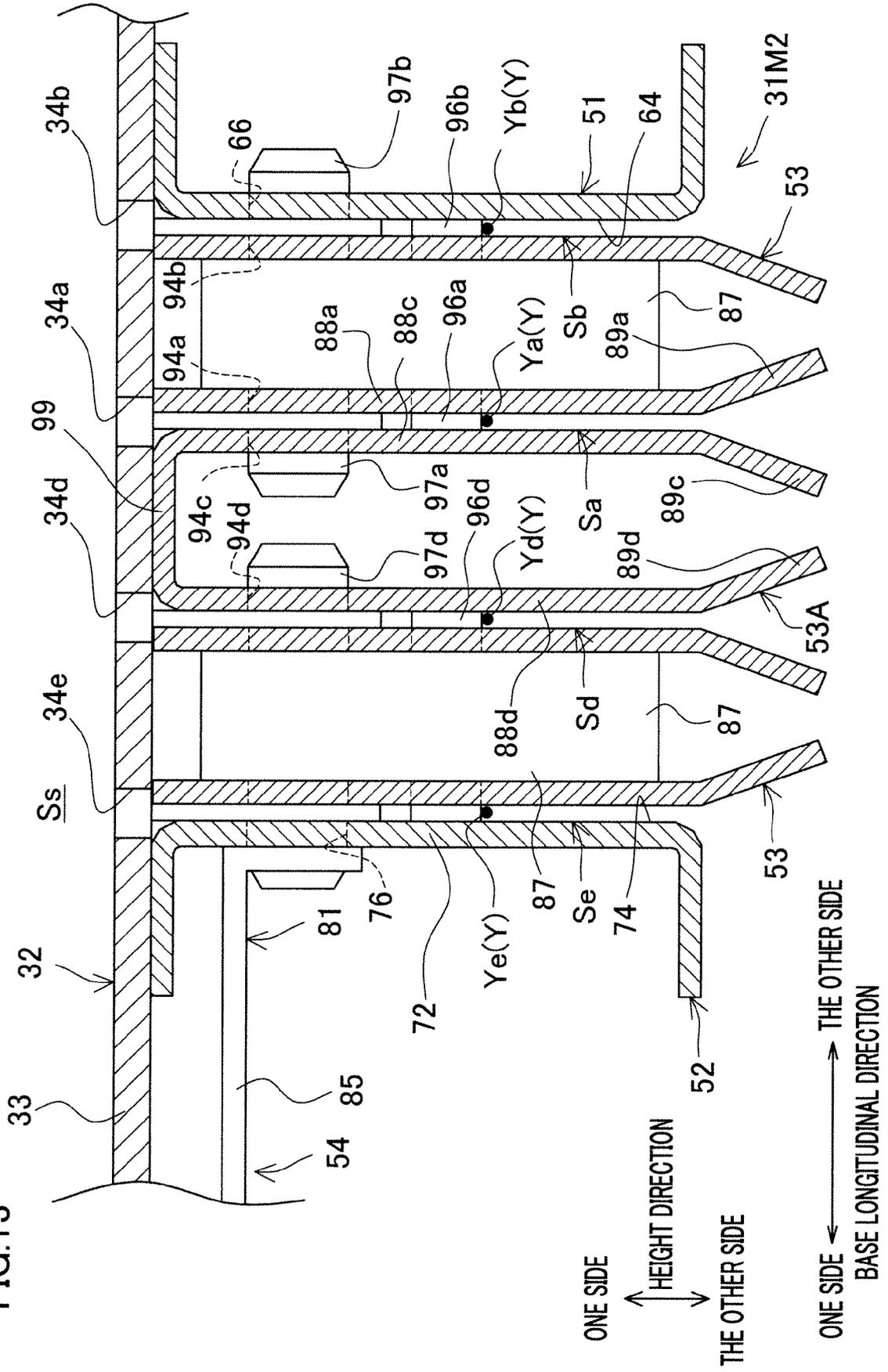


FIG.13





EUROPEAN SEARCH REPORT

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Place of search The Hague		Date of completion of the search 18 November 2022	Examiner Van Beurden-Hopkins
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