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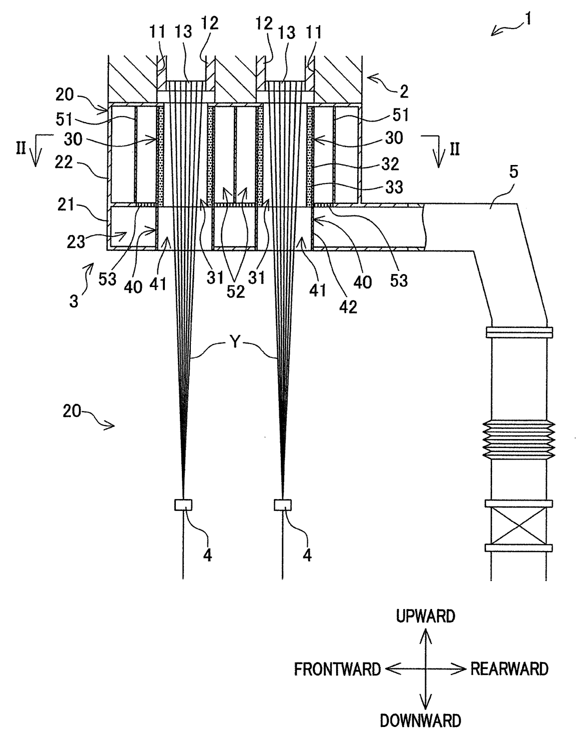
(54) YARN COOLER

(57) The qualities of yarns are uniformized. For each of cooling cylinders 30, a partition 51 is provided to surround each cooling cylinder 30 and form a circulation space 52 between the partition 51 and the outer circumferential surface of the cooling cylinder 30 to allow cooling wind to circulate in the circulation space 52, and at a border part between a supply space 23 to which the cooling wind is supplied from the outside and the circulation space 52, a flow adjustment plate 53 is provided to circulate the cooling wind from the supply space 23 into the circulation space 52 while adjusting the flow of the cooling wind.

FIG.1



EP 3 012 354 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn cooler which is configured to cool yarns spun out from a spinning beam which spins out downward a molten material as the yarns through spinnerets.

[0002] A yarn cooler for cooling yarns spun out from a spinning beam is recited in Patent Literature 1 (Japanese Unexamined Patent Publication No. 2011-252260), for example. In this yarn cooler, cooling cylinders are housed in a quench box, and the yarns are cooled as cooling wind is supplied to a yarn running space in each of the cooling cylinders. Because one quench box is provided for the plural cooling cylinders, the number of ducts supplying the cooling wind is reduced. The cooling cylinders are therefore disposed in high density, with the result that the efficiency in producing the yarns is improved.

SUMMARY OF THE INVENTION

[0003] However, as clearly shown in FIG. 4 in Patent Literature 1, the flow of the cooling wind around each cooling cylinder is significantly different between the cooling cylinders. On this account, the flow rate of the cooling wind supplied to the yarn running space may be significantly different between the cooling cylinders. Furthermore, in regard to one cooling cylinder, the flow of the cooling wind around thereof significantly varies in the circumferential direction. The cooling wind tends to swirl around the cooling cylinder, and hence the flow rate of the cooling wind supplied to one yarn running space may significantly vary in the circumferential direction. As a result, irregular cooling occurs and produced yarns tend to vary in quality, in known yarn coolers.

[0004] An object of the present invention is to uniformize the qualities of yarns in a yarn cooler which is provided with plural cooling cylinders for cooling the yarns.

[0005] To achieve the object above, the present invention provides a yarn cooler for cooling yarns spun out from a spinning beam which is configured to spin out, as the yarns, a molten material downward through spinnerets, which includes: cooling cylinders which are provided below the spinning beam to oppose the respective spinnerets and each of which includes a first yarn running space in which the yarns run, a peripheral wall of the first yarn running space including a flow control member which is arranged to adjust the flow of cooling wind flowing into the first yarn running space; partitioning cylinders which are connected with lower end portions of the respective cooling cylinders and each of which includes a second yarn running space communicating with the first yarn running space, a peripheral wall of the second yarn running space including a shielding member which is arranged to block the cooling wind from flowing into the second yarn running space; a quench box which includes a supply space to which the cooling wind is supplied from outside, the partitioning cylinders being provided in the supply space, wherein, the cooling cylinders are provided outside the supply space and a partition is provided for each of the cooling cylinders to surround the cooling cylinder and form a circulation space between the partition and the outer circumference of the cooling cylinder to allow the cooling wind to circulate in the circulation space, and at a border part between the supply space and the circulation space, a flow adjustment plate is provided to circulate the cooling wind from the supply space to the circulation space while adjusting the flow of the cooling wind.

[0006] According to the present invention, the flow of the cooling wind from the supply space formed in the quench box to the yarn running space (first yarn running space) in each cooling cylinder via the circulation space formed between the outer circumference of each cooling cylinder and the partition is established. In this regard, because the flow adjustment plate is provided at the border part between the supply space and the circulation space, variations in the flow rates of the cooling wind supplied from the supply space to the respective circulation spaces are restrained, and variations in the flow rate of the cooling wind supplied from each circulation space to each yarn running space is also restrained. Furthermore, because the circulation space is surrounded by the partition, the cooling wind does not flow into the circulation space from around the circulation space, and hence the generation of a swirl of the cooling wind is restrained in the circulation space. As a result, the flow rate of the cooling wind flowing in the circulation space is more or less uniformized in the circumferential direction, and the flow rate of the cooling wind supplied from the circulation space to the yarn running space is more or less uniformized in the circumferential direction. On this account, because the variations in the flow rate of the cooling wind supplied to the yarn running space is restrained and irregular cooling is restrained not only between the cooling cylinders but also in the circumferential direction in one cooling cylinder, the qualities of the yarns are uniformized.

[0007] In the present invention, preferably, the circulation space is plane-symmetric to at least one plane including the center axis of the cooling cylinder.

[0008] When the circulation space is plane-symmetric to at least one plane which includes the center axis of the cooling cylinder in this manner, the flow of the cooling wind in the circulation space is more or less plane-symmetric, too, and the flow rate of the cooling wind flowing in the circulation space is further uniformized in the circumferential direction. On this account, in the circumferential direction of one cooling cylinder, the variations in the flow rate of the cooling wind supplied to the yarn running space are further restrained.

[0009] In addition to the above, preferably, the circulation space is plane-symmetric to two planes which include the center axis of the cooling cylinder and are orthogonal to each other.

[0010] When the circulation space is plane-symmetric to two planes which include the center axis of the cooling cylinder and are orthogonal to each other in this way, the flow of the cooling wind in the circulation space is more or less plane-symmetric to the two orthogonal planes, and hence the flow rate of the cooling wind flowing in the circulation space is further uniformized in the circumferential direction. Therefore, in the circumferential direction of one cooling cylinder, variations in the flow rate of the cooling wind supplied to the yarn running space are further effectively restrained.

[0011] In addition to the above, preferably, the partition is a regular hexagon in shape in plan view.

[0012] By arranging the partition to form a regular hexagon in plan view, the enlargement of the circulation space and the uniformization of the flow of the cooling wind in the circumferential direction in the circulation space are both achieved with proper balance. This point will be detailed later with reference to a figure.

[0013] In addition to the above, preferably, the cooling cylinders are disposed in a staggered manner in plan view.

[0014] In this way, the cooling cylinders are densely disposed as the cooling cylinders are disposed in a staggered manner, and hence the efficiency in the production of the yarns is improved.

[0015] In addition to the above, preferably, the quench box includes a side wall which surrounds the cooling cylinders.

[0016] The side wall prevents the cooling cylinder from being exposed to the outside and protects the cooling cylinder. Furthermore, with the side wall, the strength of the quench box is improved.

[0017] In addition to the above, preferably, the cooling cylinders are lined up in an arrangement direction, and the cooling wind is supplied to the supply space in a direction orthogonal to the arrangement direction.

[0018] Because the cooling wind supplied in the direction orthogonal to the arrangement direction is likely to uniformly flow around the cooling cylinders lined up along the arrangement direction, the variations between the flow rates of the cooling wind supplied to the yarn running spaces of the cooling cylinder are further restrained. When the cooling cylinders are disposed in two dimensions as with a staggered manner, a direction in which the number of the cooling cylinders is largest is considered as the arrangement direction.

[0019] In the present invention, because the variations in the flow rate of the cooling wind supplied to the yarn running space is restrained and irregular cooling is restrained not only between the cooling cylinders but also in the circumferential direction in one cooling cylinder, the qualities of the yarns are uniformized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a partial cross section of a melt spinning device including a yarn cooler of the present invention.

FIG. 2 is a cross section taken at the II-II line in FIG. 1.

FIG. 3 is a cross section taken at the III-III line in FIG. 2.

FIG. 4 is a cross section taken at the IV-IV line in FIG. 3.

FIG. 5 is a cross section taken at the V-V line in FIG. 3.

FIG. 6 is a schematic view for comparison between shapes of partitions.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] The following will describe a yarn cooler of an embodiment of the present invention.

[Melt Spinning Device]

[0022] FIG. 1 is a partial cross section of a melt spinning device including the yarn cooler of the present invention. As shown in FIG. 1, the melt spinning device 1 includes members such as a spinning beam 2, a yarn cooler 3, and an oiling device 4. The spinning beam 2 is provided with pack housings 11. In each pack housing 11 is provided a spinning pack 12. The spinning pack 12 stores a molten material from which yarns Y are produced, e.g., molten polyester. At a lower end portion of the spinning pack 12 is provided a spinneret 13. The molten material stored in the spinning pack 12 is spun out downward through unillustrated through holes formed in the spinneret 13, as the yarns Y. In this regard, the spinnerets 13 are disposed in a staggered manner along the left-right direction to form two rows, in the same manner as later-described cooling cylinders 30 (see FIG. 2).

[0023] The yarn cooler 3 is provided below the spinning beam 2 and is configured to cool the yarns Y spun out downward from the spinning beam 2, by means of cooling wind supplied from a duct 5. The oiling device 4 is provided below the yarn cooler 3 and is configured to apply oil to the yarns Y having been cooled by the yarn cooler 3. The yarns Y to which the oil has been applied by the oiling device 4 are wound onto bobbins by an unillustrated winding device which is provided below the oiling device 4.

[Yarn Cooler]

[0024] The yarn cooler 3 is configured to cool the yarns Y by means of the cooling wind supplied from the duct 5, and stores, in a quench box 20, the cooling cylinders 30 and plural partitioning cylinders 40.

(Quench Box)

[0025] The quench box 20 includes a cooling wind supply chamber 21 connected with the duct 5 at the back end portion and a cooling cylinder housing chamber 22 which is provided above the cooling wind supply chamber 21 and houses the cooling cylinders 30 therein. Each of the cooling wind supply chamber 21 and the cooling cylinder housing chamber 22 is substantially rectangular parallelepiped in shape, and the internal space of the cooling wind supply chamber 21 functions as a supply space 23 to which the cooling wind is supplied from the duct 5. In the supply space 23, the partitioning cylinders 40 are provided.

(Cooling Cylinders)

[0026] Each of the cooling cylinders 30 is substantially cylindrical in shape, and the cooling cylinders 30 are disposed to oppose the respective spinnerets 13. The cooling cylinders 30 are provided to penetrate the cooling cylinder housing chamber 22 in an up-down direction, and a first yarn running space 31 which extends in the up-down direction is formed in each of the cooling cylinders 30. The yarns Y spun out from the spinneret 13 run downward in the first yarn running space 31.

[0027] A peripheral wall of the first yarn running space 31, i.e., a cylinder body of each cooling cylinder 30 is formed of a first flow control member 32 and a second flow control member 33 which is provided inside the first flow control member 32. The first flow control member 32 is formed of, for example, perforated metal, and adjusts the flow of the cooling wind so that the cooling wind flows substantially horizontally from a later-described circulation space 52 into the first yarn running space 31. The second flow control member 33 is formed of, for example, a multi-layer metal wire mesh and uniformizes the flow of the cooling wind flowing from the later-described circulation space 52 into the first yarn running space 31. When the first flow control member 32 is formed of perforated metal, the flow of the cooling wind from the perforated metal is suitably adjusted to be vertical to the punching surface, as the thickness ratio (=plate thickness/hole diameter) is arranged to be about 0.75 to 0.85.

(Partitioning Cylinders)

[0028] Each of the partitioning cylinders 40 is substantially cylindrical in shape and the partitioning cylinders 40 are connected with the lower end portions of the cooling cylinders 30, respectively. Each partitioning cylinder 40 is provided to penetrate the cooling wind supply chamber 21 in the up-down direction, and a second yarn running space 41 which extends in the up-down direction is provided in each partitioning cylinder 40. The second yarn running space 41 communicates with the first yarn running space 31, and the yarns Y which have run in the first yarn running space 31 immediately run downward in the second yarn running space 41.

[0029] A peripheral wall of the second yarn running space 41, i.e., a cylinder body of the partitioning cylinder 40 includes a shielding member 42. The shielding member 42 is made of a material which does not let the cooling wind to pass through, and prevents the cooling wind from flowing from the supply space 23 into the second yarn running space 41.

(Partitions)

[0030] For each of the cooling cylinders 30, a partition 51 is provided to surround the cooling cylinder 30. The partition 51 is made of a material which does not let the cooling wind to pass through, and hence an annular circulation space 52 is formed between the outer circumference of the cooling cylinder 30 and the partition 51. The cooling wind supplied from the duct 5 to the supply space 23 is adjusted by a later-described flow adjustment plate 53 and flows into each circulation space 52. The cooling wind adjusted by the flow adjustment plate 53 flows mainly upward in the circulation space 52 and is at the same time supplied to the first yarn running space 31 via the first flow control member 32 and the second flow control member 33.

(Flow Adjustment Plate)

[0031] At a border part between the supply space 23 in the cooling wind supply chamber 21 and each circulation space 52, the flow adjustment plate 53 is provided. The flow adjustment plate 53 is formed of, for example, perforated metal or honeycomb material, and adjusts the flow of the cooling wind so that the cooling wind flows mainly upward from the supply space 23 into the circulation space 52. A border part between the cooling wind supply chamber 21 and the cooling cylinder housing chamber 22, i.e., a part of the bottom surface of the cooling cylinder housing chamber 22 (or the upper surface of the cooling wind supply chamber 21) in which part no flow adjustment plate 53 is provided is made of a material which does not let the cooling wind to pass through. When the flow adjustment plate 53 is formed of perforated metal, the flow of the cooling wind from the perforated metal is suitably adjusted to be vertical to the punching surface, as the thickness ratio (=plate thickness/hole diameter) is arranged to be about 0.75 to 0.85.

(Planar Configuration of Cooling Cylinders and Partitions)

[0032] FIG. 2 is a cross section taken at the II-II line in FIG. 1. As shown in FIG. 2, the cooling cylinders 30 are disposed in a staggered manner along the left-right direction to form two rows. To be more specific, assuming that the distance between the center C of one cooling cylinder 30 and the center C of a neighboring cooling cylinder 30 is D, the cooling cylinders 30 are disposed in a staggered manner so that all of the distances D are equal. To put it differently, the cooling cylinders 30 are disposed in a staggered manner so that the center C of one cooling cylinder 30, the center C of a neighboring cooling cylinder 30, and the center C of a cooling cylinder 30 neighboring to these two cooling cylinders 30 form an equilateral triangle. In this way, the cooling cylinders 30 are densely disposed as the cooling cylinders 30 (and the spinnerets 13) are disposed in a staggered manner, and hence the efficiency in the production of the yarns Y is improved.

[0033] In the present embodiment, each partition 51 is arranged to form a regular hexagon in plan view, i.e., the partitions 51 are disposed to form a honeycomb shape. The cooling cylinders 30 are provided at the centers of the respective regular hexagons formed by the partitions 51. The circulation spaces 52 formed between the outer circumferential surfaces of the cooling cylinders 30 and the partitions 51 are identical with one another in shape. Furthermore, because the partition 51 is arranged to form a regular hexagon, each circulation space 52 is plane-symmetric to the six planes including the center axis of the cooling cylinder 30. In the circumferential direction, each of these six planes P form an angle of 30 degrees with a neighboring plane P. On this account, each of the circulation spaces 52 of the present embodiment is plane-symmetric not only to at least one plane P including the center axis of the cooling cylinder 30 but also to two planes P which include the center axis of the cooling cylinder 30 and are orthogonal to each other.

(Flow of Cooling Wind)

[0034] FIG. 3 is a cross section taken at the III-III line in FIG. 2, FIG. 4 is a cross section taken at the IV-IV line in FIG. 3, and FIG. 5 is a cross section taken at the V-V line in FIG. 3. The arrows in FIG. 3 to FIG. 5 indicate the flow of the cooling wind. While each of the supply spaces 23 and the circulation spaces 52 is actually a single space, the space is divided in FIG. 3. For the sake of convenience, parts of a divided space in FIG. 3 have respective reference numbers, even if the space is actually a single space.

[0035] To begin with, the cooling wind supplied from the duct 5 flows into the supply space 23 of the cooling wind supply chamber 21. At this stage, the cooling wind is supplied to the supply space 23 in the direction (front-back direction) orthogonal to an arrangement direction (left-right direction) in which the cooling cylinders 30 are lined up. When, as in the present embodiment, the cooling cylinders 30 are disposed in two dimensions, a direction in which the number of the cooling cylinders 30 is largest is considered as the arrangement direction.

[0036] As shown in FIG. 4, as the partitioning cylinders 40 are provided in the supply space 23, the cooling wind meanders through these partitioning cylinders 40. The flow of the cooling wind around each partitioning cylinder 40 is different between the partitioning cylinders 40. This, however, is not particularly problematic because the cooling wind does not flow from the supply space 23 into the second yarn running space 41 inside the partitioning cylinder 40.

[0037] As shown in FIG. 3, the cooling wind flowing in the supply space 23 then flows into each circulation space 52. Between the supply space 23 and each circulation space 52, the flow adjustment plate 53 is provided. On this account, the flow of the cooling wind flowing from the supply space 23 into each circulation space 52 is adjusted by the flow adjustment plate 53, and hence variations in the flow rate and the wind direction are restrained. Furthermore, because the circulation spaces 52 are all identical in shape, variations in the flow rates of the cooling wind flowing into the respective circulation spaces 52 are further restrained.

[0038] As shown in FIG. 3 and FIG. 5, the cooling wind adjusted by the flow adjustment plate 53 flows mainly upward in the circulation space 52 and at the same time flows into the first yarn running space 31 from the entire circumference of the cooling cylinder 30. In this regard, because the cooling wind passes the first flow control member 32 and the second flow control member 33, the cooling wind supplied to the first yarn running space 31 is less varied in the flow rate and the wind direction in the circumferential direction. By the cooling wind supplied to the first yarn running space 31, the yarns Y running in the first yarn running space 31 are cooled.

[Effects]

[0039] In the yarn cooler 3 of the present embodiment, because the flow adjustment plate 53 is provided at the border part between the supply space 23 and the circulation space 52, the variations in the flow rates of the cooling wind supplied from the supply space 23 to the respective circulation spaces 52 are restrained, and the variations in the flow rates of the cooling wind supplied from the circulation spaces 52 to the first yarn running spaces 31 are also restrained. Furthermore, because the circulation space 52 is surrounded by the partition 51, the cooling wind does not flow into the circulation space 52 from around the circulation space 52, and hence the generation of a swirl of the cooling wind is restrained in the circulation space 52. As a result, the flow rate of the cooling wind flowing in the circulation space 52 is more or less uniformized in the circumferential direction, and the flow rate of the cooling wind supplied from the circulation space 52 to the first yarn running space 31 is more or less uniformized in the circumferential direction. On this account, because the variations in the flow rate of the cooling wind supplied to the first yarn running space 31 is restrained and irregular cooling is restrained not only between the cooling cylinders 30 but also in the circumferential direction in one cooling cylinder 30, the qualities of the yarns Y are uniformized.

[0040] In addition to the above, in the present embodiment, the circulation space 52 is plane-symmetric to at least one plane P which includes the center axis of the cooling cylinder 30. When the circulation space 52 is plane-symmetric to at least one plane P which includes the center axis of the cooling cylinder 30 in this manner, the flow of the cooling wind in the circulation space 52 is more or less plane-symmetric, too, and the flow rate of the cooling wind flowing in the circulation space 52 is further uniformized in the circumferential direction. On this account, in the circumferential direction of one cooling cylinder 30, the variations in the flow rate of the cooling wind supplied to the first yarn running space 31 are further restrained.

[0041] In addition to the above, in the present embodiment, the circulation space 52 is plane-symmetric to two planes P which include the center axis of the cooling cylinder 30 and are orthogonal to each other. When the circulation space 52 is plane-symmetric to two planes P which include the center axis of the cooling cylinder 30 and are orthogonal to each other in this way, the flow of the cooling wind in the circulation space 52 is more or less plane-symmetric to the two orthogonal planes P, and hence the flow rate of the cooling wind flowing in the circulation space 52 is further uniformized in the circumferential direction. Therefore, in the circumferential direction of one cooling cylinder 30, variations in the flow rate of the cooling wind supplied to the first yarn running space 31 are further effectively restrained.

[0042] Furthermore, in the present embodiment, by arranging the partition 51 to form a regular hexagon in plan view, the enlargement of the circulation space 52 and the uniformization of the flow of the cooling wind in the circumferential direction in the circulation space 52 are both achieved with proper balance. This point will be described below with reference to FIG. 6. FIG. 6 is a schematic view for comparison between shapes of partitions. In the figure, the section a shows a case where partitions 61 which are rectangular in plan view are provided, whereas the section b shows partitions 71 which are circular in plan view are provided.

[0043] Coolers are typically required to have a larger circulation space 52 and a higher flow rate of cooling wind in order to improve the efficiency in the cooling of the yarns Y. To enlarge the circulation space 52, as shown in the section a in FIG. 6, for example, partitions 61 (indicated by thick lines) which are rectangular in plan viewed are typically employed. With this, the circulation space 62 is enlarged by the hatched areas in the figure, as compared to the circulation space 52 of the present embodiment. In this case, however, the shape of the circulation space 62 is irregular in the circumferential direction, and the cooling wind tends to swirl in the circulation space 62.

[0044] In the meanwhile, to uniformize the shape of the circulation space 52 in the circumferential direction, as shown in the section b in FIG. 6, for example, partitions 71 (indicated by thick lines) which are circular in plan view are typically employed. In this case, however, the circulation space 72 is narrowed by the hatched areas in the figure, as compared to the circulation space 52 of the present embodiment. In particular, when the cooling cylinders 30 are staggered as in the present embodiment, the hatched gaps are formed between the partitions 71. Such gaps are redundant spaces.

[0045] When the partition 51 is arranged to form a regular hexagon in plan view as in the present embodiment, the enlargement of the circulation space 52 and the uniformization of the flow of the cooling wind in the circumferential direction in the circulation space 52 are both achieved with proper balance. In particular, when the cooling cylinders 30 are staggered, redundant gaps are not formed around the partitions 51, and the circulation space 52 is maximized.

[0046] In addition to the above, in the present embodiment, the side walls (the side walls of the cooling cylinder housing chamber 22) surrounding the cooling cylinder 30 are provided in the quench box 20. This prevents the cooling cylinder 30 from being exposed to the outside and protects the cooling cylinder 30. Furthermore, with the side walls, the strength of the quench box 20 is improved.

[0047] In addition to the above, in the present embodiment, the cooling cylinders 30 are lined up in the arrangement direction (left-right direction), and the cooling wind is supplied from the supply space 23 in the direction orthogonal to the arrangement direction. Because the cooling wind supplied in the direction orthogonal to the arrangement direction is likely to uniformly flow around the cooling cylinders 30 lined up in the arrangement direction, the variations between the flow rates of the cooling wind supplied to the first yarn running spaces 31 of the cooling cylinders 30 are further restrained.

[Other Embodiments]

[0048] The present invention is not limited to the embodiment above and elements of the embodiments above can be suitably combined or changed within the scope of the present invention.

[0049] For example, while in the embodiment above the cooling cylinders 30 are provided in a staggered manner along the left-right direction to form two rows, the cooling cylinders 30 may be disposed in a different manner. For example, the cooling cylinders 30 may be lined up in the left-right direction to form a single row, or the cooling cylinders 30 may be arranged to form plural rows but not in a staggered manner.

[0050] In the embodiment above, arranging the partition 51 to form a regular hexagon in plan view is the most preferable. This, however, does not exclude cases where the partition 51 form a shape which is not a regular hexagon. For example, even when the partitions 61 and 71 which form rectangular and circular shapes as shown in FIG. 6 are employed, the qualities of the yarns Y are uniformized as compared to the known technologies, because one circulation space 52 is provided for one cooling cylinder 30. In this regard, when, for example, the partition 51 is arranged to form a regular polygon which is not a regular triangle or a circle in plan view and the cooling cylinder 30 is provided at the center of the formed shape, the circulation space 52 is plane-symmetric to two planes which include the center axis of the cooling cylinder 30 and are orthogonal to each other.

[0051] In the embodiment above, the cooling cylinder housing chamber 22 is provided in the quench box 20 and the cooling cylinders 30 are surrounded by the side walls of the cooling cylinder housing chamber 22. This arrangement, however, is not prerequisite. The side walls may not be provided and the outer circumferential parts of the partitions 51 may be exposed to the outside.

[0052] While in the embodiment above the cylinder body of each cooling cylinder 30 is formed of the first flow control member 32 and the second flow control member 33, the second flow control member 33 may be omitted. In such a case, the cooling wind is uniformly and suitably supplied to the yarns Y even if the second flow control member 33 is not provided, when the distance between the outermost peripheral part of the yarns Y running in the first yarn running space 31 and the first flow control member 32 is arranged to be 12 to 15 times as long as the hole diameter of the perforated metal constituting the first flow control member 32.

Claims

1. A yarn cooler for cooling yarns spun out from a spinning beam which is configured to spin out, as the yarns, a molten material downward through spinnerets, comprising:

   cooling cylinders which are provided below the spinning beam to oppose the respective spinnerets and each of which includes a first yarn running space in which the yarns run, a peripheral wall of the first yarn running space including a flow control member which is arranged to adjust the flow of cooling wind flowing into the first yarn running space;
   partitioning cylinders which are connected with lower end portions of the respective cooling cylinders and each of which includes a second yarn running space communicating with the first yarn running space, a peripheral wall of the second yarn running space including a shielding member which is arranged to block the cooling wind from flowing into the second yarn running space;
   a quench box which includes a supply space to which the cooling wind is supplied from outside, the partitioning cylinders being provided in the supply space,
   wherein,
   the cooling cylinders are provided outside the supply space and a partition is provided for each of the cooling cylinders to surround the cooling cylinder and form a circulation space between the partition and the outer circumferential surface of the cooling cylinder to allow the cooling wind to circulate in the circulation space, and
   at a border part between the supply space and the circulation space, a flow adjustment plate is provided to circulate the cooling wind from the supply space to the circulation space while adjusting the flow of the cooling wind.

2. The yarn cooler according to claim 1, wherein,
   the circulation space is plane-symmetric to at least one plane including the center axis of the cooling cylinder.

3. The yarn cooler according to claim 2, wherein,
   the circulation space is plane-symmetric to two planes which include the center axis of the cooling cylinder and are orthogonal to each other.

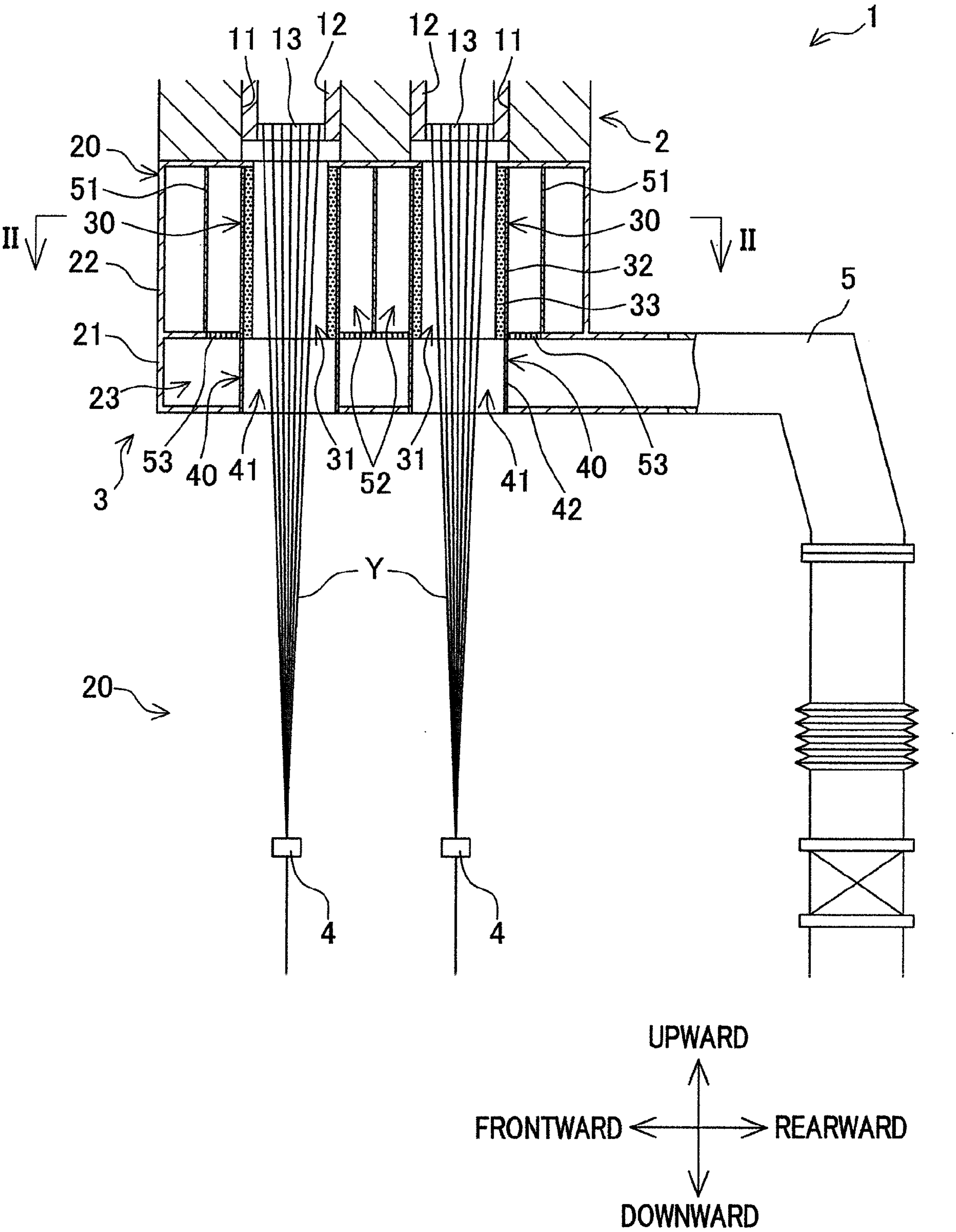
4. The yarn cooler according to claim 3, wherein,
   the partition is a regular hexagon in shape in plan view.

5. The yarn cooler according to any one of claims 1 to 4, wherein,
   the cooling cylinders are disposed in a staggered manner in plan view.

6. The yarn cooler according to any one of claims 1 to 5, wherein,
   the quench box includes a side wall which surrounds the cooling cylinders.

7. The yarn cooler according to any one of claims 1 to 6, wherein,
   the cooling cylinders are lined up in an arrangement direction, and the cooling wind is supplied to the supply space in a direction orthogonal to the arrangement direction.

FIG.1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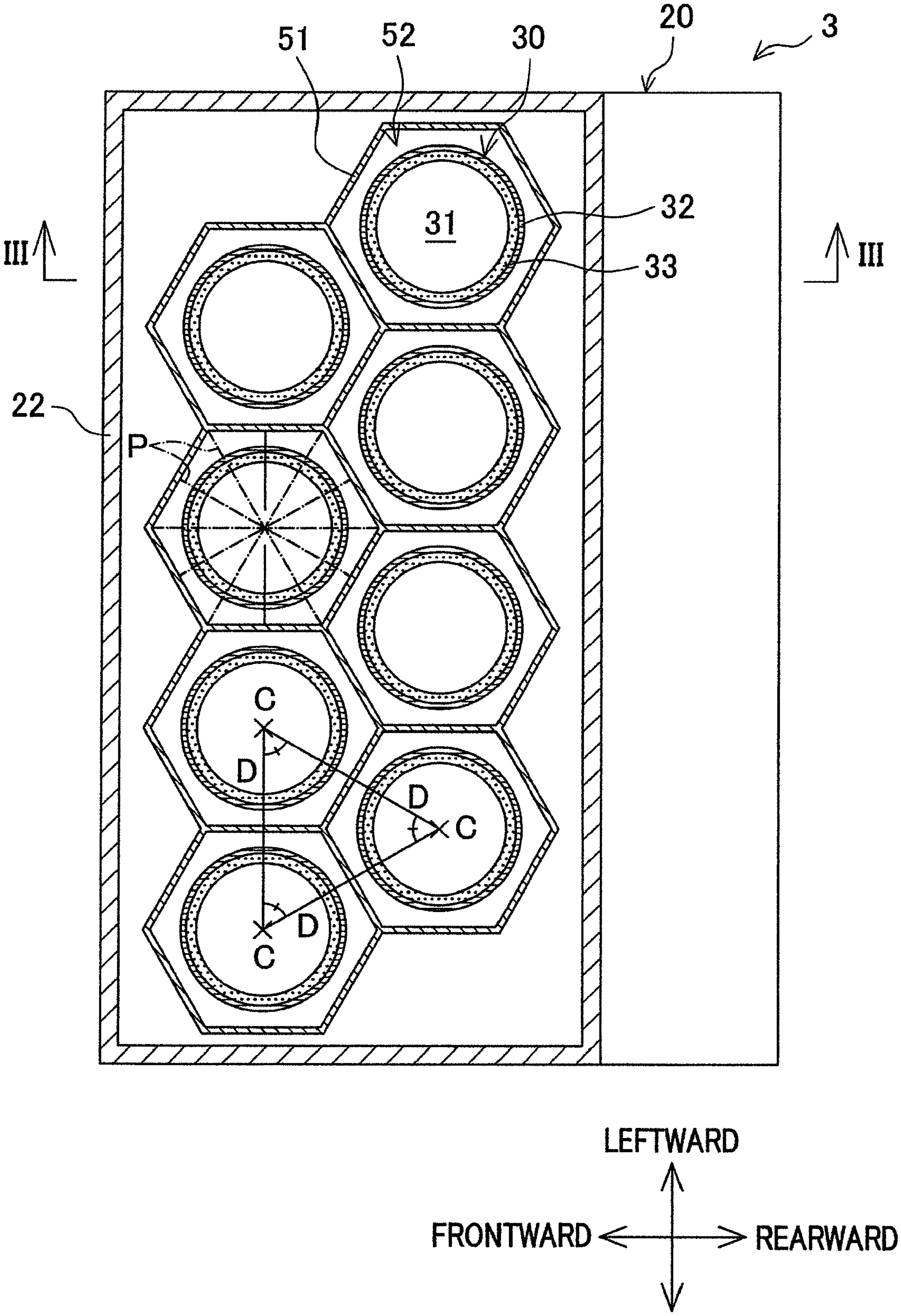
DOWNWARD

FIG.2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LEFTWARD
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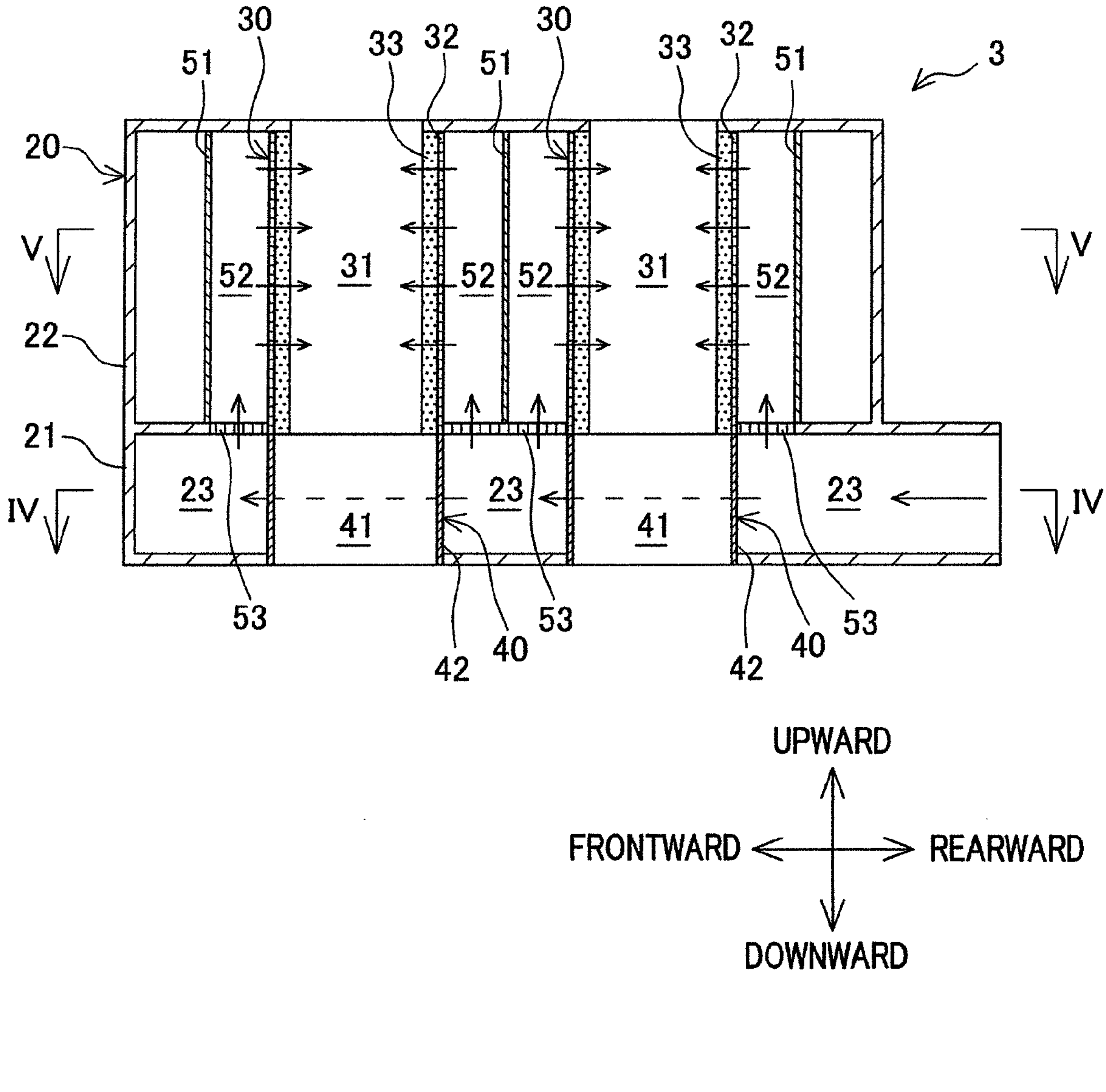
REARWARD
RIGHTWARD

FIG.3



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UPWARD
FRONTWARD
REARWARD
DOWNWARD

FIG.4

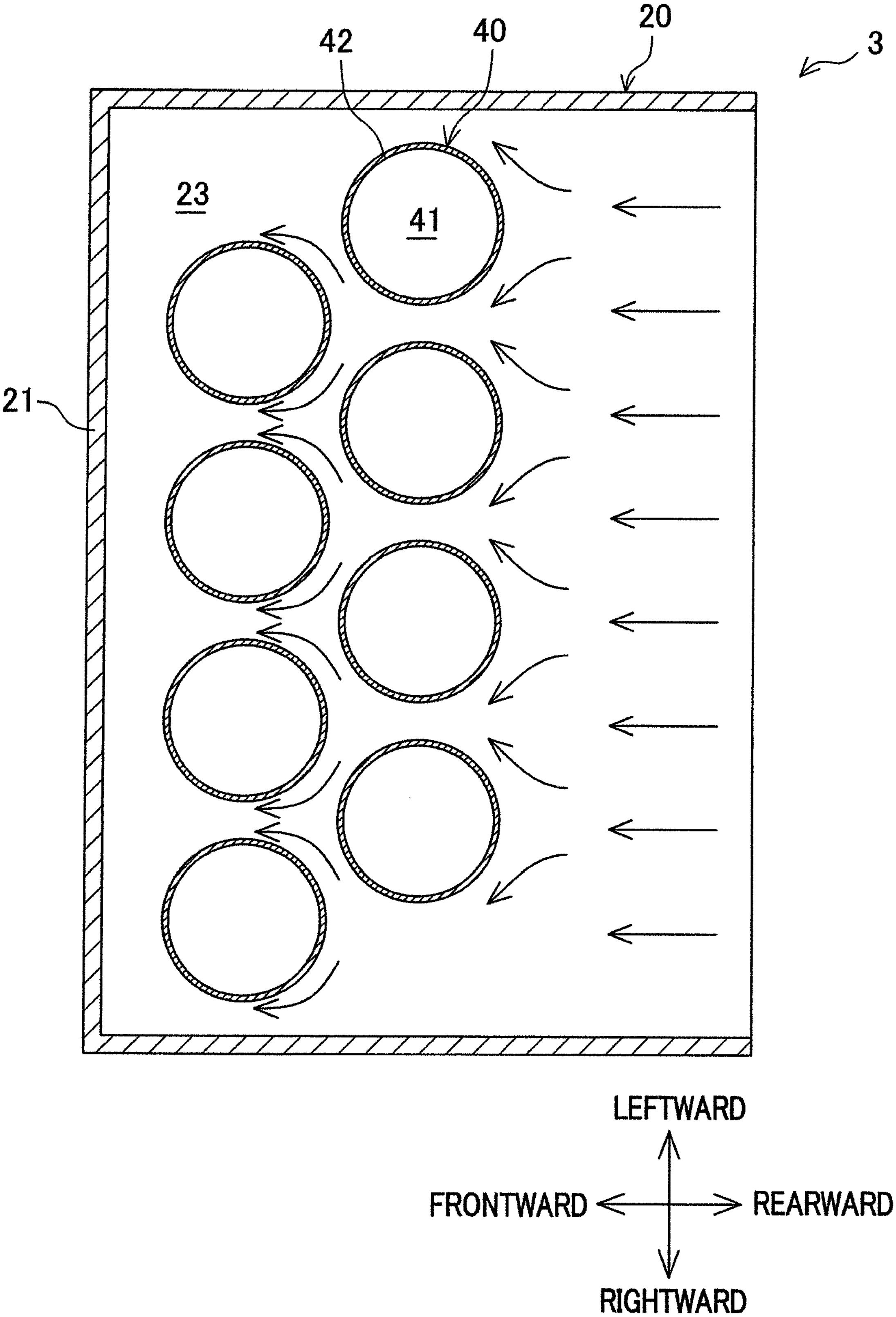
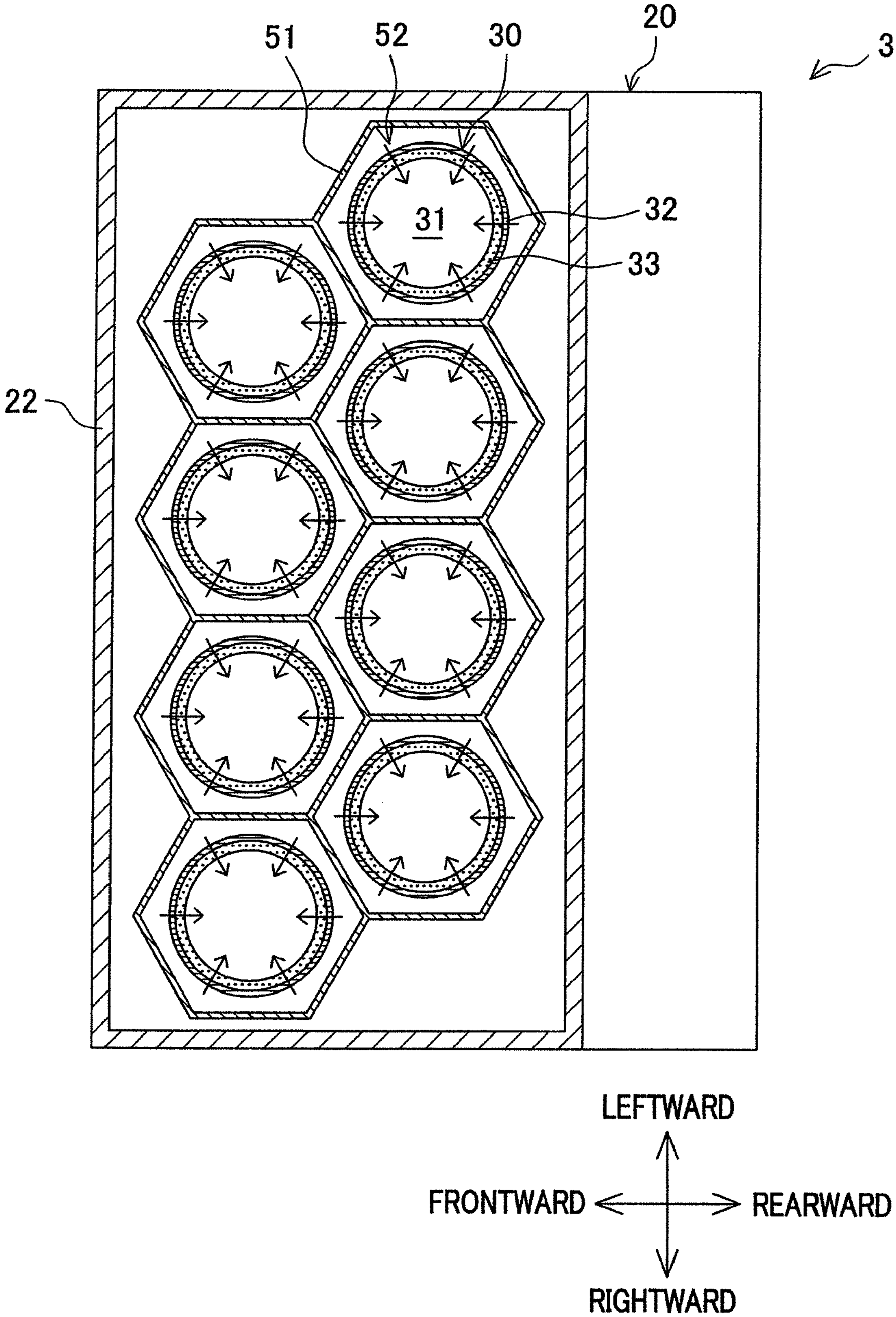


FIG.5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LEFTWARD
FRONTWARD
REARWARD
RIGHTWARD

FIG.6A

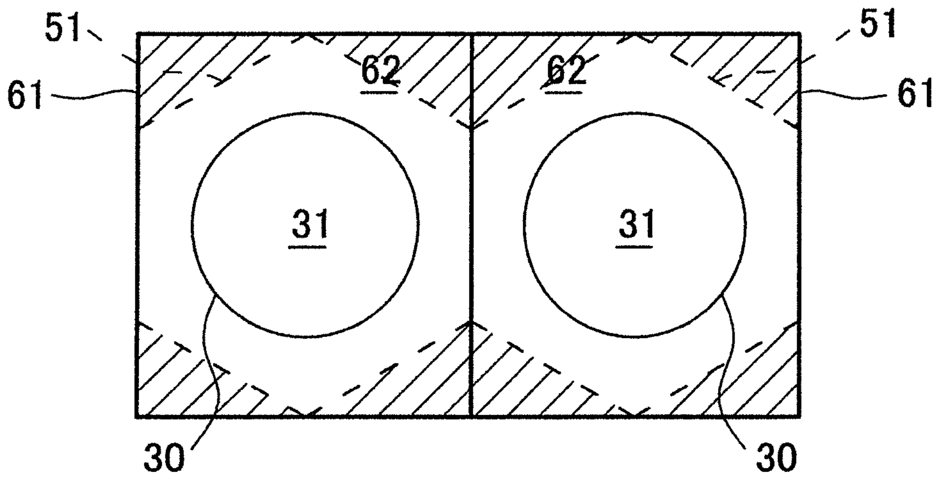
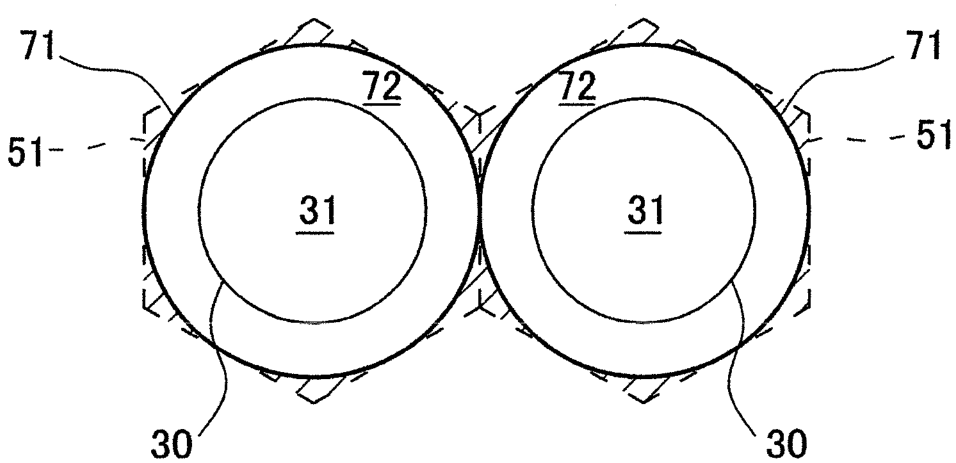


FIG.6B



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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 0143

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	DE 10 2012 023002 A1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 28 May 2014 (2014-05-28) * paragraphs [0022], [0023], [0024], [0028] * -----	1-7	INV. D01D5/088
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TECHNICAL FIELDS SEARCHED (IPC)
D01D
D04H

The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
The Hague	3 February 2016	Van Beurden-Hopkins

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 19 0143

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03-02-2016

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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