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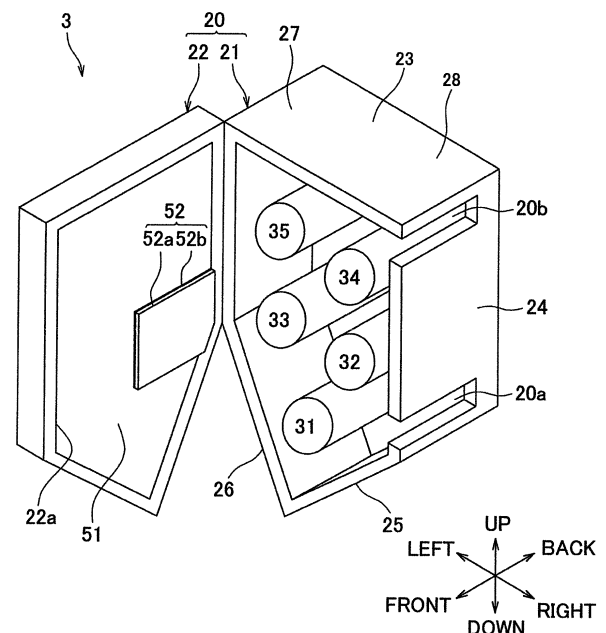
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(54) **SPUN YARN DRAWING APPARATUS**

(57) Power consumption of a preheating roller for heating yarns before drawn is reduced, and adherence of contaminants on the surface of the preheating roller is prevented. A spun yarn drawing apparatus 3 for drawing yarns spun out from a spinning apparatus includes preheating rollers 31 to 33 for heating the yarns before drawn, conditioning rollers 34 and 35 which are provided on the downstream in the yarn running direction of the preheating rollers 31 to 33 and are higher in temperature and rotation speed than the preheating rollers 31 to 33, the yarns being drawn between the conditioning rollers 34 and 35 and the preheating rollers 31 to 33, and a thermal insulation box 20 including an internal space S in which the preheating rollers 31 to 33 and the conditioning rollers 34 and 35 are housed. A heat conduction acceleration portion 51 which is higher in heat conductivity than a material of a thermal insulation box 20 is provided from a region in the vicinity of the conditioning rollers 34 and 35 to a region in the vicinity of the preheating rollers 31 to 33 on the inner surface of the thermal insulation box 20.

FIG.2



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a spun yarn drawing apparatus configured to draw yarns spun out from a spinning apparatus.

[0002] As a spun yarn drawing apparatus configured to draw yarns spun out from a spinning apparatus, Patent Literature 1 (Japanese Unexamined Patent Publication No. 2014-101611) recites a spun yarn drawing apparatus in which plural heating rollers and conditioning rollers are housed in a heat retaining box, for example. In this apparatus, after the yarns are heated to a drawing temperature by the heating rollers, the yarns are drawn between the heating rollers and the conditioning rollers, and the drawn yarns are conditioned by the conditioning rollers. In this connection, by providing a duct for guiding hot air around the conditioning rollers to around the heating rollers, the power consumption of the heating rollers is considered to be restrained.

SUMMARY OF THE INVENTION

[0003] However, the above-described method of moving heat from a high-temperature region to a low-temperature region by moving hot air involves the problem below. The hot air around the conditioning rollers may include contaminants such as oil mist which is generated due to evaporation of oil included in the yarns. When such hot air including the contaminants is supplied to the low-temperature region around the preheating rollers, the contaminants are cooled and adhered to the surfaces of the preheating rollers. As a result, the contaminants fixedly adhered to the surfaces of the rollers may cause disadvantages such as cutting of the yarns.

[0004] In consideration of the problem above, an object of the present invention is to reduce the power consumption of a preheating roller heating yarns before drawn and prevent contaminants from being adhered to the surface of the preheating roller, in a spun yarn drawing apparatus configured to draw yarns spun out from a spinning apparatus.

[0005] The present invention relates to a spun yarn drawing apparatus configured to draw yarns spun out from a spinning apparatus, including: at least one preheating roller configured to heat the yarns before drawn; a conditioning roller which is provided on the downstream in a yarn running direction of the at least one preheating roller and is higher in temperature and rotation speed than the at least one preheating roller, the yarns being drawn between the at least one preheating roller and the conditioning roller; and a thermal insulation box including an internal space in which the at least one preheating roller and the conditioning roller are housed, from a region in the vicinity of the conditioning roller to a region in the vicinity of the at least one preheating roller, a heat conduction acceleration portion which is higher in heat con-

ductivity than a material of the thermal insulation box is formed at an inner surface of the thermal insulation box.

[0006] As in the present invention, by providing, from a region in the vicinity of the conditioning roller to a region in the vicinity of the preheating roller at an inner surface of the thermal insulation box, a heat conduction acceleration portion which is higher in heat conductivity than a material of the thermal insulation box, heat generated from the hot conditioning roller is transferred to the cold preheating roller by heat conduction via the heat conduction acceleration portion. With this, power consumption required for heating the preheating roller is reduced. Furthermore, because the heat conduction is utilized in this way, only heat is transferred to the preheating roller without moving the hot air, and hence movement of contaminants to around the preheating roller together with the air is prevented. On this account, according to the present invention, the power consumption of the preheating roller is reduced and adherence of contaminants on the surface of the preheating roller is prevented. It is noted that the region in the vicinity of the conditioning roller indicates a region which is closer to the conditioning roller than to the preheating roller, whereas the region in the vicinity of the preheating roller indicates a region which is closer to the preheating roller than to the conditioning roller.

[0007] Preferably, the thermal insulation box includes an openable door which opposes end faces of the at least one preheating roller and the conditioning roller, and a heat conduction acceleration portion is provided at the door.

[0008] Such a door is typically larger in area than other parts. On this account, the heat conduction acceleration portion is sufficiently large when the heat conduction acceleration portion is provided at the door. Therefore the amount of heat transferred from the conditioning roller to the preheating roller tends to be large.

[0009] Preferably, a concave portion is formed in the door to be open toward the internal space when the door is closed, and the heat conduction acceleration portion is formed by filling the concave portion with a material which is higher in heat conductivity than a material of the door.

[0010] This arrangement increases the volume of the heat conduction acceleration portion, and hence the amount of heat transferred from the conditioning roller to the preheating roller is further increased.

[0011] Preferably, the heat conduction acceleration portion protrudes from the concave portion.

[0012] When the heat conduction acceleration portion protrudes from the concave portion, the distance between the heat conduction acceleration portion and the preheating roller and the distance between the heat conduction acceleration portion and the conditioning roller are reduced. This facilitates the transfer of heat from the conditioning roller to the heat conduction acceleration portion and the transfer of heat from the heat conduction acceleration portion to the preheating roller.

[0013] Preferably, the thermal insulation box includes

a side wall which extends along axes of the at least one preheating roller and the conditioning roller, and the heat conduction acceleration portion is provided at the side wall.

[0014] As the heat conduction acceleration portion is provided in this way, heat radiated from the side wall of the thermal insulation box to the circumferential surface of the preheating roller is increased, with the result that the temperature of the surface of the preheating roller is effectively increased.

[0015] Preferably, a heat insulation part which is lower in heat conductivity than the heat conduction acceleration portion is provided at a part of a surface of the heat conduction acceleration portion.

[0016] When there is a region where heat radiation from the heat conduction acceleration portion is not desired, the heat radiation from that region is reduced by providing the heat insulation part as above.

[0017] Preferably, the heat insulation part is a laminated body formed of a metal plate and a heat insulating material, and the metal plate faces the internal space whereas the heat insulating material faces the heat conduction acceleration portion.

[0018] With this arrangement, when, for example, a yarn is cut, the cut yarn makes contact with the metal plate side of the heat insulation part. On this account, the heat insulating material is not damaged by the cut yarn and hence the deterioration in the heat insulation by the heat insulation part is prevented.

[0019] Preferably, the at least one preheating roller include plural preheating rollers, and the heat insulation part is provided at a region of a surface of the heat conduction acceleration portion, which region is in the vicinity of a last preheating roller which is most downstream one in the yarn running direction of the preheating rollers.

[0020] When plural preheating rollers are provided, the last preheating roller on the most downstream in the yarn running direction is close to the conditioning roller. The last preheating roller is therefore susceptible to an influence of the hot conditioning roller and tends to excessively increase in temperature. In this regard, by providing the heat insulation part at a region in the vicinity of the last preheating roller in the surface of the heat conduction acceleration portion, heat transfer from the heat conduction acceleration portion to the last preheating roller is restrained, and hence temperature increase in the last preheating roller is restrained. It is noted that the region in the vicinity of the last preheating roller indicates a region which is closer to the last preheating roller than to other rollers.

[0021] In the present invention, by providing, from a region in the vicinity of the conditioning roller to a region in the vicinity of the preheating roller at an inner surface of the thermal insulation box, a heat conduction acceleration portion which is higher in heat conductivity than a material of the thermal insulation box, power consumption of the preheating roller is reduced and adherence of contaminants on the surface of the preheating roller is

prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 schematically shows a spun yarn take-up machine including a spun yarn drawing apparatus of an embodiment.

FIG. 2 is a perspective view of a state in which a door of a thermal insulation box is open.

FIG. 3 is a cross section of a state in which the door of the thermal insulation box is closed.

FIG. 4 is a cross section showing details of the internal structure of the spun yarn drawing apparatus.

FIG. 5 is a perspective view of a heat insulation member.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] The following will describe a spun yarn drawing apparatus of an embodiment of the present invention. FIG. 1 schematically shows a spun yarn take-up machine including a spun yarn drawing apparatus of the present embodiment. As shown in FIG. 1, the spun yarn take-up machine 1 is configured to draw, by the spun yarn drawing apparatus 3, yarns Y spun out from a spinning apparatus 2 and then wind the yarns Y by a take-up winder 4. Hereinafter, the descriptions are based on directions shown in the figures.

[0024] The spinning apparatus 2 generates the yarns Y by serially spinning out a molten fibrous material such as polyester. The yarns Y spun out from the spinning apparatus 2 receive oil at an oil guide 10, and are then sent to the spun yarn drawing apparatus 3 via a guide roller 11. The spun yarn drawing apparatus 3 is an apparatus for drawing the yarns Y and is provided below the spinning apparatus 2. In the spun yarn drawing apparatus 3, plural godet rollers 31 to 35 are provided in a thermal insulation box 20. The spun yarn drawing apparatus 3 will be detailed later.

[0025] The yarns Y drawn by the spun yarn drawing apparatus 3 are sent to the take-up winder 4 via a guide roller 12. The take-up winder 4 is an apparatus for winding the yarns Y and is provided below the spun yarn drawing apparatus 3. The take-up winder 4 includes members such as a bobbin holder 13 and a contact roller 14. The bobbin holder 13 is cylindrical in shape and extends away from the viewer of FIG. 1, and is rotationally driven by an unillustrated motor. To the bobbin holder 13, plural bobbins B are attached to be lined up along its axis. By rotating the bobbin holder 13, the take-up winder 4 simultaneously winds the yarns Y onto the bobbins B so as to produce plural packages P. The contact roller 14 makes contact with the surface of each package P and applies predetermined contact pressure to the surface, in order to adjust the shape of each package P.

[0026] Now, the spun yarn drawing apparatus 3 will be

detailed. The spun yarn drawing apparatus 3 includes the plural (five in this embodiment) godet rollers 31 to 35 housed in an internal space S of the thermal insulation box 20. Each of the godet rollers 31 to 35 is rotationally driven by an unillustrated motor and is a heating roller including an unillustrated heater. At a lower part of a right side wall of the thermal insulation box 20, an inlet 20a is formed to introduce the yarns Y into the thermal insulation box 20. At an upper part of the right side wall of the thermal insulation box 20, an outlet 20b is formed to allow the yarns Y to go out from the thermal insulation box 20. The yarns Y introduced through the inlet 20a are wound onto the lowest godet roller 31 and then onto the other godet rollers one by one, and eventually go out through the outlet 20b.

[0027] The godet rollers 31 to 35 are positioned so that the yarns Y are partially wound onto each roller. The lower three godet rollers 31 to 33 are preheating rollers for preliminarily heating the yarns Y before drawn, and a roller surface temperature of each of these godet rollers 31 to 33 is arranged to be equal to or higher than the glass transition temperature of the yarns Y (e.g., about 80 degrees centigrade). In the meanwhile, the upper two godet rollers 34 and 35 are conditioning rollers for thermally setting the drawn yarns Y, and a roller surface temperature of each of these godet rollers 34 and 35 is arranged to be higher than the roller surface temperature of the lower three godet rollers 31 to 33 (e.g., about 130 to 140 degrees centigrade). The yarn feeding speeds of the upper two godet rollers 34 and 35 are higher than the yarn feeding speeds of the lower three godet rollers 31 to 33. Hereinafter, the godet rollers 31 to 33 may be called preheating rollers whereas the godet rollers 34 and 35 may be called conditioning rollers.

[0028] The yarns Y introduced into the thermal insulation box 20 via the inlet 20a are, to begin with, preliminarily heated to a temperature at which the yarns Y are drawable, while the yarns Y are fed by the preheating rollers 31 to 33. The yarns Y having been preliminarily heated are drawn on account of a difference in the yarn feeding speed between the preheating roller 33 and the conditioning roller 34. The yarns Y are heated to a higher temperature while being fed by the conditioning rollers 34 and 35, and the drawn state is thermally fixed. The yarns Y having been drawn in this way go out from the thermal insulation box 20 through the outlet 20b.

[0029] To achieve power saving in the spun yarn drawing apparatus 3, hot air around the conditioning rollers 34 and 35 may be supplied to around the preheating rollers 31 to 33 in order to reduce the power consumption of the preheating rollers 31 to 33. In this arrangement, however, contaminants such as oil mist included in the hot air around the conditioning rollers 34 and 35 may be sent to around the preheating rollers 31 to 33 together with the air, and may be fixedly attached to the surfaces of the preheating rollers 31 to 33.

[0030] On this account, in the spun yarn drawing apparatus 3 of the present embodiment, the reduction in

the power consumption of the preheating rollers 31 to 33 is achieved by providing the heat conduction acceleration portion at the inner surface of the thermal insulation box 20. FIG. 2 is a perspective view showing a state in which a door of the thermal insulation box is open, whereas FIG. 3 is a cross section showing a state in which the door of the thermal insulation box is closed. To be more specific, FIG. 3 is a cross section taken along the vertical surface including the rotation axes of the preheating rollers 33 and the conditioning rollers 35. In FIG. 2, later-described flow control members 41 to 45 and the heat insulation member 47 are not shown.

[0031] As shown in FIG. 2, the thermal insulation box 20 includes a housing 21 which houses the rollers 31 to 35 therein and a door 22 which is rotatable about an unillustrated hinge or the like with respect to the housing 21. The housing 21 is formed of a ceiling 23, right side wall 24, lower right side wall 25, a lower left side wall 26, a left side wall 27, and a back wall 28, and the rollers 31 to 35 protrude forward from the back wall 28.

[0032] In the door 22, a concave portion 22a is formed across the substantially entire surface of the door 22 to open toward the internal space S of the thermal insulation box 20 when the door 22 is closed. As the concave portion 22a is filled with a material which is higher in heat conductivity than a material of the thermal insulation box 20, a heat conduction acceleration portion 51 is formed. In the present embodiment, the thermal insulation box 20 (the housing 21 and the door 22) is made of stainless steel which excels in strength because it functions as a structural body, whereas the heat conduction acceleration portion 51 is made of aluminum alloy which is higher in heat conductivity than the stainless steel because heat conduction is prioritized. Furthermore, as shown in FIG. 3, the heat conduction acceleration portion 51 slightly protrudes from the concave portion 22a of the door 22 to shorten the distance between the heat conduction acceleration portion 51 and end faces of the rollers 31 to 35.

[0033] With this heat conduction acceleration portion 51, heat generated from the conditioning rollers 34 and 35 is actively moved to the preheating rollers 31 to 33 side by means of heat conduction via the heat conduction acceleration portion 51 (see the arrow T in FIG. 3). As a result, the power consumption of the preheating rollers 31 to 33 is reduced.

[0034] When plural preheating rollers 31 to 33 are provided as in the present embodiment, among the preheating rollers 31 to 33, the last preheating roller 33 which is most downstream in the yarn running direction and configured to heat the yarns Y immediately before drawn is close to the hot conditioning rollers 34 and 35. On this account, the roller surface temperature of the last preheating roller 33 is susceptible to an influence of the conditioning rollers 34 and 35, and the temperature of the last preheating roller 33 may become higher than a set temperature. Because the temperature of the last preheating roller 33 significantly influences on the temperature of the yarns Y when they are drawn, required quality

of the yarns Y cannot be maintained unless the temperature of the last preheating roller 33 is suitably controlled.

[0035] For the reason above, in the spun yarn drawing apparatus 3 of the present embodiment, a front heat insulation part 52 is provided at a region of the surface of the heat conduction acceleration portion 51 which region faces the end face of the last preheating roller 33. As shown in FIG. 2, the front heat insulation part 52 is formed by laminating a metal plate 52a which is a structural body and a heat insulation coating 52b applied to the surface of the metal plate 52a on the door 22 side. The front heat insulation part 52 is pasted onto the surface of the heat conduction acceleration portion 51. The heat conductivity of the front heat insulation part 52 is at least lower than the heat conductivity of the heat conduction acceleration portion 51, and is preferably lower than the heat conductivity of the door 22.

[0036] By this front heat insulation part 52, the heat generated from the conditioning rollers 34 and 35 is restrained from being radiated around the last preheating roller 33 during the process of heat transfer in the heat conduction acceleration portion 51 toward the preheating rollers 31 to 33. The front heat insulation part 52 is preferably formed on the entirety of the region of the heat conduction acceleration portion 51 which region opposes the end face of the last preheating roller 33, and is more preferably formed on the entirety of the region facing the installation space 46 (see FIG. 4) for the last preheating roller 33 described later.

[0037] In addition to the above, in the spun yarn drawing apparatus 3 of the present embodiment, in order to restrain the temperature increase in the last preheating roller 33, the heat insulation member 47 in which the side heat insulation part 48 and the back heat insulation part 49 are integrated and the heat insulation part 53 attached to the last preheating roller 33 side of the flow control member 44 are provided in addition to the front heat insulation part 52. FIG. 4 is a cross section showing the details of the internal structure of the spun yarn drawing apparatus 3, whereas FIG. 5 is a perspective view of the heat insulation member 47. In FIG. 5, the last preheating roller 33 is not shown.

[0038] Although not illustrated in FIGs. 1 and 2, in the thermal insulation box 20, flow control members 41 to 45 are provided more or less along the running direction of the yarns Y to control the airflow in the thermal insulation box 20. Among these flow control members 41 to 45, an installation space 46 in which the last preheating roller 33 is provided is mostly defined by the flow control member 42 between the preheating roller 31 and the last preheating roller 33, the leading end of the flow control member 43 between the preheating roller 32 and the conditioning roller 34, and the flow control member 44 between the last preheating roller 33 and the conditioning roller 35. The heat insulation member 47 is provided to face this installation space 46.

[0039] The heat insulation member 47 includes a polygonal back heat insulation part 49 in which an opening

for providing the last preheating roller 33 is formed at a central part and a side heat insulation part 48 which protrudes from a part of the periphery of the back heat insulation part 49. The side heat insulation part 48 is formed by folding a plate in accordance with the shape of the periphery of the back heat insulation part 49.

[0040] The side heat insulation part 48 of the heat insulation member 47 is shaped to be mostly along the lower left side wall 26 and the left side wall 27 of the thermal insulation box 20. The side heat insulation part 48 is slightly separated from the side walls 26 and 27, and an air layer 50 is formed between the side heat insulation part 48 and the side walls 26 and 27. With this air layer 50, the heat insulation effect by the side heat insulation part 48 is improved. However, when the air layer 50 is thick, heat transfer due to convection is significant, and the air layer 50 cannot function as a heat insulating layer. For this reason, the thickness of the air layer 50 is preferably, for example, about 30mm or less. In the meanwhile, the back heat insulation part 49 of the heat insulation member 47 is in contact with the back wall 28 of the thermal insulation box 20 and is fixed by an unillustrated bolt or the like, and hence no air layer is formed between the back heat insulation part 49 and the back wall 28.

[0041] The side heat insulation part 48 is formed by laminating a metal plate 48a as a structural body and a heat insulation coating 48b which is applied to the surface of the metal plate 48a on the side wall 26 and 27 side. Similarly, the back heat insulation part 49 is formed by laminating a metal plate 49a as a structural body and a heat insulation coating 49b which is applied to the surface of the metal plate 49a on the back wall 28 side. Because the side heat insulation part 48 and the back heat insulation part 49 are provided in this way, even if heat from the hot conditioning rollers 34 and 35 is transferred to around the installation space 46 for the last preheating roller 33 due to the heat conduction via the side walls 26 and 27 and the back wall 28 of the thermal insulation box 20, transfer of the heat from the side walls 26 and 27 or the back wall 28 to the installation space 46 is restrained.

[0042] In addition to the above, in the present embodiment, the heat insulation part 53 is provided between a high-temperature space 54 formed around the conditioning rollers 34 and 35 and the installation space 46 neighboring the high-temperature space 54. To be more specific, the heat insulation part 53 is provided on the last preheating roller 33 side of the flow control member 44, and hence an amount of heat directly transferred from the high-temperature space 54 to the installation space 46 is reduced. The heat insulation part 53 may not be independent from the flow control member 44. The flow control member 44 may function as a heat insulation part in such a way that the flow control member 44 is made of a material with low heat conductivity. Furthermore, being similar to the heat insulation parts 48 and 49, the heat insulation part 53 may be formed by laminating a metal plate as a structural body and a heat insulation coating

applied to the surface of the metal plate on the last preheating roller 33 side.

[0043] In addition to the above, in the present embodiment, among the flow control members 42 to 44 provided around the last preheating roller 33, plural openings 42a are formed in the flow control member 42 which is on the inlet 20a side of the last preheating roller 33. Air flowing into the thermal insulation box 20 through the inlet 20a flows, together with an accompanied flow generated by the running of the yarns Y, along a path F which is formed between the circumferential surface of the preheating roller 31 provided between the flow control member 42 and the inlet 20a and the inner surfaces of the lower right side wall 25 and the lower left side wall 26 of the thermal insulation box 20. As the openings 42a are formed on an extension line of this path F, relatively cold air flowing through the inlet 20a is supplied to the installation space 46 for the last preheating roller 33 via the openings 42a, with the result that excessive temperature increase in the last preheating roller 33 is prevented.

(Effects)

[0044] As described above, in the spun yarn drawing apparatus 3 of the present embodiment, at the inner surface of the thermal insulation box 20, the heat conduction acceleration portion 51 which is higher in heat conductivity than the material of the thermal insulation box 20 is provided from a region in the vicinity of the conditioning rollers 34 and 35 to a region in the vicinity of the preheating rollers 31 to 33. On this account, heat generated from the hot conditioning rollers 34 and 35 is transferred to the cold preheating rollers 31 to 33 on account of heat conduction via the heat conduction acceleration portion 51. In this way, the power consumption required to heat the preheating rollers 31 and 32 is reduced. Furthermore, because the heat conduction is utilized in this way, only heat is transferred to the preheating rollers 31 to 33 without moving the hot air, and hence movement of contaminants to around the preheating rollers 31 to 33 together with the air is prevented. On this account, according to the present invention, the power consumption of the preheating rollers 31 to 33 is reduced and adherence of contaminants on the surfaces of the preheating rollers 31 to 33 is prevented.

[0045] In addition to the above, in the present embodiment, the thermal insulation box 20 includes the openable door 22 facing the end faces of the preheating rollers 31 to 33 and the conditioning rollers 34 and 35, and the heat conduction acceleration portion 51 is provided on the door 22. Because the door 22 is typically larger in area than the side walls 24 to 27 of the thermal insulation box 20, the heat conduction acceleration portion 51 is sufficiently large when the heat conduction acceleration portion 51 is provided at the door 22. Therefore the amount of heat transferred from the conditioning rollers 34 and 35 to the preheating rollers 31 to 33 tends to be large.

[0046] In addition to the above, when plural preheating rollers 31 to 33 are provided as in the present embodiment, the last preheating roller 33 which is most downstream in the yarn running direction is close to the conditioning rollers 34 and 35 and hence susceptible to an influence of the hot conditioning rollers 34 and 35. On this account, the temperature of the last preheating roller 33 tends to be excessively increased. In this regard, as in the present embodiment, heat transfer from the heat conduction acceleration portion 51 to the last preheating roller 33 is restrained and temperature increase in the last preheating roller 33 is restrained, by providing the heat insulation part 52 at a region of the surface of the heat conduction acceleration portion 51 which region is in the vicinity of the last preheating roller 33.

[0047] In addition to the above, in the present embodiment, the heat insulation part 52 is formed by laminating the metal plate 52a and the heat insulating material 52b, and the metal plate 52a faces the internal space S whereas the heat insulating material 52b faces the heat conduction acceleration portion 51. On this account, when, for example, a yarn Y is cut, the cut yarn Y makes contact with the metal plate 52a side of the heat insulation part 52. Therefore the heat insulating material 52b is not damaged by the cut yarn Y and hence the deterioration in the heat insulation by the heat insulation part 52 is prevented.

[Other Embodiments]

[0048] Although the embodiment of the present invention has been described, the present invention is not limited to the above and can be suitably changed within the scope of the present invention as described in the examples below.

[0049] For example, the embodiment above has described the spun yarn drawing apparatus 3 including the three preheating rollers 31 to 33 and the two conditioning rollers 34 and 35. In this connection, the number of the rollers and the arrangement of the rollers may be optionally changed.

[0050] In addition to the above, while in the embodiment above the heat conduction acceleration portion 51 is provided on the substantially entire surface of the door 22, at which part and in which range the heat conduction acceleration portion 51 is provided may be optionally changed. For example, the heat conduction acceleration portion 51 may be provided on the side walls 24 to 27 extending along the axes of the preheating rollers 31 to 33 and the conditioning rollers 34 and 35. When the heat conduction acceleration portion 51 is provided in this way, heat radiated from the side walls 24 to 27 of the thermal insulation box 20 to the circumferential surfaces of the preheating rollers 31 to 33 is increased, with the result that the temperatures of the surfaces of the preheating rollers 31 to 33 are effectively increased. When it is necessary to restrain the temperature increase in the last preheating roller 33 as described above, providing the heat conduction acceleration portion 51 on the right

side wall 24 which is far from the last preheating roller 33 is effective.

[0051] In the embodiment above, the heat insulation part 52 is provided in the vicinity of the last preheating roller 33. In this regard, when there is another region where heat radiation from the heat conduction acceleration portion 51 should be restrained, the heat insulation part 52 may be provided at that region of the surface of the heat conduction acceleration portion 51.

[0052] In the embodiment above, the heat conduction acceleration portion 51 is made of aluminum alloy which is higher in heat conductivity than stainless steel. The heat conduction acceleration portion 51, however, may be differently arranged, and may be made of any other material on condition that the material is higher in heat conductivity than the material (which is not limited to stainless steel) of the thermal insulation box 20. For example, the heat conduction acceleration portion 51 may be made of, for example, copper alloy or a C/C composite material.

[0053] In addition to the above, in the embodiment above, the heat insulation parts 48, 49, and 52 are provided at the inner surfaces of the side walls 26 and 27, the back wall 28, and the door 22 of the thermal insulation box 20, respectively, and the heat insulation part 53 is provided on the flow control member 44. In this regard, at which member a heat insulation part is provided may be optionally determined.

[0054] In addition to the above, while in the embodiment above no air layer is particularly provided between each of the back heat insulation part 49 and the front heat insulation part 52 and the inner surface of the thermal insulation box 20, an air layer may be provided between each of the heat insulation parts 49 and 52 and the inner surface of the thermal insulation box 20 by, for example, providing a spacer.

[0055] In addition to the above, in the embodiment above, the heat insulation parts 48, 49, and 52 are formed by applying the heat insulation coatings 48b, 49b, and 52a which are heat insulating materials onto the metal plates 48a, 49a, and 52a. The heat insulation parts 48, 49, and 52, however, may be differently arranged. For example, members having lower heat conductivity than the metal plates 48a, 49a, and 52a may be pasted onto the metal plates 48a, 49a, and 52a.

[0056] In addition to the above, in the embodiment above, the openings 42a are formed in the flow control member 42 as the air introduction portions through which the air from the inlet 20a is supplied to the last preheating roller 33. The air introduction portions, however, may be differently arranged. For example, the flow control member 42 may not be provided on the extension line of the path F shown in FIG. 4.

Claims

1. A spun yarn drawing apparatus configured to draw

yarns spun out from a spinning apparatus, comprising:

at least one preheating roller configured to heat the yarns before drawn;

a conditioning roller which is provided on the downstream in a yarn running direction of the at least one preheating roller and is higher in temperature and rotation speed than the at least one preheating roller, the yarns being drawn between the at least one preheating roller and the conditioning roller; and

a thermal insulation box including an internal space in which the at least one preheating roller and the conditioning roller are housed, from a region in the vicinity of the conditioning roller to a region in the vicinity of the at least one preheating roller, a heat conduction acceleration portion which is higher in heat conductivity than a material of the thermal insulation box is formed at an inner surface of the thermal insulation box.

2. The spun yarn drawing apparatus according to claim 1, wherein, the thermal insulation box includes an openable door which opposes end faces of the at least one preheating roller and the conditioning roller, and a heat conduction acceleration portion is provided at the door.

3. The spun yarn drawing apparatus according to claim 2, wherein, a concave portion is formed in the door to be open toward the internal space when the door is closed, and the heat conduction acceleration portion is formed by filling the concave portion with a material which is higher in heat conductivity than a material of the door.

4. The spun yarn drawing apparatus according to claim 3, wherein, the heat conduction acceleration portion protrudes from the concave portion.

5. The spun yarn drawing apparatus according to any one of claims 1 to 4, wherein, the thermal insulation box includes a side wall which extends along axes of the at least one preheating roller and the conditioning roller, and the heat conduction acceleration portion is provided at the side wall.

6. The spun yarn drawing apparatus according to any one of claims 1 to 5, wherein, a heat insulation part which is lower in heat conductivity than the heat conduction acceleration portion is provided at a part of a surface of the heat conduction acceleration portion.

7. The spun yarn drawing apparatus according to claim 6, wherein, the heat insulation part is a laminated body formed of a metal plate and a heat insulating material, and the metal plate faces the internal space

whereas the heat insulating material faces the heat conduction acceleration portion.

8. The spun yarn drawing apparatus according to claim 6 or 7, wherein, 5
the at least one preheating roller include plural preheating rollers, and
the heat insulation part is provided at a region of a surface of the heat conduction acceleration portion, which region is in the vicinity of a last preheating roller which is most downstream one in the yarn running direction of the preheating rollers. 10

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FIG.1

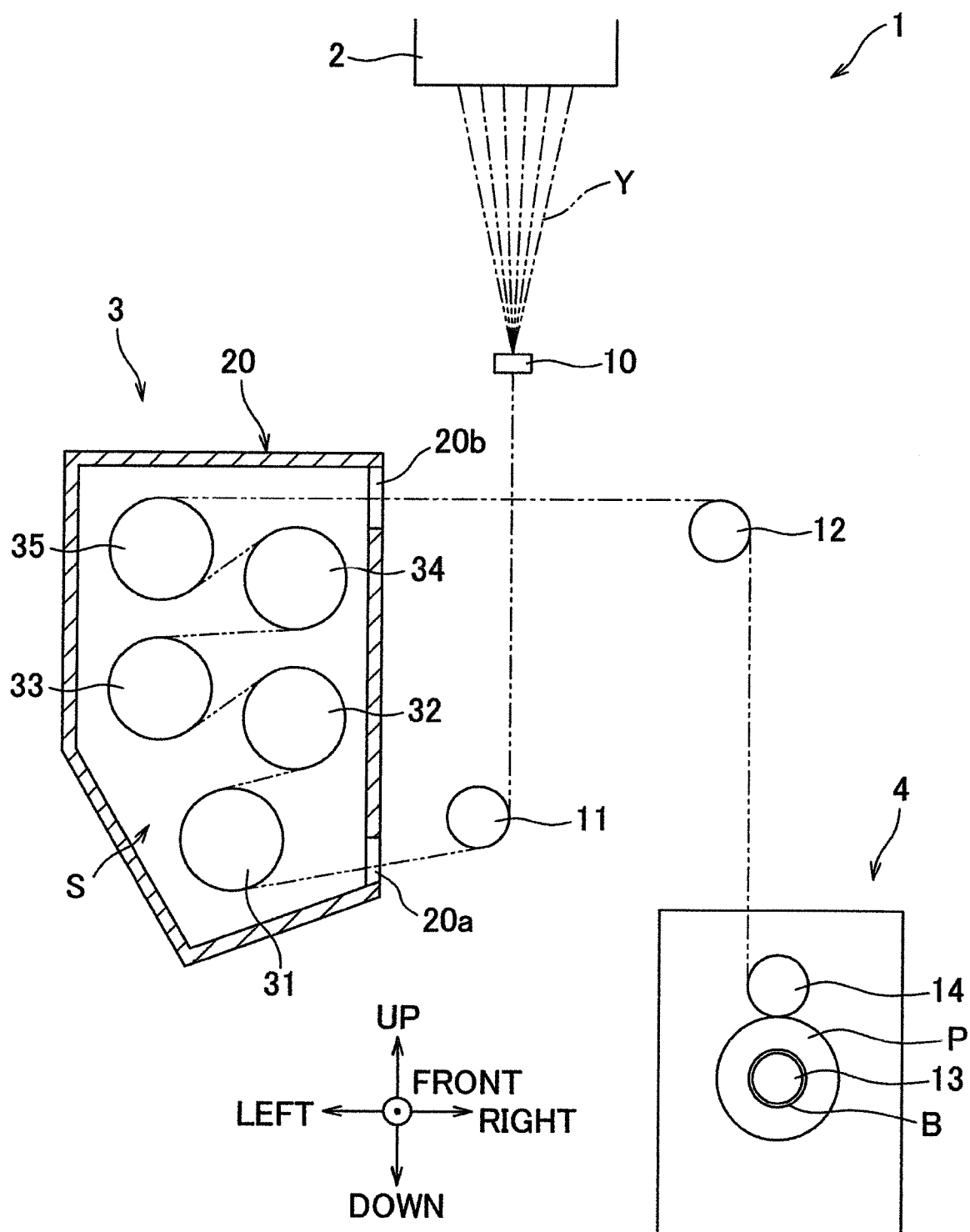


FIG.2

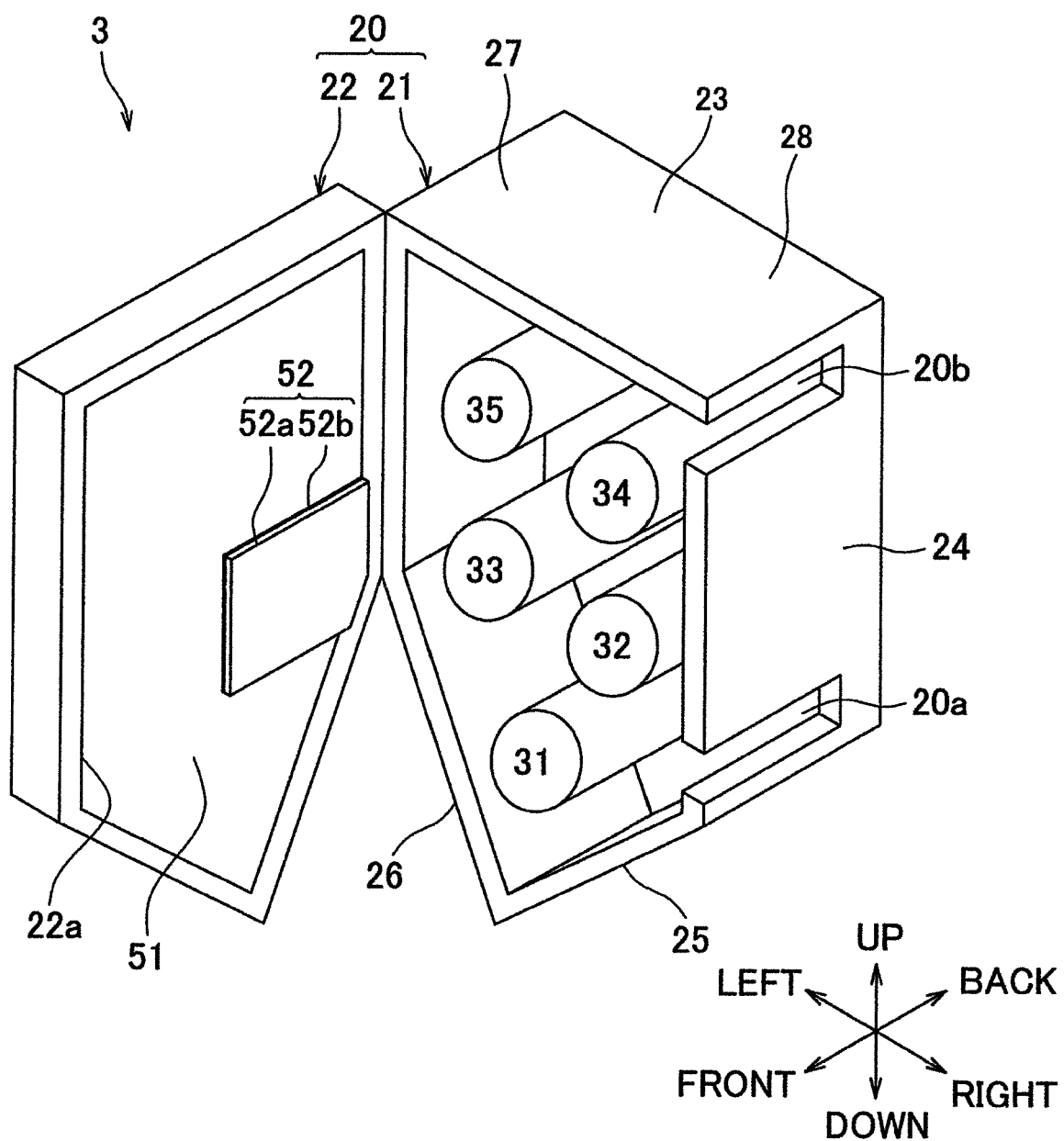


FIG.3

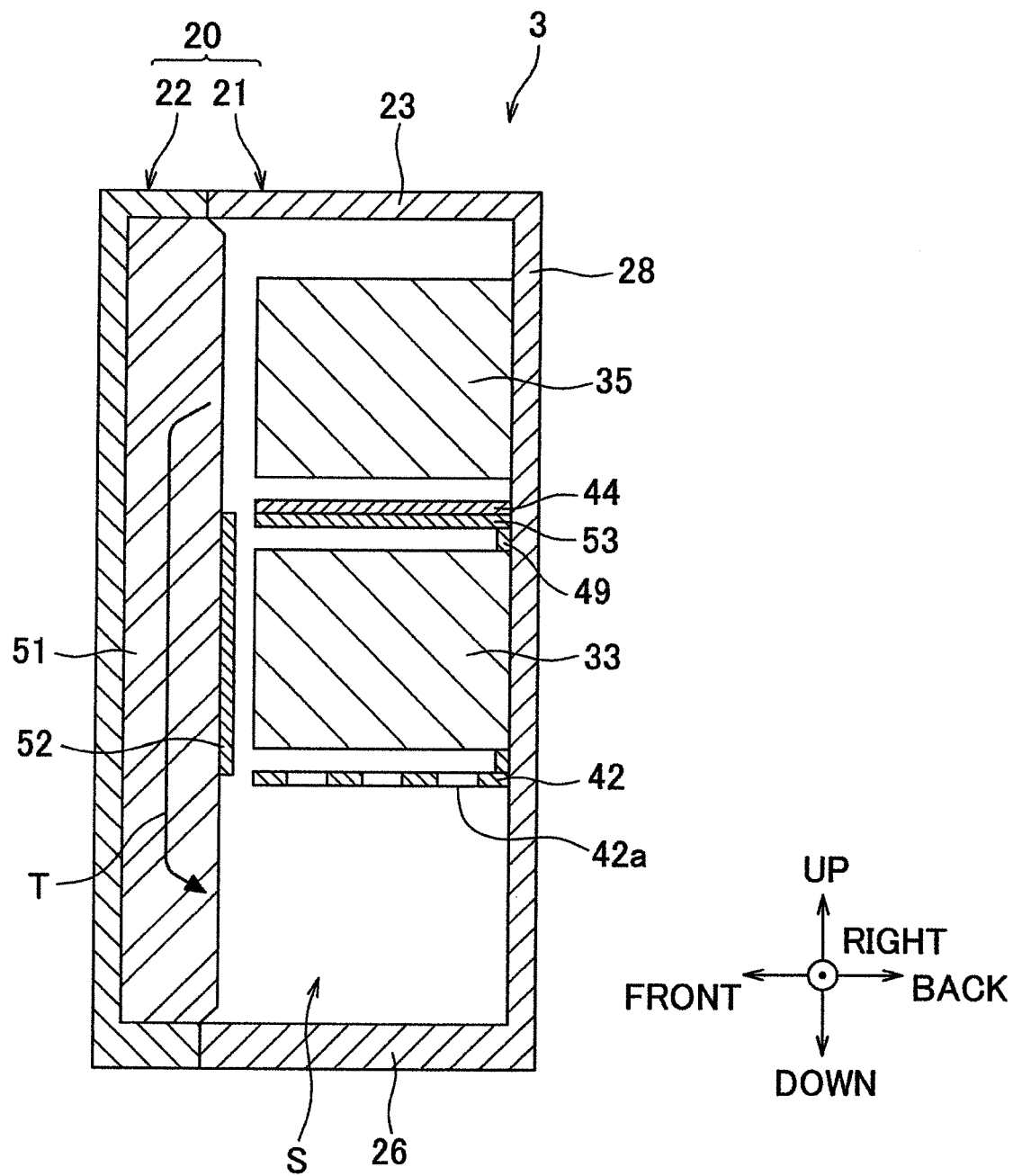


FIG.4

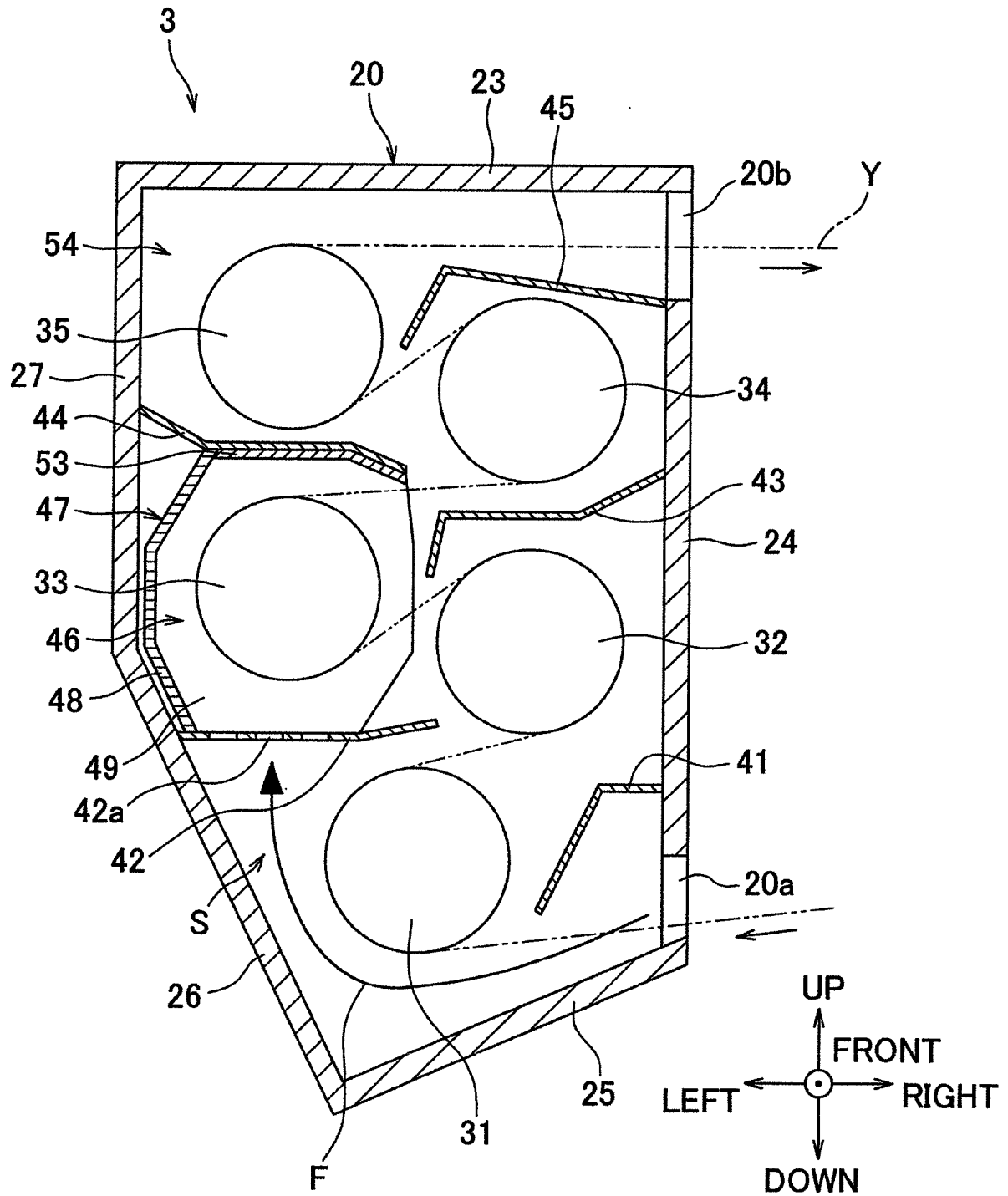
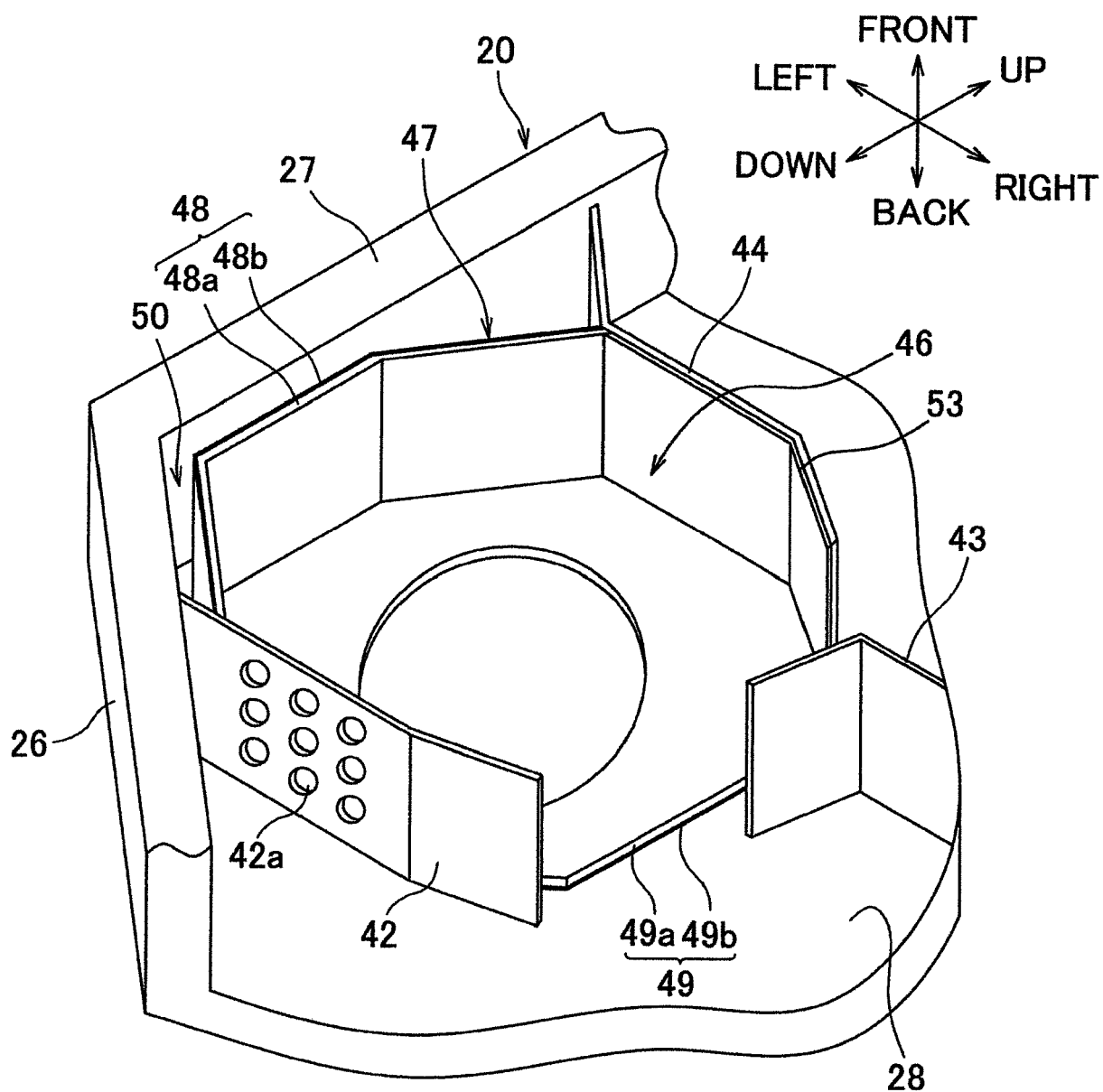


FIG.5





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