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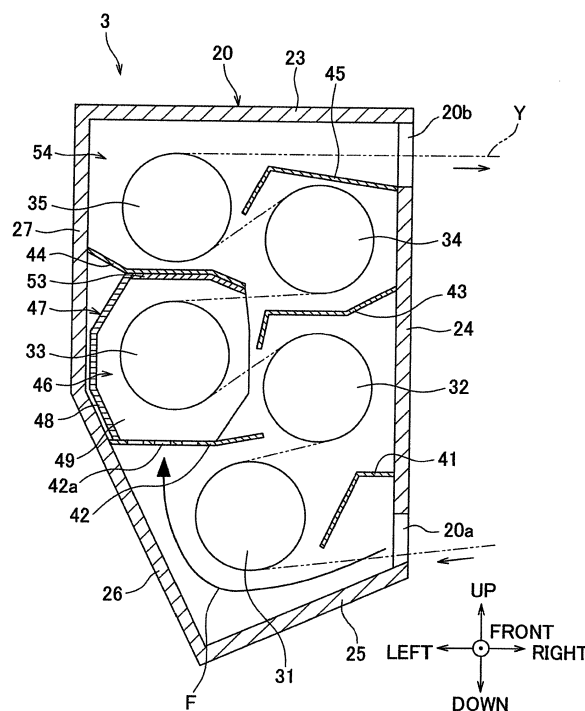
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(54) **SPUN YARN DRAWING APPARATUS**

(57) The accuracy in temperature control of a preheating roller heating yarns before draws is improved. A preheating roller 33 for heating yarns Y before drawn, conditioning rollers 34 and 35 which are higher in temperature and rotation speed than the preheating roller 33, the yarns Y being drawn between the conditioning rollers 34 and 35 and the preheating roller 33, a thermal insulation box 20 housing the preheating roller 33 and the conditioning rollers 34 and 35, and heat shielding members 42 to 44 provided around the preheating roller 33 are provided. A heat insulation part 48, 49 is provided at least at a region of the inner surface of the thermal insulation box 20 which region faces an installation space 46 which is defined by heat shielding members 42 to 44 and in which the preheating roller 33 is provided.

FIG.2



Description**BACKGROUND OF THE INVENTION**

5 **[0001]** The present invention relates to a spun yarn drawing apparatus configured to draw yarns spun out from a spinning apparatus.

10 **[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. 2014-101610) 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. At this stage, if temperatures of the heating rollers are changed by an influence of the hot conditioning rollers, the temperature of the yarns when drawn may not be maintained at a predetermined temperature. To solve this problem, in Patent Literature 1, heat radiation from the conditioning rollers is blocked by covering the most downstream heating roller by a blocking

SUMMARY OF THE INVENTION

20 **[0003]** However, even if the heating roller is covered with the blocking cover, heat conduction through a side wall of the heat retaining box or the like is unavoidable. On this account, heat from the conditioning rollers which are arranged to be higher in temperature than the heating rollers is transferred to the space covered by the blocking cover via a side wall or the like of the heat retaining box, with the result that the temperature of the heating rollers becomes higher than the predetermined temperature.

25 **[0004]** In consideration of the problem above, an object of the present invention is to improve the accuracy of temperature control of a preheating roller which heats yarns before drawn, in a spun yarn drawing apparatus configured to draw yarns spun out from a spinning apparatus.

30 **[0005]** The present invention relates to a spun yarn drawing apparatus including: a 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 preheating roller and is higher in temperature and rotation speed than the preheating roller, the yarns being drawn between the conditioning roller and the preheating roller; a thermal insulation box housing the preheating roller and the conditioning roller; and a heat shielding member provided around the preheating roller, a heat insulation part being provided at least at a part of a region of an inner surface of the thermal insulation box, the region facing a preheating roller installation space defined by the heat shielding member.

35 **[0006]** According to the present invention, by the heat shielding member provided around the preheating roller, the influence of the heat radiation from the conditioning roller on the preheating roller is restrained. Furthermore, the heat insulation part is provided at least at a part of the region of the inner surface of the thermal insulation box which region faces the preheating roller installation space defined by the heat shielding member. On this account, even if the heat from the conditioning roller which is higher in temperature than the preheating roller reaches the vicinity of the preheating roller due to heat conduction via the thermal insulation box, the heat is restrained from being transferred to the preheating roller installation space. Therefore, by the present invention, an influence of the conditioning roller on the preheating roller is restrained not only in terms of heat radiation but also in terms of heat conduction, with the result that the accuracy in the temperature control of the preheating roller is improved.

40 **[0007]** Preferably, the heat insulation part is provided at least at a part of the region of the inner surface of the thermal insulation box the region facing the preheating roller installation space in which the preheating roller neighboring a high-temperature space around the conditioning roller is provided.

45 **[0008]** The preheating roller provided in the preheating roller installation space neighboring the high-temperature space around the conditioning roller is susceptible to an influence of the conditioning roller and the temperature of the preheating roller tends to be higher than the set temperature. By providing the heat insulation part in such a preheating roller installation space, the temperature of the preheating roller susceptible to the influence of the conditioning roller is precisely controllable.

50 **[0009]** Preferably, the heat insulation part is provided at least at a part of the region of the inner surface of the thermal insulation box, the region facing the preheating roller installation space in which the preheating roller heating the yarns immediately before drawn is provided.

55 **[0010]** The preheating roller heating the yarns immediately before drawn significantly influences on the temperature of the yarns when they are drawn. By providing the heat insulation part in such a preheating roller installation space in which the preheating roller is provided, the temperature of the yarns when drawn is suitably controllable.

[0011] Preferably, an air layer is provided between the inner surface of the thermal insulation box and the heat insulation part.

[0012] With this arrangement, the heat insulation effect is improved by the air layer, and hence the transfer of heat

from the thermal insulation box to the preheating roller installation space is further restrained.

[0013] 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 preheating roller whereas the heat insulating material faces the inner surface of the thermal insulation box.

[0014] 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. For this reason, the heat insulating material is not damaged by the cut yarn, and hence the deterioration in the heat insulation capability of the heat insulation part is prevented.

[0015] Preferably, the thermal insulation box includes a side wall extending along an axis of the preheating roller, and the heat insulation part is provided at a region of an inner surface of the side wall which region faces a circumferential surface of the preheating roller.

[0016] With this arrangement of the heat insulation part, the heat radiated from the side wall of the thermal insulation box to the circumferential surface of the preheating roller is significantly reduced, with the result that temperature increase in the roller surface, which directly influences on the temperature of the yarns, is effectively restrained.

[0017] Preferably, a heat insulation part is provided on an inner surface of a back wall of the thermal insulation box, and the heat insulation parts provided at the side wall and the back wall are integrally formed.

[0018] By providing the heat insulation part at the back wall of the thermal insulation box, heat transferred from the back wall to the preheating roller installation space is reduced, and hence the temperature increase in the preheating roller is further certainly restrained. Furthermore, because the heat insulation part on the back wall is integrated with the heat insulation part on the side wall, the heat insulation parts are easily attached.

[0019] Preferably, the thermal insulation box includes a door which faces an end face of the preheating roller, and the heat insulation part is provided at a region of an inner surface of the door which region opposes the end face of the preheating roller.

[0020] By providing the heat insulation part in this way, heat transferred from the door of the thermal insulation box to the preheating roller is reduced, and hence the temperature increase in the preheating roller is restrained.

[0021] Preferably, a second heat insulation part is provided between the high-temperature space and the preheating roller installation space in which the preheating roller neighboring the high-temperature space is provided.

[0022] By providing such a second heat insulation part, an amount of heat directly transferred from the high-temperature space to the preheating roller installation space is reduced, and hence the temperature increase in the preheating roller is further effectively restrained.

[0023] Preferably, in the thermal insulation box, an inlet for introducing the yarns and an air introduction portion for guiding air from the inlet to the preheating roller are formed.

[0024] By providing such an air introduction portion, relatively cool air flowing from the inlet into the thermal insulation box is supplied to the preheating roller installation space, with the result that the temperature increase in the preheating roller is further effectively restrained.

[0025] Preferably, the air introduction portion is an opening formed in the heat shielding member which is provided on the inlet side of the preheating roller.

[0026] By forming the opening in the heat shielding member and utilizing the opening as the air introduction portion, the air introduction portion is easily provided without requiring an additional member or changing the position of a member.

[0027] In the present invention, the influence of the conditioning roller on the temperature of the preheating roller is effectively restrained and the accuracy in the temperature control of the preheating roller is improved, because the heat insulation part is provided at least at a part of the region of the inner surface of the thermal insulation box which region faces the preheating roller installation space defined by the heat shielding member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028]

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

FIG. 2 is a cross section showing details of the internal structure of the spun yarn drawing apparatus.

FIG. 3 is a perspective view of a heat insulation member.

FIG. 4 is a perspective view of a state in which a door is open.

FIG. 5 is a cross section of a state in which the door is closed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] 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 the 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.

[0030] 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 are 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.

[0031] The yarns Y drawn by the spun yarn drawing apparatus 3 are sent to a 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.

[0032] 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 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.

[0033] 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.

[0034] 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.

[0035] In regard to the above, the last preheating roller 33 among the preheating rollers 31 to 33, which is on the most downstream in the yarn running direction and heats the yarns Y which are 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 the 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.

[0036] In consideration of the above, in the spun yarn drawing apparatus 3 of the present embodiment, a heat shielding member is provided around the last preheating roller 33. FIG. 2 is a cross section showing the details of the internal structure of the spun yarn drawing apparatus 3. Although not illustrated in FIG. 1, 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 flow control members 42 to 44 provided around the last preheating roller 33 function as heat shielding members for the last preheating roller 33.

[0037] Each of the heat shielding members 42 to 44 has a heat shielding property. As the heat shielding members 42 to 44 are provided to surround the last preheating roller 33, heat radiation between the last preheating roller 33 and the other rollers 31, 32, 34, and 35 is restrained. In particular, because of the heat shielding members 43 and 44 provided between the last preheating roller 33 and the hot conditioning rollers 34 and 35, excessive heat increase in the last

preheating roller 33 due to the heat radiation from the conditioning rollers 34 and 35 is restrained.

[0038] However, when the heat shielding members 42 to 44 are simply provided to surround the last preheating roller 33, increase in the temperature of the last preheating roller 33 to be higher than the set temperature may not be completely avoided. This is presumably because heat is transferred from the conditioning rollers 34 and 35 to the installation space 46 of the last preheating roller 33 due to heat conduction via the thermal insulation box 20. For this reason, in the spun yarn drawing apparatus 3 of the present embodiment, a heat insulation part is provided at least at a region of the inner surface of the thermal insulation box 20, which region faces the installation space 46 for the last preheating roller 33 defined by the heat shielding members 42 to 44.

[0039] Now, the structure of the thermal insulation box 20 will be described. As shown in FIG. 4, 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. The door 22 includes a housing portion 29 which is open toward the housing 21 when the door 22 is closed and a heat conduction acceleration portion 51 where the housing portion 29 is filled with a material having higher heat conductivity than the material of the housing portion 29. In the present embodiment, the housing 21 and the housing portion 29 of the door 22 are made of stainless steel which excels in strength, whereas the heat conduction acceleration portion 51 is made of aluminum alloy which is higher in heat conductivity than the stainless steel.

[0040] In the present embodiment, as heat insulation parts of the present invention, a side heat insulation part 48 (see FIGs. 2 and 3) is provided at the inner surfaces of the lower left side wall 26 and the left side wall 27 of the thermal insulation box 20, a back heat insulation part 49 (see FIGs. 2 and 3) is provided at the inner surface of the back wall 28 of the thermal insulation box 20, and a front heat insulation part 52 (see FIGs. 4 and 5) is provided at the inner surface of the door 22 of the thermal insulation box 20. The side heat insulation part 48 and the back heat insulation part 49 are integrated as a heat insulation member 47. Furthermore, as a second heat insulation part of the present invention, a heat insulation part 53 is provided on the last preheating roller 33 side of the heat shielding member 44.

[0041] FIG. 3 is a perspective view showing the heat insulation member 47. In FIG. 3, the last preheating roller 33 is not shown. 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.

[0042] 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.

[0043] 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.

[0044] 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 heat shielding 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 heat shielding member 44. The heat shielding member 44 may function as a heat insulation part in such a way that the heat shielding 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.

[0045] In addition to the above, in the present embodiment, among the heat shielding members 42 to 44 provided around the last preheating roller 33, plural openings 42a are formed in the heat shielding member 42 which is on the inlet 20a side (see FIG. 2) 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 heat shielding 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.

[0046] Now, the heat conduction acceleration portion 51 and the front heat insulation part 52 provided on the door 22 of the thermal insulation box 20 will be described. FIG. 4 is a perspective view showing a state in which the door 22 is open, whereas FIG. 5 is a cross section showing a state in which the door 22 is closed. To be more specific, FIG. 5 is a cross section taken along the vertical surface including the rotation axes of the last preheating roller 33 and the conditioning roller 35. In FIG. 4, the flow control members 41 to 45 and the heat insulation member 47 are not shown.

[0047] As described above, due to the heat from the hot conditioning rollers 34 and 35, the temperature of the last preheating roller 33 may be disadvantageously increased to be higher than the set temperature. However, on the other hand, there is a demand for supplying the heat from the hot conditioning rollers 34 and 35 to the preheating rollers 31 and 32 in order to reduce the power required for heating the preheating rollers 31 and 32.

[0048] To meet this demand, in the present embodiment, the heat conduction acceleration portion 51 is provided by filling the housing portion 29 constituting the door 22 and made of stainless steel with aluminum alloy which is higher in heat conductivity than the stainless steel. With this arrangement, the heat generated from the conditioning rollers 34 and 35 is actively transferred to the preheating rollers 31 and 32 side via the heat conduction acceleration portion 51 (see the arrow T in FIG. 5). In this way, the power required to heat the preheating rollers 31 and 32 is reduced. In particular, as shown in FIG. 5, as the heat conduction acceleration portion 51 is arranged to protrude toward the rollers 31 to 35 as compared to the housing portion 29, the distance between the heat conduction acceleration portion 51 and the conditioning rollers 34 and 35 is reduced and the efficiency in the heat transfer by the heat conduction acceleration portion 51 is improved.

[0049] In regard to the above, the power consumption of the preheating rollers 31 and 32 may be reduced by supplying hot air around the conditioning rollers 34 and 35 to the side on which the preheating rollers 31 and 32 are provided. In this arrangement, however, oil mist or the like generated around the hot conditioning rollers 34 and 35 may be disadvantageously cooled by the cool preheating rollers 31 and 32 and may be adhered to the surfaces of the rollers. In this connection, in the present embodiment in which the heat transfer is performed by heat conduction, only heat is transferred to the preheating rollers 31 and 32 side without the movement of the oil mist or the like, and hence contamination of the surfaces of the preheating rollers 31 and 32 is prevented.

[0050] In addition to the above, in the present embodiment, the front heat insulation part 52 is provided at a region of the inner surface of the door 22 (heat conduction acceleration portion 51), which region opposes the end face of the last preheating roller 33. As shown in FIG. 4, 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.

[0051] 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 and 32. On this account, increase in temperature of the last preheating roller 33 to be higher than the set temperature is restrained, while the power required to heat the preheating rollers 31 and 32 is reduced. The front heat insulation part 52 is preferably formed on the entirety of the region of the inner surface of the door 22 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 for the last preheating roller 33.

(Effects)

[0052] As described above, in the spun yarn drawing apparatus 3 of the present embodiment, the heat insulation parts 48, 49, and 52 are formed at least at a region of the inner surface of the thermal insulation box 20 which region faces the installation space 46 for the last preheating roller 33 defined by the heat shielding members 42 to 44. On this account, even if the heat from the conditioning rollers 34 and 35 which are higher in temperature than the last preheating roller 33 reaches the vicinity of the last preheating roller 33 due to heat conduction via the thermal insulation box 20, the heat is restrained from being transferred to the installation space 46 for the last preheating roller 33. Therefore an influence of the hot conditioning rollers 34 and 35 on the last preheating roller 33 is restrained not only in terms of the heat radiation but also in terms of the heat conduction, with the result that the accuracy in the temperature control of the last preheating roller 33 is improved.

[0053] In addition to the above, in the present embodiment, the heat insulation part 53 is provided between the high-temperature space 54 around the conditioning rollers 34 and 35 and the installation space 46 for the last preheating roller 33, which neighbors the high-temperature space 54. This reduces the amount of heat directly transferred from the

high-temperature space 54 to the installation space 46, with the result that temperature increase in the last preheating roller 33 is further effectively restrained.

[0054] Table 1 shows the set temperatures of the rollers 31 to 35 and the temperatures of the rollers 31 to 35 before and after the heat insulation parts 48, 49, 52, and 53 are provided. Before the heat insulation parts 48, 49, 52, and 53 were provided, the temperature of the last preheating roller 33 was 89 degrees centigrade which is higher by 9 degrees centigrade than the set temperature. After the heat insulation parts 48, 49, 52, and 53 were provided, the temperature of the last preheating roller 33 was maintained at 80 degrees centigrade which was the set temperature. In this way, improvement in the accuracy of the temperature control of the last preheating roller 33 was confirmed by the specific example.

[Table 1]

	SET TEMPERATURE [°C]	TEMPERATURE BEFORE PROVIDING HEAT INSULATION PART [°C]	TEMPERATURE AFTER PROVIDING HEAT INSULATION PART [°C]
PREHEATING ROLLER 31	82	82	82
PREHEATING ROLLER 32	80	80	80
LAST PREHEATING ROLLER 33	80	89	80
CONDITIONING ROLLER 34	138	138	138
CONDITIONING ROLLER 35	138	138	138

[0055] In addition to the above, in the present embodiment, because the air layer 50 is provided between the inner surface of the thermal insulation box 20 and the heat insulation part 48, the heat insulation effect is improved, and hence heat transfer from the thermal insulation box 20 to the installation space 46 for the last preheating roller 33 is further restrained.

[0056] In addition to the above, in the present embodiment, the heat insulation parts 48, 49, and 52 are formed by laminating the metal plates 48a, 49a, and 52a and the heat insulating materials 48b, 49b, and 52b, and are arranged such that the metal plates 48a, 49a, and 52a face the last preheating roller 33 whereas the heat insulating materials 48b, 49b, and 52b face the inner surfaces of the thermal insulation box 20. With this arrangement, when, for example, a yarn Y is cut, the cut yarn Y makes contact with the side of the heat insulation parts 48, 49, and 52 on which side the metal plates 48a, 49a, and 52a are provided. For this reason, the heat insulating materials 48b, 49b, and 52b are not damaged by the cut yarn Y and hence deterioration in the heat insulation capability of the heat insulation parts 48, 49, and 52 is prevented.

[0057] In addition to the above, in the present embodiment, the thermal insulation box 20 includes the side walls 26 and 27 extending along the axis of the last preheating roller 33, and the heat insulation part 48 is provided to oppose the region of the inner surfaces of the side walls 26 and 27 which region opposes the circumferential surface of the last preheating roller 33. With this arrangement of the heat insulation part 48, the heat radiated from the side walls 26 and 27 of the thermal insulation box 20 to the circumferential surface of the last preheating roller 33 is significantly reduced, with the result that temperature increase in the roller surface, which directly influences on the temperature of the yarns Y, is effectively restrained.

[0058] In addition to the above, in the present embodiment, the heat insulation part 49 is provided also at the inner surface of the back wall 28 of the thermal insulation box 20, and the heat insulation parts 48 and 49 formed on the side walls 26 and 27 and the back wall 28 are integrally formed. By providing the heat insulation part 49 also at the back wall 28 of the thermal insulation box 20 in this way, the heat transferred from the back wall 28 to the installation space 46 for the last preheating roller 33 is reduced, with the result that the temperature increase in the last preheating roller 33 is further certainly restrained. Furthermore, because the heat insulation part 49 on the back wall 28 is integrated with the heat insulation part 48 on the side walls 26 and 27, the heat insulation parts 48 and 49 are easily attached.

[0059] In addition to the above, in the present embodiment, the thermal insulation box 20 is provided with the door 22 opposing the end face of the last preheating roller 33, and the heat insulation part 52 is provided in the region of the

inner surface of the door 22 which region opposes the end face of the last preheating roller 33. By providing the heat insulation part 52 in this way, the heat transferred from the door 22 of the thermal insulation box 20 to the last preheating roller 33 is reduced, with the result that the temperature increase in the last preheating roller 33 is restrained.

[0060] In addition to the above, in the present embodiment, the inlet 20a for introducing the yarns Y and the air introduction portions 42a for introducing the air flowing through the inlet 20a into the last preheating roller 33 are made through the thermal insulation box 20. With these air introduction portions 42a, the relatively cool air flowing into the thermal insulation box 20 through the inlet 20a is supplied to the installation space 46 for the last preheating roller 33, with the result that the temperature increase in the last preheating roller 33 is further effectively restrained.

[0061] In particular, in the present embodiment, because the air introduction portions 42a are openings formed through the heat shielding member 42 which is on the inlet 20a side of the last preheating roller 33, the air introduction portions 42a are easily provided without requiring an additional member or changing the position of a member.

[Other Embodiments]

[0062] 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.

[0063] For example, in the embodiment above, the heat insulation parts 48, 49, 52, and 53 provided around the installation space 46 for the last preheating roller 33 have been described. In addition to this, in regard to the preheating rollers 31 and 32 other than the last preheating roller 33, a heat insulation part may be provided around a space in which each of the preheating rollers 31 and 32 is provided, if there is a problem that the temperature of the space becomes higher than a set temperature due to the heat from the hot conditioning rollers 34 and 35. For example, because the preheating roller 32 neighbors a high-temperature region 54, the temperature of the space in which the roller 32 is provided tends to be higher than a set temperature. On this account, it is effective in this case to provide a heat insulation part at a portion (e.g., the heat shielding member 43 or the right side wall 24) facing an installation space (which is mostly defined by the heat shielding members 41 to 43) for the preheating roller 32. It is noted that the number of the rollers and the arrangement of the rollers may be optionally changed.

[0064] 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 at the heat shielding member 44. In this regard, at which member a heat insulation part is provided may be optionally determined.

[0065] 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.

[0066] 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.

[0067] In addition to the above, in the embodiment above, the openings 42a are formed in the heat shielding 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 heat shielding member 42 may not be provided on the extension line of the path F shown in FIG. 2.

[0068] In addition to the above, in the embodiment above, the heat conduction acceleration portion 51 is provided only in the door 22. The heat conduction acceleration portion 51, however, may be provided at another part of the thermal insulation box 20. The materials of the parts of the thermal insulation box 20 may be optionally changed.

Claims

1. A spun yarn drawing apparatus configured to draw yarns spun out from a spinning apparatus, comprising:

a 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 preheating roller and is higher in temperature and rotation speed than the preheating roller, the yarns being drawn between the conditioning roller and the preheating roller;
 a thermal insulation box housing the preheating roller and the conditioning roller; and
 a heat shielding member provided around the preheating roller,

a heat insulation part being provided at least at a part of a region of an inner surface of the thermal insulation box, the region facing a preheating roller installation space defined by the heat shielding member.

2. The spun yarn drawing apparatus according to claim 1, wherein, the heat insulation part is provided at least at a part of the region of the inner surface of the thermal insulation box, the region facing the preheating roller installation space in which the preheating roller neighboring a high-temperature space around the conditioning roller is provided.
3. The spun yarn drawing apparatus according to claim 1 or 2, wherein, the heat insulation part is provided at least at a part of the region of the inner surface of the thermal insulation box, the region facing the preheating roller installation space in which the preheating roller heating the yarns immediately before drawn is provided.
4. The spun yarn drawing apparatus according to any one of claims 1 to 3, wherein, an air layer is provided between the inner surface of the thermal insulation box and the heat insulation part.
5. The spun yarn drawing apparatus according to any one of claims 1 to 4, 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 preheating roller whereas the heat insulating material faces the inner surface of the thermal insulation box.
6. The spun yarn drawing apparatus according to any one of claims 1 to 5, wherein, the thermal insulation box includes a side wall extending along an axis of the preheating roller, and the heat insulation part is provided at a region of an inner surface of the side wall which region faces a circumferential surface of the preheating roller.
7. The spun yarn drawing apparatus according to claim 6, wherein, a heat insulation part is provided on an inner surface of a back wall of the thermal insulation box, and the heat insulation parts provided at the side wall and the back wall are integrally formed.
8. The spun yarn drawing apparatus according to any one of claims 1 to 7, wherein, the thermal insulation box includes a door which faces an end face of the preheating roller, and the heat insulation part is provided at a region of an inner surface of the door which region opposes the end face of the preheating roller.
9. The spun yarn drawing apparatus according to claim 2, wherein, a second heat insulation part is provided between the high-temperature space and the preheating roller installation space in which the preheating roller neighboring the high-temperature space is provided.
10. The spun yarn drawing apparatus according to any one of claims 1 to 9, wherein, in the thermal insulation box, an inlet for introducing the yarns and an air introduction portion for guiding air from the inlet to the preheating roller are formed.
11. The spun yarn drawing apparatus according to claim 10, wherein, the air introduction portion is an opening formed in the heat shielding member which is provided on the inlet side of the preheating roller.

FIG. 1

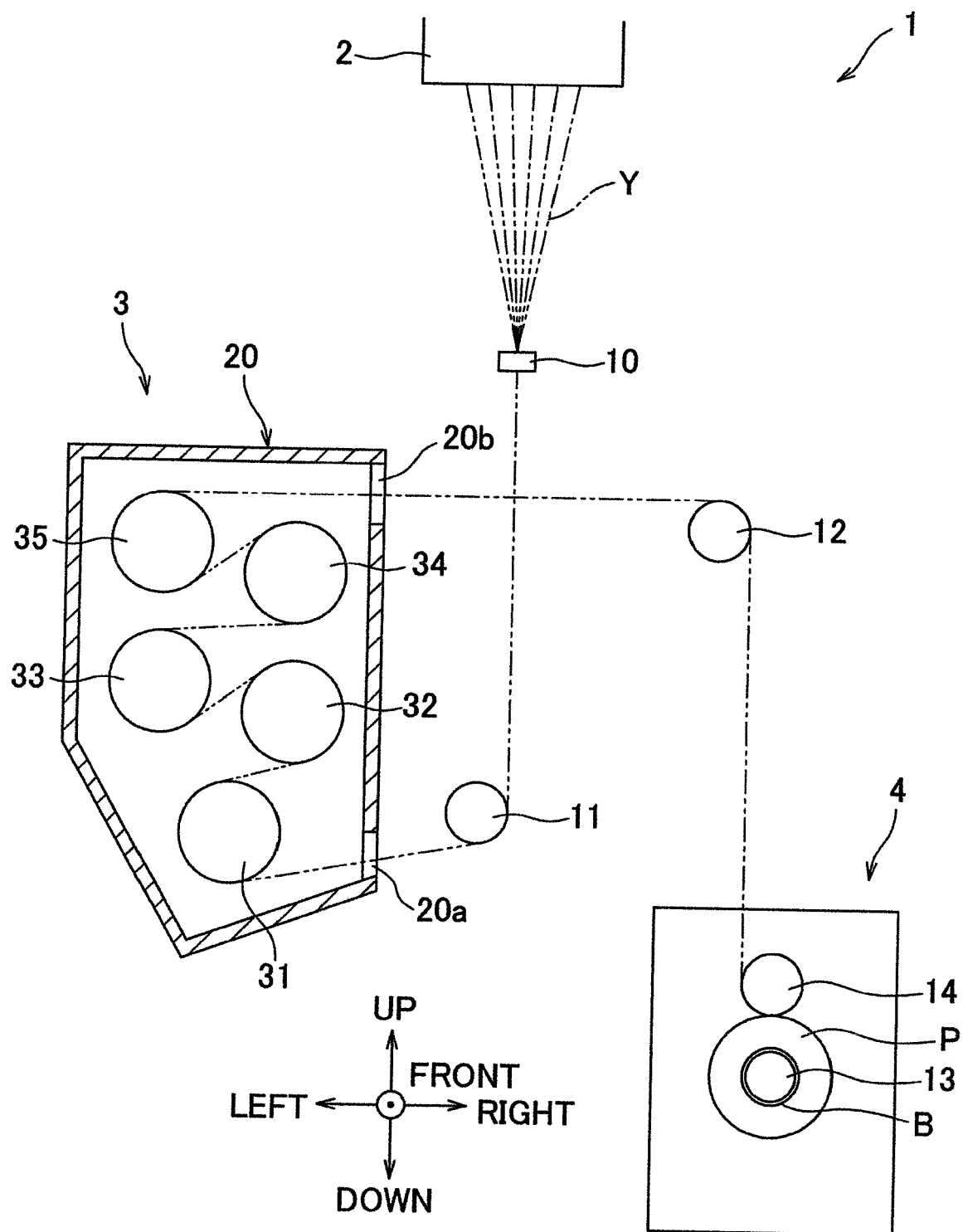


FIG.2

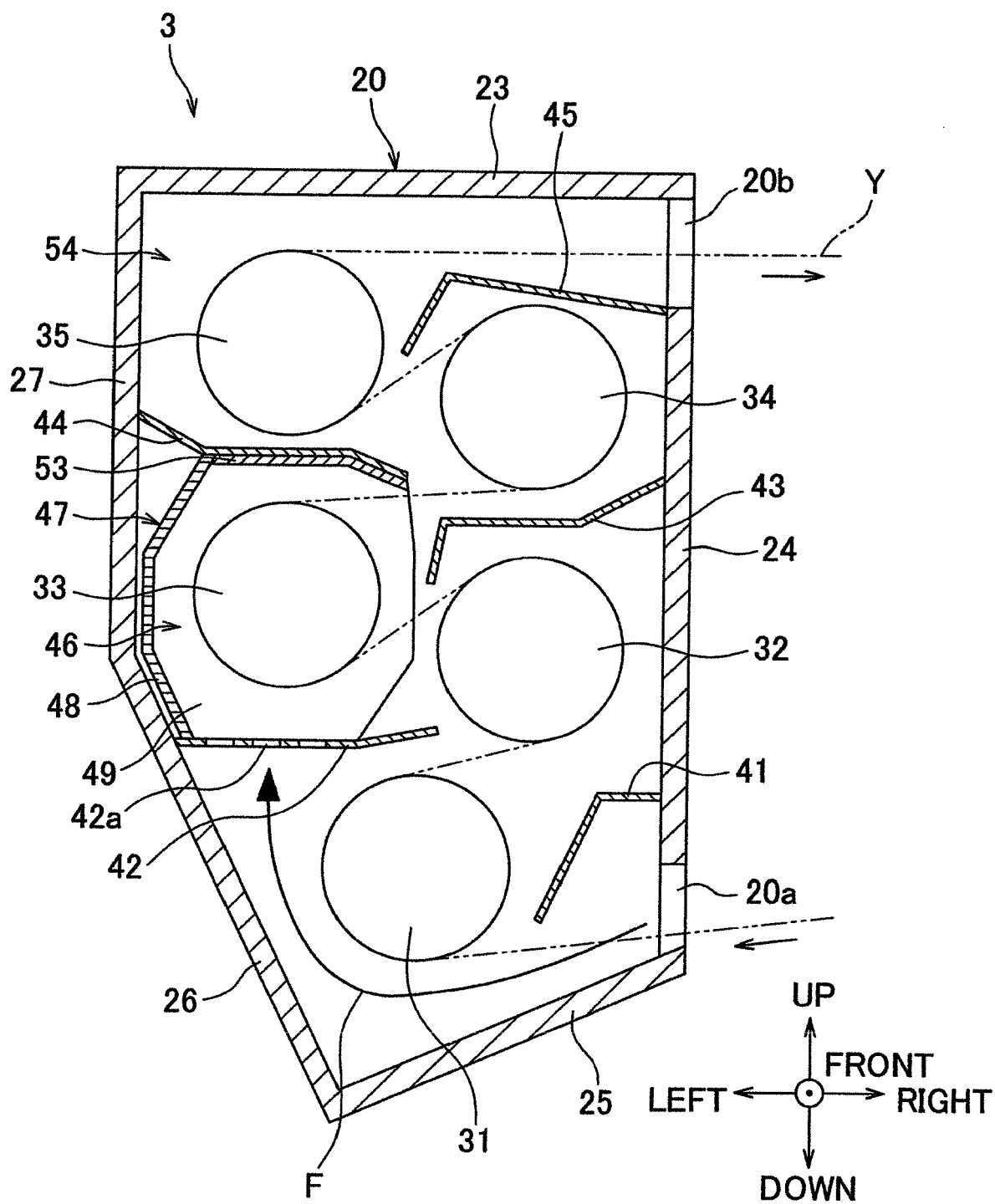


FIG.3

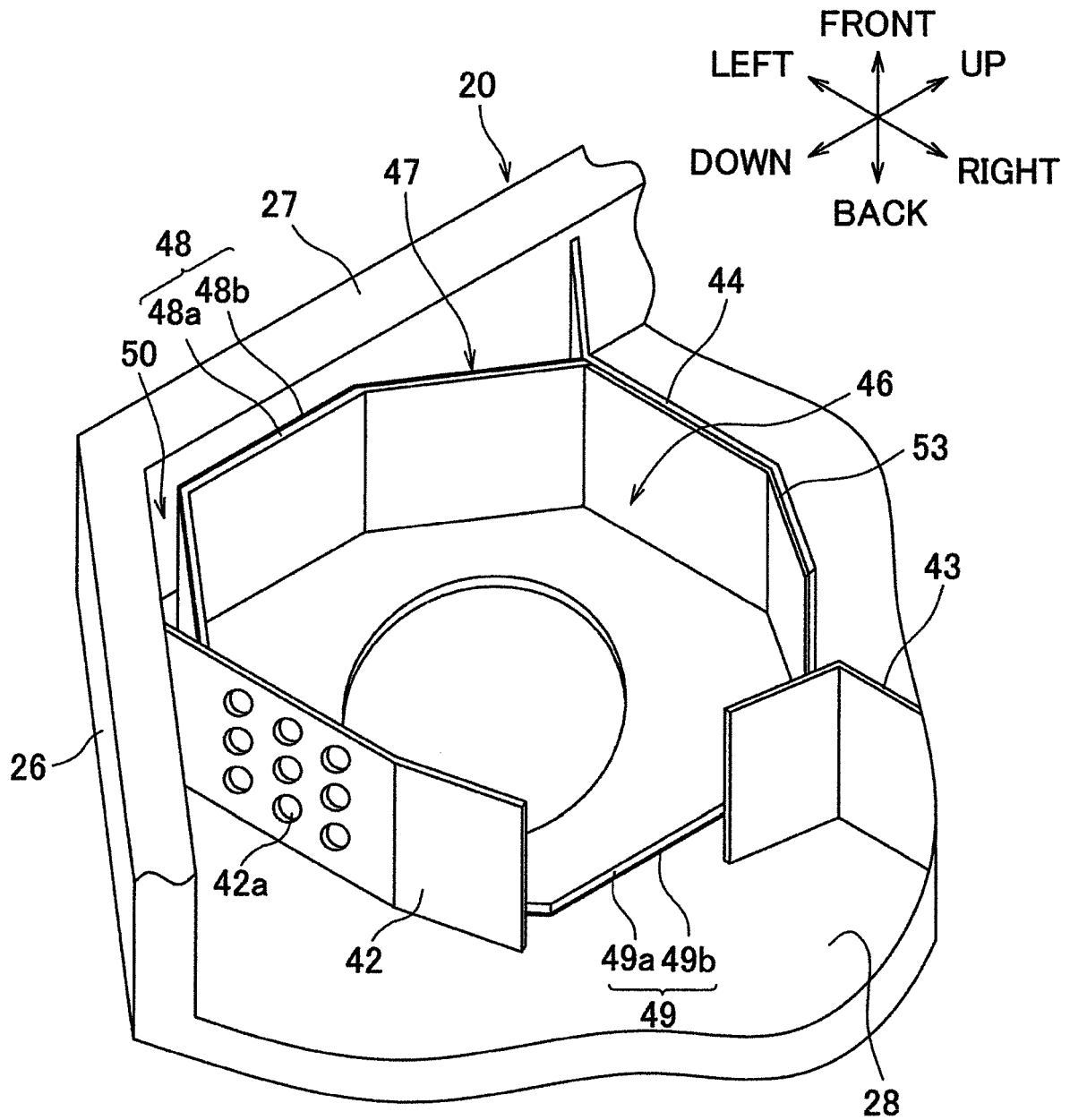


FIG.4

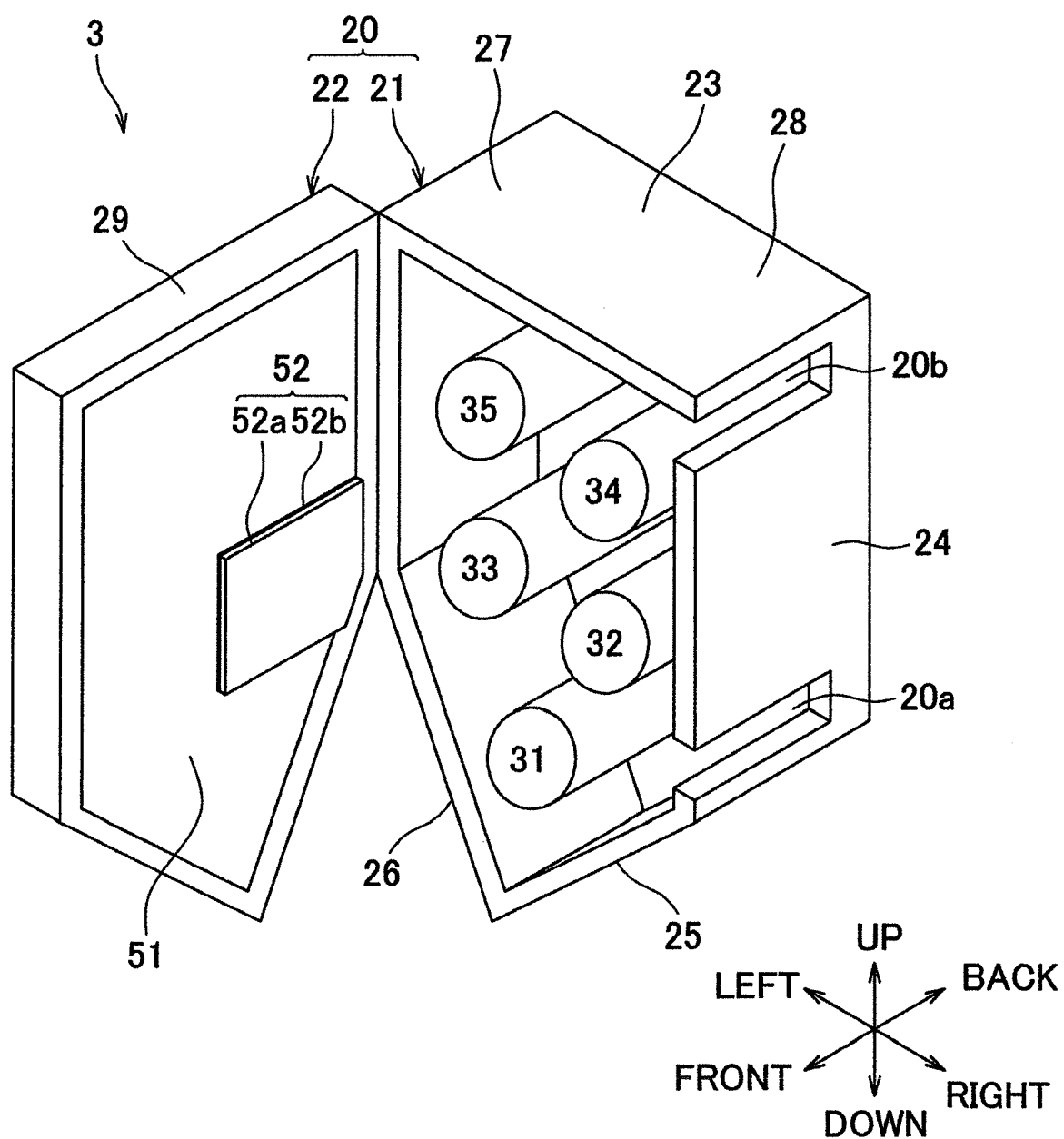
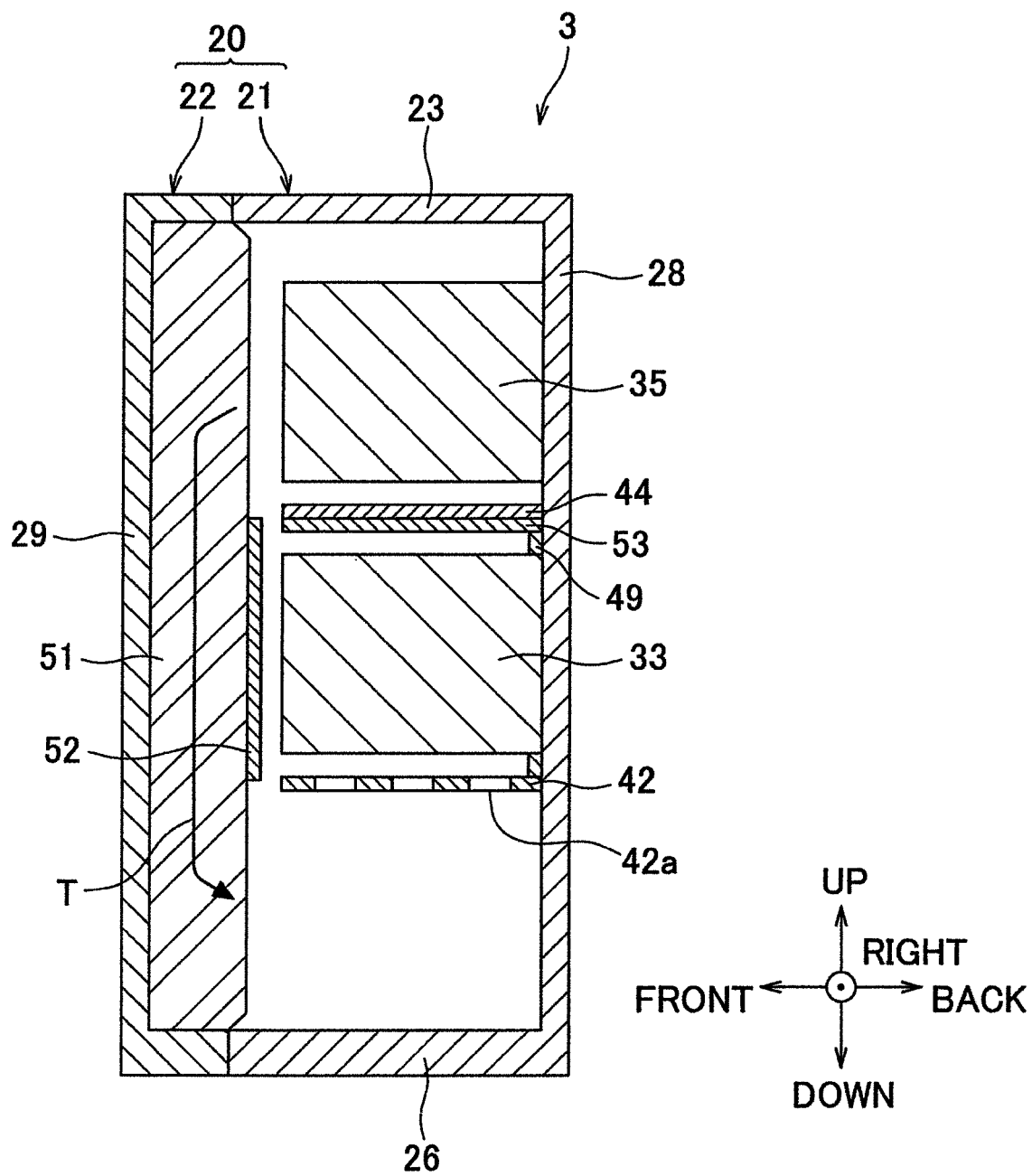


FIG.5





EUROPEAN SEARCH REPORT

Application Number
EP 16 15 8439

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 May 2016	Examiner Van Beurden-Hopkins
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