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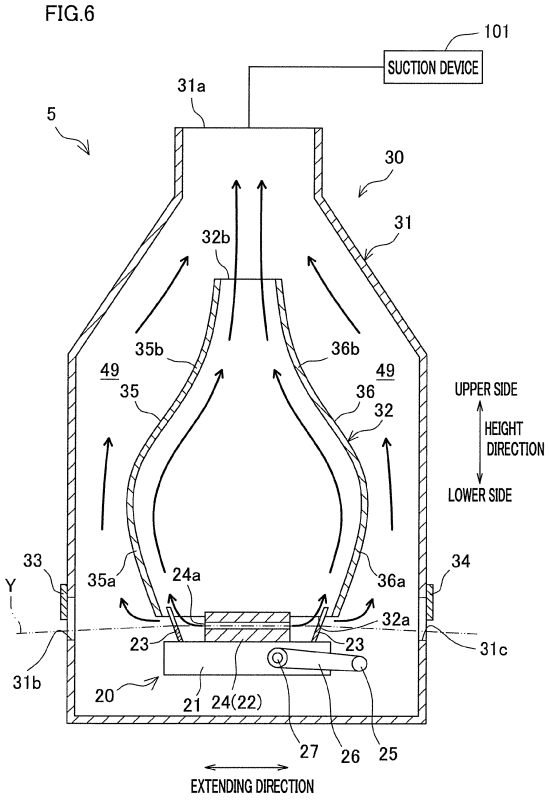
(54) OIL RECOVERY APPARATUS, YARN PROCESSING MECHANISM, AND SPUN YARN TAKE-UP APPARATUS

(57) An object of the present invention is to effectively collect oil mist scattering from a yarn processing apparatus with low cost.

An oil recovery apparatus 30 is configured to collect oil mist scattering from a yarn processing apparatus 20 performing a predetermined process for a yarn Y by ejecting fluid into a yarn running space 24a where the yarn Y to which oil has been applied runs. The oil recovery apparatus 30 includes: a housing 31 which accommodates the yarn processing apparatus 20 and has a suction port 31a; and a guide member 32 which is provided in the housing 31 to guide an ejected stream from the yarn running space 24a, which is generated by ejection of the fluid, to the suction port 31a.

FIG.6



EP 3 967 794 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an oil recovery apparatus configured to collect oil mist scattering from a yarn processing apparatus performing a predetermined process for a yarn by ejecting fluid into a yarn running space where the yarn to which oil has been applied runs, and further relates to a yarn processing mechanism including the oil recovery apparatus and a spun yarn take-up apparatus.

[0002] Conventionally, oil may be applied to a yarn for purposes such as decreasing friction, suppressing static electricity, improving a package shape, and improving the uniformity in yarn heating. In a yarn processing apparatus configured to perform a predetermined process for a yarn by ejecting fluid into a yarn running space where a yarn to which oil has been applied runs, the ejection of the fluid causes part of the oil adhered to the yarn to be blown off so as to become oil mist. If such oil mist scatters from the yarn processing apparatus, the oil mist may adhere to a resin member and deteriorate the resin member, oil droplets resulting from the oil mist may adhere to a yarn or a package and deteriorate the yarn quality, or the surrounding environment may be hazed in white and deteriorated. Examples of the yarn processing apparatus include an interlacing device and a migration nozzle. The interlacing device is configured to interlace a yarn by ejecting fluid. The migration nozzle is configured to uniformize oil applied to a yarn.

[0003] To solve the problem above, for example, Patent Literature 1 (Japanese Laid-Open Patent Publication No. 2017-218706) discloses a technology of guiding an ejected stream from a yarn running space of an interlacing device to a duct member, converting the oil mist to oil droplets by a filter provided inside the duct member, and collecting the oil droplets. Meanwhile, Patent Literature 2 (Japanese Laid-Open Patent Publication No. 2017-509810) discloses a technology of sucking floating matters such as oil mist generated by an interlacing device.

SUMMARY OF THE INVENTION

[0004] However, even if the duct member is provided in the vicinity of the interlacing device as in Patent Literature 1, a large amount of oil mist does not flow into the duct member. As such, it is difficult to efficiently collect the oil mist by this arrangement. When oil mist is collected by suction as in Patent Literature 2, how much oil mist is collected largely depends on the capability of a suction device. However, the suction device is often an existing device in a factory, etc., and there is a limit in the enhancement of the capability of the device. In this connection, the enhancement of the capability of the suction device requires high cost.

[0005] In consideration of the above, an object of the present invention is to effectively collect oil mist scattering from a yarn processing apparatus with low cost.

[Solution to Problem]

[0006] An oil recovery apparatus of the present invention is configured to collect oil mist scattering from a yarn processing apparatus performing a predetermined process for a yarn by ejecting fluid into a yarn running space where the yarn to which oil has been applied runs, and the oil recovery apparatus includes: a housing which accommodates the yarn processing apparatus and has a suction port; and a guide member which is provided in the housing to guide an ejected stream from the yarn running space, which is generated by ejection of the fluid, to the suction port.

[0007] In the present invention, the suction port is provided in the housing which accommodates the interlacing device. The oil mist scattering from the yarn processing apparatus is collected through the suction port. However, when the housing is simply provided, the oil mist stagnates in the housing in a case where the suction force of a suction device is insufficient. The oil mist stagnating at around the yarn disadvantageously leaks out to the outside of the housing with an accompanied flow. However, if the capability of the suction device is enhanced in order to suppress the leakage of the oil mist, a large cost increase may occur. Therefore, the guide member which guides the ejected stream from the yarn running space to the suction port is provided in the present invention. With this arrangement, because the oil mist is guided to the suction port by using the force of the ejected stream from the yarn running space, the oil mist is effectively collectable with low cost.

[0008] In the present invention, the guide member may be a duct member having an inlet into which the stream is taken and an outlet from which the stream is discharged toward the suction port.

[0009] With this arrangement, because the ejected stream is reliably guided to the suction port by using the duct member, the oil mist is further effectively collectable. In this regard, the ejection of the fluid from the outlet of the duct member can be used for assisting the suction by the suction port of the housing.

[0010] In the present invention, a part of the duct member, which is on the outlet side and includes the outlet, may gradually decrease in flow passage area toward the outlet side.

[0011] With this arrangement, because the pressure of the fluid flowing toward the outlet is increased, the fluid is discharged from the outlet while the force generated at the time of the ejection from the yarn running space is maintained to some degree. Therefore, the effect of sucking assistance with use of the fluid ejection from the duct member is enhanced. As a result, the oil mist is further effectively collectable.

[0012] In the present invention, the duct member may have at least one guide surface provided to intersect with

an extending direction in which the yarn running space extends, and an end portion on the inlet side of the at least one guide surface may be positioned outside the yarn running space in the extending direction.

[0013] With this arrangement, the ejected stream ejected from each of the both ends of the yarn running space is easily taken into the duct member.

[0014] In the present invention, a part of the at least one guide surface, which is on the inlet side and includes an end portion on the inlet side, may extend toward the outside of the yarn running space in the extending direction and toward the outlet side.

[0015] With this arrangement, because the ejected stream from the yarn running space is facilitated to flow toward the outlet side by the at least one guide surface, the disturbance of the flow due to the collision with the at least one guide surface is suppressed.

[0016] In the present invention, the at least one guide surface may be curved from the end portion on the inlet side toward the end portion on the outlet side.

[0017] When the at least one guide surface has corners, the flow of the fluid tends to be disturbed by the corners. In this regard, because the at least one guide surface is a curved surface, the flow of the fluid is smooth.

[0018] In the present invention, the guide surfaces may be provided as a pair on respective sides of the yarn running space in the extending direction, and the paired guide surfaces may be plane-symmetric about the center of the yarn running space in the extending direction.

[0019] With this arrangement, the flow of the fluid in the duct member tends to be symmetric, and the flow is less likely to be disturbed.

[0020] In the present invention, a suction passage communicating with the suction port may be formed between an inner surface of the housing and an outer surface of the duct member.

[0021] With this arrangement, because the oil mist which is not taken into the duct member is also sucked from the suction port through the suction passage, the oil mist is further effectively collectable.

[0022] In the present invention, the duct member may be movable between a separated position where the duct member is far from the yarn processing apparatus and a near position where the duct member is close to the yarn processing apparatus as compared to the separated position.

[0023] As the distance between the duct member and the yarn processing apparatus is decreased, an amount of the collected oil mist is increased. In this case, however, the duct member disturbs yarn threading to the yarn processing apparatus. Therefore, as described above, the duct member is configured to be movable so that the collection efficiency of the oil mist and the yarn threading are both facilitated.

[0024] In the present invention, the housing may have an opening portion through which the yarn passes, and a door may be provided to change an aperture area of the opening portion.

[0025] As the opening portion provided in the housing is small, a leakage amount of the oil mist from the housing is decreased. In this case, however, it is difficult to thread the yarn through the opening portion in the yarn threading to the yarn processing apparatus. Therefore, as described above, the door is provided at the opening portion to facilitate both the decrease in leakage of the oil mist and the yarn threading.

[0026] A yarn processing mechanism of the present invention includes: a yarn processing apparatus performing a predetermined process for a yarn by ejecting fluid into a yarn running space where the yarn to which oil has been applied runs; and any one of the oil recovery apparatuses described above.

[0027] In the yarn processing mechanism configured as such, the oil mist scattering from the yarn processing apparatus is effectively collectable with low cost as described above.

[0028] In the present invention, the yarn processing apparatus may include: a yarn processing unit where the yarn running space is formed; a supporting member supporting the yarn processing unit; and a jet guide member provided outside the yarn processing unit in the extending direction in which the yarn running space extends, and the jet guide member may protrude from the supporting member toward the guide member.

[0029] With this arrangement, because the ejected stream from the yarn running space is guided to the guide member by the jet guide member, the oil mist is further effectively collectable.

[0030] In the present invention, the jet guide member protruding from the supporting member may be inclined away from the yarn running space in the extending direction.

[0031] With this arrangement, because the ejected stream from the yarn running space is facilitated to flow toward the guide member by the jet guide member, the disturbance of the flow due to the collision with the jet guide member is suppressed.

[0032] In the present invention, the jet guide member may have a guide groove in which the yarn is inserted.

[0033] With this arrangement, because the jet guide member can be also used as a yarn guide member, increase in the number of components is suppressed.

[0034] A spun yarn take-up apparatus of the present invention includes: an oil applicator configured to apply oil to a yarn; and any one of the yarn processing mechanisms described above, which is provided downstream of the oil applicator in a yarn running direction.

[0035] In the spun yarn take-up apparatus configured as such, the oil mist scattering from the yarn processing apparatus is effectively collectable with low cost as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

FIG. 1 is a schematic diagram of a spun yarn take-up apparatus including an interlace imparting mechanism according to an embodiment.
FIG. 2 is a perspective view of an interlacing device.
FIG. 3 is a cross section of the interlace imparting mechanism including an oil recovery apparatus.
FIG. 4 is a cross section of the interlace imparting mechanism including the oil recovery apparatus.
FIG. 5 is a perspective view of a duct member.
FIG. 6 shows a flow of air in the interlace imparting mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Spun Yarn Take-Up Apparatus)

[0037] The following will describe an embodiment of the present invention. FIG. 1 is a schematic diagram of a spun yarn take-up apparatus including an interlace imparting mechanism according to the present embodiment. Hereinafter, upward, downward, forward, and rearward directions shown in FIG. 1 will be referred to as upward, downward, forward, and rearward directions of the spun yarn take-up apparatus 1.

[0038] The spun yarn take-up apparatus 1 takes up synthetic fiber yarns Y spun out from a spinning apparatus 100 and forms packages P by winding the yarns Y onto bobbins B, respectively. The spun yarn take-up apparatus 1 includes an oil guide 2 (which corresponds to an oil applicator of the present invention), a drawing unit 3, a first take-up roller 4, an interlace imparting mechanism 5 (which corresponds to a yarn processing mechanism of the present invention), a second take-up roller 6, and a winding device 7. From the spinning apparatus 100, polymer which is supplied from a polymer supplier (not illustrated) formed of a gear pump or the like is pushed out downward through an unillustrated spinneret.

[0039] While being lined up in the direction vertical to the plane of FIG. 1, the yarns Y spun out from the spinning apparatus 100 run on a yarn path which passes the oil guide 2, the drawing unit 3, the first take-up roller 4, the interlace imparting mechanism 5, and the second take-up roller 6. The yarns Y are distributed in the front-rear direction from the second take-up roller 6, and are then wound onto the respective bobbins B at the winding device 7.

[0040] To the yarns Y spun out from the spinning apparatus 100, oil is applied at the oil guide 2. The yarns Y are then sent to the drawing unit 3. While the oil guide 2 of the present embodiment is provided between the spinning apparatus 100 and the drawing unit 3 in a yarn running direction, the oil guide 2 can be provided at a desired position provided upstream of a later-described interlacing device 20 in the yarn running direction. The drawing unit 3 accommodates unillustrated heating rollers in a heat retaining box. By the heating rollers, the drawing unit 3 draws the yarns Y spun out from the spinning apparatus 100, while heating them.

[0041] The yarns Y drawn by the drawing unit 3 are sent to the winding device 7 by the first take-up roller 4 and the second take-up roller 6. Between the first take-up roller 4 and the second take-up roller 6, the interlace imparting mechanism 5 having the interlacing device 20 (which corresponds to the yarn processing apparatus of the present invention) configured to interlace filaments which form each yarn Y is provided. In this regard, the interlace imparting mechanism 5 can be provided at a desired position provided downstream of the oil guide 2 in the yarn running direction. For example, the interlace imparting mechanism 5 may be provided between the drawing unit 3 and the first take-up roller 4 as indicated by broken lines in FIG. 1. The interlacing device 20 and the interlace imparting mechanism 5 will be detailed later.

[0042] The winding device 7 includes a base 11, a turret 12, two bobbin holders 13, a supporting frame 14, a contact roller 15, and a traverse unit 16. The winding device 7 simultaneously winds the yarns Y sent from the second take-up roller 6 onto the bobbins B by rotating the bobbin holders 13, so as to form packages P.

[0043] The disc-shaped turret 12 is attached to the base 11. The turret 12 is rotationally driven by an unillustrated motor. The two cylindrical bobbin holders 13 are cantilevered by the turret 12 so as to extend in the front-rear direction. To each bobbin holder 13, the bobbins B are attached along the axial direction (front-rear direction) so as to be side by side. The two bobbin holders 13 are movable between an upper winding position and a lower retracted position as the turret 12 rotates.

[0044] The supporting frame 14 extends in the front-rear direction, and is fixed to the base 11 at the rear end portion of the supporting frame 14. A roller supporting member 17 extending in the front-rear direction is attached to a lower portion of the supporting frame 14 so as to be vertically movable relative to the supporting frame 14. The roller supporting member 17 rotatably supports the contact roller 15 extending in the front-rear direction. This contact roller 15 applies a predetermined contact pressure to the packages P so that the shape of the packages P is adjusted.

[0045] The traverse unit 16 is provided at the roller supporting member 17. The traverse unit 16 includes traverse guides 16a lined up in the front-rear direction. The traverse guides 16a are driven by an unillustrated motor, and are configured to reciprocate in the front-rear direction. As each traverse guide 16a to which the yarn Y is threaded reciprocates, the yarn Y is wound onto the corresponding bobbin B while being traversed about a fulcrum guide 18.

(Interlacing Device)

[0046] FIG. 2 is a perspective view of the interlacing device 20. An extending direction in FIG. 2 indicates the direction in which a later-described yarn running space 24a extends. An arrangement direction indicates the direction in which yarns Y are lined up and which is orthog-

onal to the extending direction. A height direction indicates the direction orthogonal to both the extending direction and the arrangement direction. In the present specification, one side in the height direction (upper side in FIG. 2) is referred to as an upper side while the other side (lower side in FIG. 2) is referred to as a lower side for the sake of convenience. However, the upper and lower sides in the height direction may not necessarily match with the upper and lower sides in the vertical direction (upper and lower sides in FIG. 1).

[0047] The interlacing device 20 interlaces the yarns Y with compressed air (i.e., one example of fluid in the present invention). The interlacing device 20 includes a supporting member 21, an interlacing portion 22 (which corresponds the yarn processing unit of the present invention), and two yarn guide members 23 (which correspond to a jet guide member of the present invention). The supporting member 21 supports the interlacing portion 22 and the two yarn guide members 23. The two yarn guide members 23 and plural interlacing pieces 24 forming the interlacing portion 22 protrude from the supporting member 21 toward the same side in the height direction (i.e., upward).

[0048] The interlacing portion 22 is formed by the interlacing pieces 24 which are lined up in the arrangement direction. In each interlacing piece 24, the yarn running space 24a is formed to penetrate the interlacing piece 24 in the extending direction. The yarn Y runs in this yarn running space 24a. At a gap between upper portions of two adjacent interlacing pieces 24, a yarn insertion passage 24b is formed in order to insert the yarn Y into the yarn running space 24a. At a central portion of each interlacing piece 24 in the extending direction, an injection port (not illustrated) from which compressed air is ejected toward the corresponding yarn running space 24a is formed. As the yarn Y running in the yarn running space 24a is influenced by the compressed air ejected from the injection port, the yarn Y is interlaced. This compressed air is ejected as an ejected stream from each of both ends of the yarn running space 24a.

[0049] The two yarn guide members 23 are provided on the respective sides of the interlacing portion 22 in the extending direction, so as to be separated from the interlacing portion 22. Each yarn guide member 23 protrudes from the supporting member 21, and has a wall shape extending in the arrangement direction. The yarn guide member 23 does not protrude vertically upward from the supporting member 21, but protrudes from the supporting member 21 while being inclined away from the interlacing portion 22 in the extending direction. The yarn guide member 23 has guide grooves 23a provided at regular intervals in the arrangement direction. Each guide groove 23a is an open-top slit in shape. As the yarns Y are inserted into the respective guide grooves 23a, the yarn path of each yarn Y is defined in the interlacing device 20.

[0050] Although not shown in FIG. 2, a yarn threading assisting member 25 (see FIG. 3 and FIG. 4) which is used at the time of yarn threading is provided in the interlacing device 20. The yarn threading assisting member 25 is a round-bar member extending in the arrangement direction. One end portion of the yarn threading assisting member 25 is fixed to an arm 26, and attached to the supporting member 21 via the arm 26. While the yarn threading assisting member 25 is cantilevered in the present embodiment, the yarn threading assisting member 25 may be supported at both sides. The arm 26 is swingable about a fulcrum 27. Because of this, the yarn threading assisting member 25 is movable between a lower position shown in FIG. 3 and an upper position shown in FIG. 4.

(Oil recovery apparatus)

[0051] In the interlacing device 20 structured as above, ejection of the compressed air blows off a part of the oil adhering to each yarn Y. As a result, oil mist is generated. If such oil mist scatters from the interlacing device 20 with a stream ejected from the yarn running space 24a, the oil mist may adhere to a resin member and deteriorate the resin member or may adhere to the yarn Y or a package P and deteriorate the yarn quality. Therefore, an oil recovery apparatus 30 is provided in the interlace imparting mechanism 5 to collect the oil mist scattering from the interlacing device 20.

[0052] FIG. 3 and FIG. 4 are cross sections of the interlace imparting mechanism 5 including the oil recovery apparatus 30. To be more specific, FIGs. 3 and 4 are cross sections taken along the direction orthogonal to the arrangement direction. FIG. 3 shows a later-described duct member 32 at a near position where the duct member 32 is close to the interlacing device 20, and FIG. 4 shows the duct member 32 at a separated position where the duct member 32 is far from the interlacing device 20. FIG. 5 is a perspective view of the duct member 32.

[0053] As shown in FIG. 3 and FIG. 4, the oil recovery apparatus 30 includes a housing 31 and the duct member 32 (which corresponds to a guide member of the present invention). The housing 31 is a box-shaped member which accommodates the interlacing device 20 and the duct member 32. At an upper end portion of the housing 31, a suction port 31a connected to a suction device 101 is provided. The suction port 31a is a nozzle extending in the height direction, and an upward suction force is generated at this port. The interlacing device 20 is provided at a lower portion of the housing 31, and the duct member 32 is provided above the interlacing device 20. While the interlacing device 20 is fixed, the duct member 32 is movable in the height direction as described later. A suction passage 49 communicating with the suction port 31a is formed between an inner surface of the housing 31 and an outer surface of the duct member 32. The oil recovery apparatus 30 collects oil mist scattering from the interlacing device 20, by sucking the oil mist from the suction port 31a through the duct member 32 or the suc-

tion passage 49.

[0054] The housing 31 has an opening portion 31b through which yarns Y are introduced into the housing 31 and an opening portion 31c through which the yarns Y are discharged to the outside of the housing 31. Doors 33 and 34 capable of changing aperture areas of the opening portions 31b and 31c are provided at the opening portions 31b and 31c.

[0055] The duct member 32 has a function of guiding an ejected stream from each yarn running space 24a of the interlacing device 20 to the suction port 31a, and is provided to cover the interlacing device 20. As shown in FIG. 5, the duct member 32 is a hollow member formed of four side surfaces 35 to 38 and extends in the height direction. An inlet 32a into which the stream is taken is provided at a lower end of the duct member 32, and an outlet 32b from which the stream is discharged toward the suction port 31a is provided at an upper end of the duct member 32. The inlet 32a includes the entire interlacing device 20 when viewed in the height direction. The outlet 32b is positioned so as to oppose the suction port 31a, and an aperture area of the outlet 32b is smaller than that of the inlet 32a.

[0056] The paired side surfaces 35 and 36 which oppose each other in the extending direction are equal to guide surfaces of the present invention. Hereinafter, these surfaces are referred to as guide surfaces 35 and 36. The guide surfaces 35 and 36 are provided to intersect with the extending direction of the yarn running space 24a. The paired side surfaces 37 and 38 which oppose each other in the arrangement direction are flat surfaces which are parallel to the surface orthogonal to the arrangement direction. As shown in FIG. 5, a slider 39 is fixed to the side surface 38. A rail member 40 extending in the height direction is fixed to the inner surface of the housing 31, and the slider 39 is slidably engaged with the rail member 40. Because of this, the duct member 32 is movable in the height direction between the near position (i.e., position shown in FIG. 3) and the separated position (i.e., position shown in FIG. 4). The movement of the duct member 32 may be manually performed by an operator, or a driving device configured to move the duct member 32 may be provided.

[0057] It is preferable to provide means for positioning the duct member 32 at the near position and at the separated position. For example, the duct member 32 may be positioned at the near position such that the lower end of the duct member 32 makes contact with an unillustrated stopper provided in the interlacing device 20. In addition to that, the duct member 32 may be positioned at the separated position by engagement between the housing 31 and the duct member 32 with use of engagement means such as a latch. Of course, the duct member 32 may be positioned by using other positioning means.

[0058] The paired guide surfaces 35 and 36 are curved surfaces when viewed in the arrangement direction, and are plane-symmetric about the center of the interlacing device 20 (i.e., yarn running space 24a) in the extending direction. Lower end portions of the guide surfaces 35 and 36 partially overlap the yarn guide members 23 when viewed in the extending direction. To be more specific, in the height direction, the lower ends of the guide surfaces 35 and 36 are lower than upper ends of the yarn guide members 23 and are upper than lower ends of the guide grooves 23a. The lower end portions of the guide surfaces 35 and 36 are provided outside the yarn running space 24a and, specifically, outside the upper end portions of the yarn guide members 23 in the extending direction. Because of this, an ejected stream from the yarn running space 24a is easily taken into the duct member 32.

[0059] Parts of the guide surfaces 35 and 36, which are on the lower side (i.e., the inlet 32a side) and which include the lower end portions, are first curved portions 35a and 36a which extend upward (i.e., toward the outlet 32b side) and away from the interlacing portion 22 in the extending direction. The first curved portions 35a and 36a are curved outward in the extending direction of the interlacing portion 22. Parts of the guide surfaces 35 and 36, which are on the upper side and which include the upper end portions, are second curved portions 35b and 36b which extend upward and toward each other. The second curved portions 35b and 36b are curved inward in the extending direction of the interlacing portion 22. The first curved portion 35a and the second curved portion 35b are continuous with each other, and the first curved portion 36a and the second curved portion 36b are also continuous with each other.

[0060] In the duct member 32, the first curved portions 35a and 36a gradually increase the flow passage area (i.e., area of the duct member 32 in a cross section orthogonal to the height direction) from the bottom to an intermediate part. In addition to that, the second curved portions 35b and 36b gradually decrease the flow passage area from the intermediate part to the top in the duct member 32. In this regard, the directions of respective tangents to the lower end portions of the first curved portions 35a and 36a are substantially identical with inclinations of the yarn guide members 23.

(Yarn Threading)

[0061] The following will describe a process in yarn threading to the interlacing device 20 accommodated in the housing 31, with reference to FIG. 3 and FIG. 4. A surface of the housing 31, which is close to the viewer of FIG. 3 and FIG. 4, is a door (not illustrated) which is openable and closeable. The yarn threading to the interlacing device 20 is executable by opening the door.

[0062] When the yarn threading is started, the duct member 32 is moved to the separated position where the duct member 32 is far from the interlacing device 20 as shown in FIG. 4. Subsequently, the doors 33 and 34 are opened, and the yarn threading assisting member 25 is moved to the upper position. When the doors 33 and 34 are open, the aperture areas of the opening portions 31b

and 31c are at the maximum. This makes it easy to thread yarns Y through the opening portions 31b and 31c in the yarn threading.

[0063] After that, by using an unillustrated suction gun, the yarns Y are wound onto the first take-up roller 4 (see FIG. 1) and then introduced into the housing 31 through the opening portion 31b. Subsequently, the yarns Y are wound onto the yarn threading assisting member 25, discharged to the outside of the housing 31 through the opening portion 31c, and wound onto the second take-up roller 6. As the yarn threading assisting member 25 is moved down to the lower position in this state, the yarns Y are inserted into the respective guide grooves 23a of the yarn guide members 23 as shown in FIG. 3.

[0064] The duct member 32 is then moved down to the near position where the duct member 32 is close to the interlacing device 20, so as to cover the interlacing device 20. Lastly, the yarn threading to the interlacing device 20 is completed by closing the doors 33 and 34. Once the doors 33 and 34 are closed, the aperture areas of the opening portions 31b and 31c are changed to be at the minimum for the yarns Y to pass through. As a result, leakage of the oil mist is suppressed.

(Flow of Air)

[0065] FIG. 6 shows a flow of air in the interlace imparting mechanism 5, and indicates the flow by arrows. An ejected stream ejected from each of the both ends of the yarn running space 24a of the interlacing device 20 flows along the extending direction and collides with one of the yarn guide members 23. The ejected stream which has collided with one of the yarn guide members 23 cannot flow downward because of existence of the supporting member 21. Most of the ejected stream therefore flows upward, and flows into the duct member 32 through the inlet 32a. At this time, because the yarn guide members 23 are inclined upward and outward, the ejected stream having collided with one of the yarn guide members 23 is facilitated to flow upward. As a result, disturbance of the flow due to collision with the yarn guide members 23 is suppressed.

[0066] The ejected stream flowing into the duct member 32 flows mainly along one of the guide surfaces 35 and 36. Because the first curved portions 35a and 36a are inclined outward, the flow flowing upward and outward along one of the yarn guide members 23 is smoothly guided upward. Because the second curved portions 35b and 36b extend toward the outlet 32b and toward each other, the flow passage area inside the duct member 32 gradually decreases. This increases the pressure of the air flowing toward the outlet 32b, and thus the force generated at the time of ejection from the yarn running space 24a is maintained to some degree. As a result, the air is powerfully discharged from the outlet 32b toward the suction port 31a. Because such ejection of the air from the outlet 32b of the duct member 32 can be used for assisting the suction by the suction port 31a of the housing 31, the oil mist is efficiently collectable.

[0067] Meanwhile, oil mist scattering from the interlacing device 20 partially leaks out to the outside of the duct member 32 from gaps between the yarn guide members 23 and the duct member 32 or through the guide grooves 23a of the yarn guide members 23. However, because the suction passage 49 is formed between the housing 31 and the duct member 32, the oil mist which is not taken into the duct member 32 is also collected after being guided to the suction port 31a with the flow of the air in the suction passage 49. At this time, because the air is powerfully discharged from the outlet 32b as described above, the air in the suction passage 49 is sucked by the negative pressure. Therefore, the oil mist floating in the suction passage 49 is preferably collectable.

(Effects)

[0068] In the present embodiment, the suction port 31a is provided in the housing 31 which accommodates the interlacing device 20. The oil mist scattering from the interlacing device 20 is collected through the suction port 31a. However, when the housing 31 is simply provided, the oil mist stagnates in the housing 31 in a case where the suction force of the suction device 101 is insufficient. The oil mist stagnating at around the yarns Y disadvantageously leaks out to the outside of the housing 31 with an accompanied flow. In this regard, if the capability of the suction device 101 is enhanced in order to suppress the leakage of the oil mist, a large cost increase may occur. Therefore, a guide member (i.e., the duct member 32) is provided in the present embodiment to guide the ejected stream from the yarn running space 24a to the suction port 31a. With this arrangement, because the oil mist is guided to the suction port 31a by using the force of the ejected stream from the yarn running space 24a, the oil mist is effectively collectable with low cost.

[0069] In the present embodiment, the guide member is the duct member 32 having the inlet 32a into which the ejected stream is taken and the outlet 32b from which the ejected stream is discharged toward the suction port 31a. With this arrangement, because the ejected stream is reliably guided to the suction port 31a by the duct member 32, the oil mist is further effectively collectable. In this regard, the ejection of the air from the outlet 32b of the duct member 32 can be used for assisting the suction by the suction port 31a of the housing 31.

[0070] In the present embodiment, a part of the duct member 32, which is on the outlet 32b side and which includes the outlet 32b, gradually decreases in flow passage area toward the outlet 32b side. With this arrangement, because the pressure of the air flowing toward the outlet 32b is increased, the air is discharged from the outlet 32b while the force generated at the time of the ejection from the yarn running space 24a is maintained to some degree. Therefore, the effect of sucking assistance with use of the air ejection from the duct member 32 is enhanced. As a result, the oil mist is further effec-

tively collectable.

[0071] In the present embodiment, the duct member 32 includes the guide surfaces 35 and 36 provided to intersect with the extending direction of the yarn running space 24a, and the end portions on the inlet 32a side of the guide surfaces 35 and 36 are positioned outside the yarn running space 24a in the extending direction. With this arrangement, the ejected stream ejected from each of the both ends of the yarn running space 24a is easily taken into the duct member 32.

[0072] In the present embodiment, parts of the guide surfaces 35 and 36, which are on the inlet 32a side and which include the end portions on the inlet 32a side, extend toward the outlet 32b side and toward the outside of the yarn running space 24a in the extending direction. With this arrangement, because the ejected stream from the yarn running space 24a is facilitated to flow toward the outlet 32b side by the guide surfaces 35 and 36, the disturbance of the flow due to the collision with the guide surfaces 35 and 36 is suppressed.

[0073] In the present embodiment, the guide surfaces 35 and 36 are curved from the end portions on the inlet 32a side toward the end portions on the outlet 32b side. When the guide surfaces 35 and 36 have corners, the flow of the air tends to be disturbed by the corners. In this regard, because the guide surfaces 35 and 36 are curved surfaces, the flow of the air is smooth.

[0074] In the present embodiment, the paired guide surfaces 35 and 36 are plane-symmetric about the center of the yarn running space 24a in the extending direction. With this arrangement, the flow of the air in the duct member 32 tends to be symmetric, and the flow of the air is less likely to be disturbed.

[0075] In the present embodiment, the suction passage 49 communicating with the suction port 31a is formed between the inner surface of the housing 31 and the outer surface of the duct member 32. With this arrangement, because the oil mist which is not taken into the duct member 32 is also sucked from the suction port 31a through the suction passage 49, the oil mist is further effectively collectable.

[0076] In the present embodiment, the duct member 32 is movable between the separated position where the duct member 32 is far from the interlacing device 20 and the near position where the duct member 32 is close to the interlacing device 20 as compared to the separated position. As the distance between the duct member 32 and the interlacing device 20 is decreased, an amount of the collected oil mist is increased. In this case, however, the duct member 32 disturbs the yarn threading to the interlacing device 20. Therefore, as described above, the duct member 32 is configured to be movable so that the collection efficiency of the oil mist and the yarn threading are both facilitated.

[0077] In the present embodiment, the housing 31 has the opening portions 31b and 31c through which the yarns Y pass, and the doors 33 and 34 are provided to change the aperture areas of the opening portions 31b and 31c. As the opening portions 31b and 31c provided in the housing 31 are small, a leakage amount of the oil mist from the housing 31 is decreased. In this case, however, it is difficult to thread the yarns Y through the opening portions 31b and 31c in the yarn threading to the interlacing device 20. Therefore, as described above, the doors 33 and 34 are provided at the opening portions 31b and 31c to facilitate both the decrease in leakage of the oil mist and the yarn threading.

[0078] In the present embodiment, the interlacing device 20 includes the interlacing portion 22 where the yarn running space 24a is formed, the supporting member 21 supporting the interlacing portion 22, and the jet guide member (i.e., the yarn guide members 23) provided outside the interlacing portion 22 in the extending direction of the yarn running space 24a. In this regard, the yarn guide members 23 protrudes from the supporting member 21 toward the guide member (i.e., the duct member 32). With this arrangement, because the ejected stream from the yarn running space 24a is guided to the guide member (i.e., duct member 32) by the jet guide member (i.e., the yarn guide members 23), the oil mist is further effectively collectable.

[0079] In the present embodiment, the jet guide member (i.e., yarn guide members 23) protruding from the supporting member 21 is inclined away from the yarn running space 24a in the extending direction. With this arrangement, because the ejected stream from the yarn running space 24a is facilitated to flow toward the guide member (i.e., duct member 32) by the jet guide member (i.e., yarn guide members 23), the disturbance of the flow due to the collision with the jet guide member (i.e., yarn guide members 23) is suppressed.

[0080] In the present embodiment, the jet guide member (i.e., yarn guide members 23) have the guide grooves 23a in which the yarns Y are inserted. With this arrangement, because the jet guide member can be also used as a yarn guide member, increase in the number of components is suppressed.

(Other Embodiments)

[0081] The following will describe modifications of the above-described embodiment.

[0082] The housing 31 of the embodiment above may be differently arranged. For example, the suction port 31a may be provided at a different position from the upper end portion of the housing 31. Alternatively, plural suction ports 31a may be provided. The doors 33 and 34 may not be provided at the opening portions 31b and 31c.

[0083] The duct member 32 of the present embodiment may be differently arranged. For example, the guide surfaces 35 and 36 of the duct member 32 may not be curved. The guide surfaces 35 and 36 may be flat surfaces or bent surfaces. The side surfaces 37 and 38 of the duct member 32 may be curved surfaces. For another example, the duct member 32 may have a straight cylindrical shape or straight square-tube shape, may be a

hollow member which is circular frustum or truncated pyramid in shape, or may be shaped as a pipe which is bent at an intermediate part of the pipe. The direction in which the duct member 32 extends may be suitably changed. Although the position of the outlet 32b in the duct member 32 may be differently arranged, it is preferable to provide the outlet 32b so as to oppose the suction port 31a of the housing 31.

[0084] While in the embodiment above the duct member 32 is movable, the duct member 32 may not be movable as long as the yarn threading to the interlacing device 20 is possible. The duct member 32 may be provided as plural parts. Alternatively, a part of the duct member 32, which is on the inlet 32a side or the outlet 32b side, may be provided as plural paths.

[0085] While in the embodiment above the guide member of the present invention is the duct member 32, the guide member may be differently arranged. For example, the guide member may be formed of a single guide plate or plural guide plates (such as the guide surfaces 35 and 36).

[0086] While in the embodiment above the yarn guide members 23 of the interlacing device 20 protrude from the supporting member 21 to be inclined away from the yarn running space 24a, the yarn guide members 23 may extend straight in the height direction. Each yarn guide member 23 may not be a plate member. The yarn guide member 23 may have any shape as long as it protrudes from the supporting member 21.

[0087] In the embodiment above, the spun yarn take-up apparatus 1 includes the drawing unit 3. Alternatively, the present invention may be applied to a spun yarn take-up apparatus which does not include the drawing unit 3.

[0088] The embodiment above has described a case where the yarn processing apparatus of the present invention is the interlacing device 20. Alternatively, an oil recovery apparatus of the present invention may be applied to other yarn processing apparatuses. Examples of other yarn processing apparatuses include, e.g., a migration nozzle configured to uniformize oil applied to a yarn. While the embodiment above has also described an example in which fluid is ejected from each of the both ends of the yarn running space 24a, the yarn processing apparatus of the present invention may be configured so that the fluid is ejected from only one of the both ends of the yarn running space 24a. In this case, the guide surfaces and jet guide member of the present invention may be provided only on the side where the fluid is ejected from the yarn running space 24a.

Claims

1. An oil recovery apparatus (30) configured to collect oil mist scattering from a yarn processing apparatus (20) performing a predetermined process for a yarn (Y) by ejecting fluid into a yarn running space (24a) where the yarn (Y) to which oil has been applied runs, the oil recovery apparatus (30) comprising:

   a housing (31) which accommodates the yarn processing apparatus (20) and has a suction port (31a); and
   a guide member (32) which is provided in the housing (31) to guide an ejected stream from the yarn running space (24a), which is generated by ejection of the fluid, to the suction port (31a).

2. The oil recovery apparatus (30) according to claim 1, wherein, the guide member (32) is a duct member (32) having an inlet (32a) into which the stream is taken and an outlet (32b) from which the stream is discharged toward the suction port (31a).

3. The oil recovery apparatus (30) according to claim 2, wherein, a part of the duct member (32), which is on the outlet (32b) side and includes the outlet (32b), gradually decreases in flow passage area toward the outlet (32b) side.

4. The oil recovery apparatus (30) according to claim 2 or 3, wherein,

   the duct member (32) has at least one guide surface (35, 36) provided to intersect with an extending direction in which the yarn running space (24a) extends, and
   an end portion on the inlet (32a) side of the at least one guide surface (35, 36) is positioned outside the yarn running space (24a) in the extending direction.

5. The oil recovery apparatus (30) according to claim 4, wherein, a part of the at least one guide surface (35, 36), which is on the inlet (32a) side and includes an end portion on the inlet (32a) side, extends toward the outside of the yarn running space (24a) in the extending direction and toward the outlet (32b) side.

6. The oil recovery apparatus (30) according to claim 4 or 5, wherein, the at least one guide surface (35, 36) is curved from the end portion on the inlet (32a) side toward the end portion on the outlet (32b) side.

7. The oil recovery apparatus (30) according to any one of claims 4 to 6, wherein,

   the guide surfaces (35, 36) are provided as a pair on respective sides of the yarn running space (24a) in the extending direction, and
   the paired guide surfaces (35, 36) are plane-symmetric about the center of the yarn running space (24a) in the extending direction.

8. The oil recovery apparatus (30) according to any one

of claims 2 to 7, wherein, a suction passage (49) communicating with the suction port (31a) is formed between an inner surface of the housing (31) and an outer surface of the duct member (32).

9. The oil recovery apparatus (30) according to any one of claims 2 to 8, wherein, the duct member (32) is movable between a separated position where the duct member (32) is far from the yarn processing apparatus (20) and a near position where the duct member (32) is close to the yarn processing apparatus (20) as compared to the separated position.

10. The oil recovery apparatus (30) according to any one of claims 1 to 9, wherein,

the housing (31) has an opening portion (31b, 31c) through which the yarn (Y) passes, and
a door (33, 34) is provided to change an aperture area of the opening portion (31b, 31c).

11. A yarn processing mechanism (5) comprising:

a yarn processing apparatus (20) performing a predetermined process for a yarn (Y) by ejecting fluid into a yarn running space (24a) where the yarn (Y) to which oil has been applied runs; and
the oil recovery apparatus (30) according to any one of claims 1 to 10.

12. The yarn processing mechanism (5) according to claim 11, wherein,
the yarn processing apparatus (20) includes:

a yarn processing unit (22) where the yarn running space (24a) is formed;
a supporting member (21) supporting the yarn processing unit (22); and
a jet guide member (23) provided outside the yarn processing unit (22) in the extending direction in which the yarn running space (24a) extends, and
the jet guide member (23) protrudes from the supporting member (21) toward the guide member (32).

13. The yarn processing mechanism (5) according to claim 12, wherein, the jet guide member (23) protruding from the supporting member (21) is inclined away from the yarn running space (24a) in the extending direction.

14. The yarn processing mechanism (5) according to claim 12 or 13, wherein, the jet guide member (23) has a guide groove (23a) in which the yarn (Y) is inserted.

15. A spun yarn take-up apparatus (1) comprising:

an oil applicator (2) configured to apply oil to a yarn (Y); and
the yarn processing mechanism (5) according to any one of claims 11 to 14, which is provided downstream of the oil applicator (2) in a yarn running direction.

FIG.1

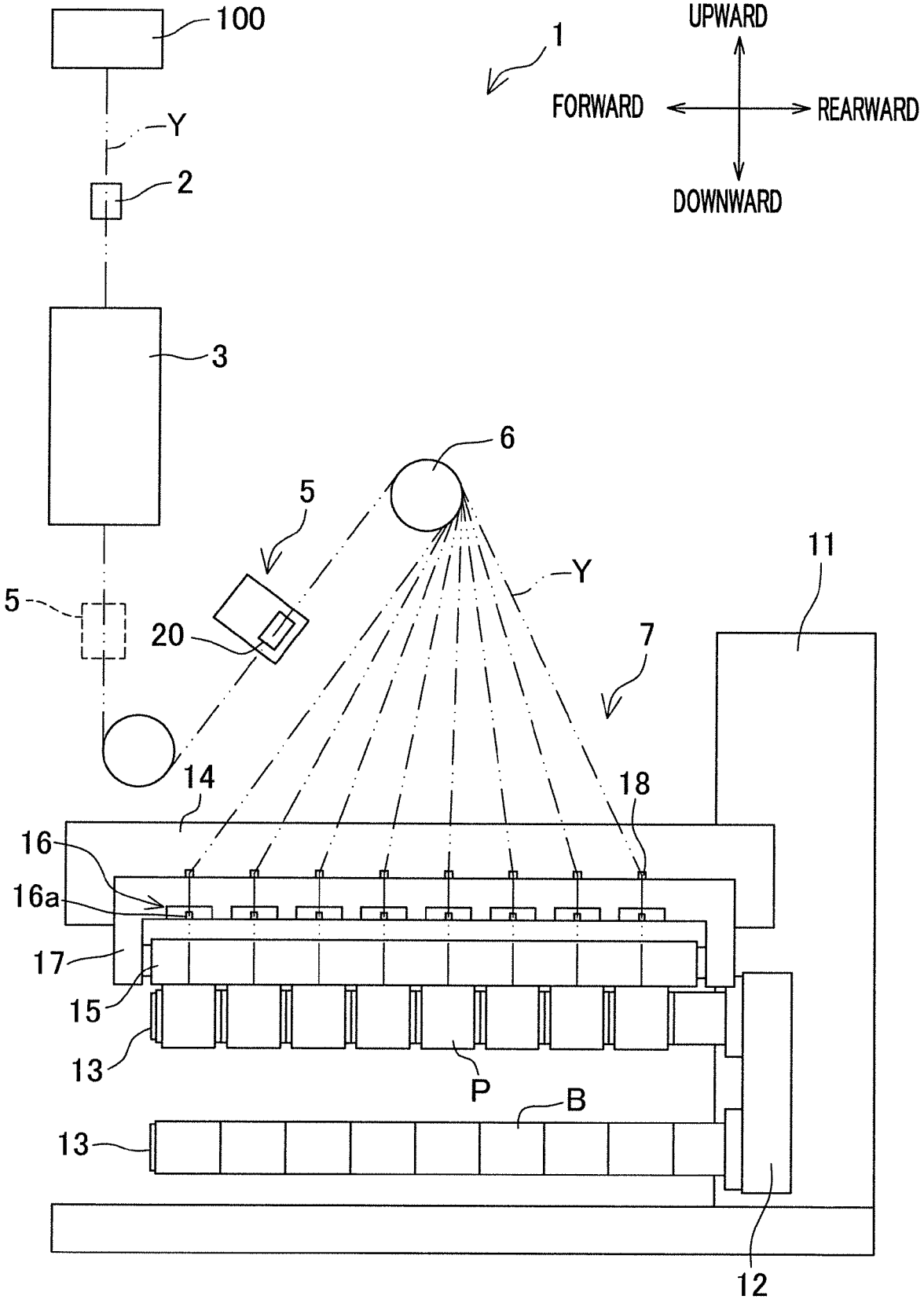

100
1
UPWARD
FORWARD
REARWARD
DOWNWARD
Y
2
3
6
5
5
20
Y
11
7
14
18
16
16a
17
15
13
P
B
13
12

FIG.2

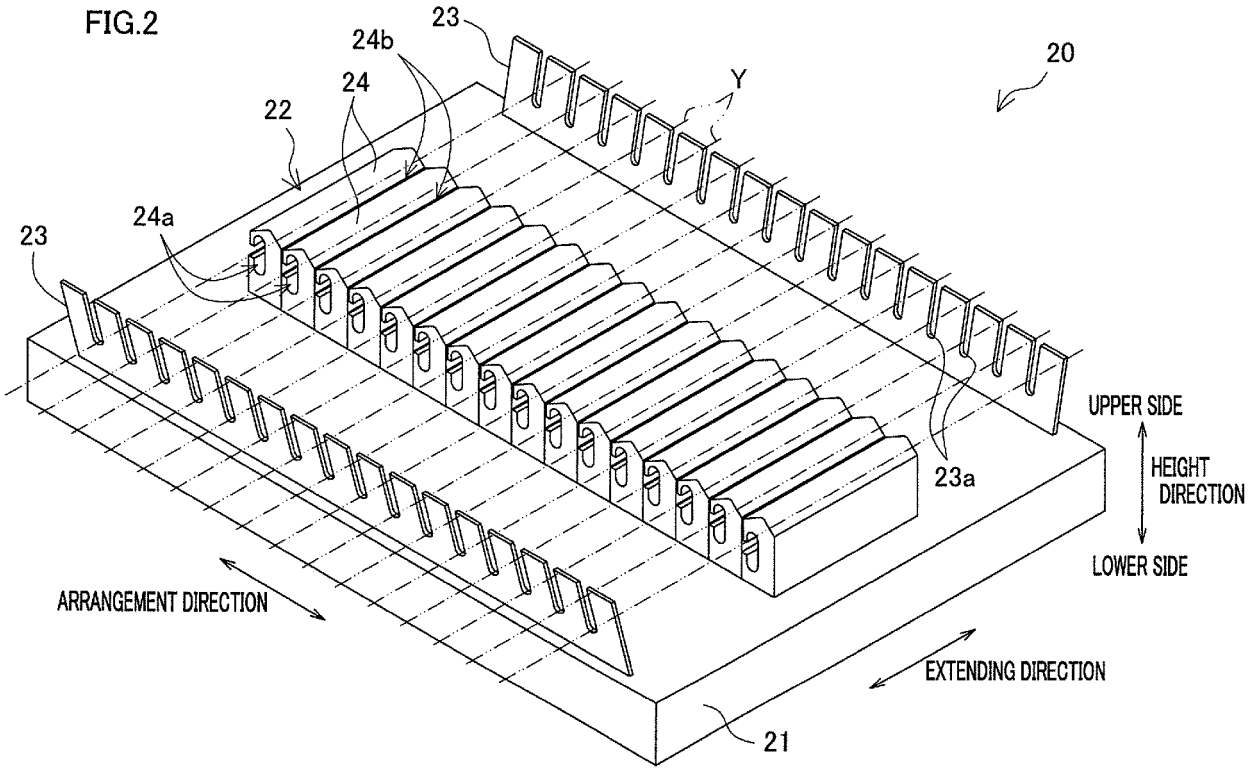

23
24b
24
22
Y
20
24a
23
UPPER SIDE
HEIGHT DIRECTION
23a
LOWER SIDE
ARRANGEMENT DIRECTION
EXTENDING DIRECTION
21

FIG.3

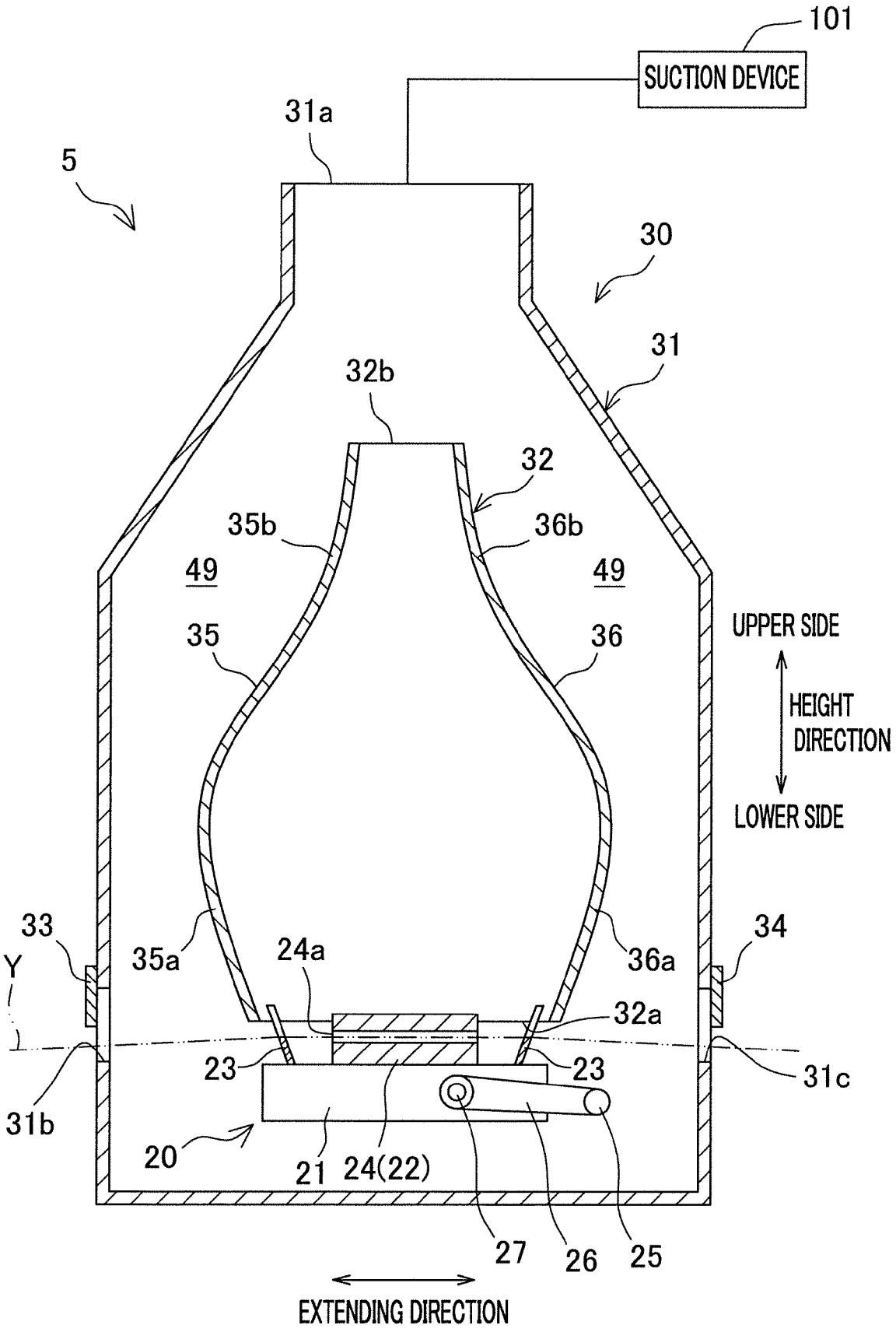

101
SUCTION DEVICE
31a
5
30
31
32b
32
35b
36b
49
49
35
36
UPPER SIDE
HEIGHT DIRECTION
LOWER SIDE
33
34
Y
35a
24a
36a
32a
23
23
31c
31b
20
21
24(22)
27
26
25
EXTENDING DIRECTION

FIG.4

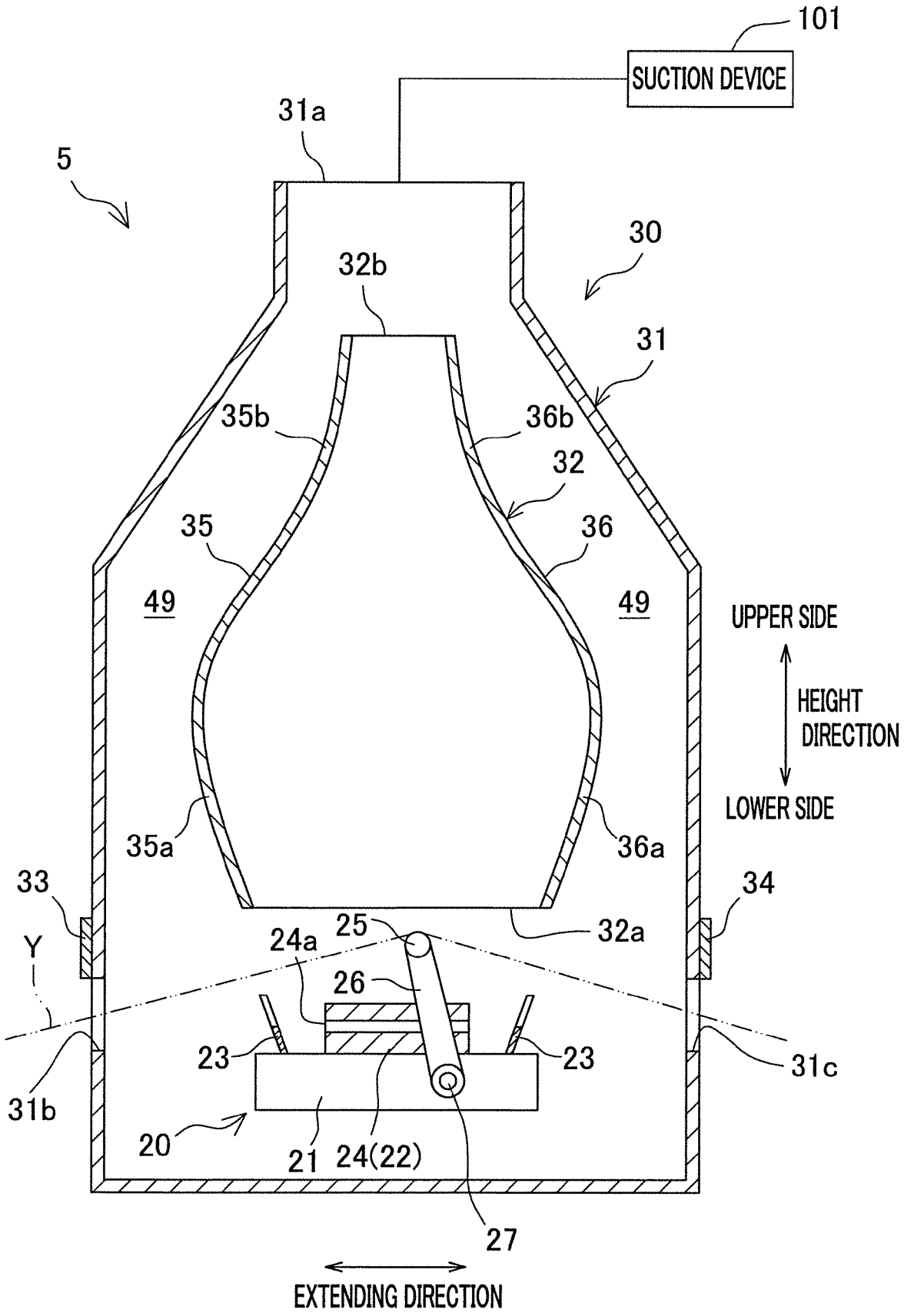
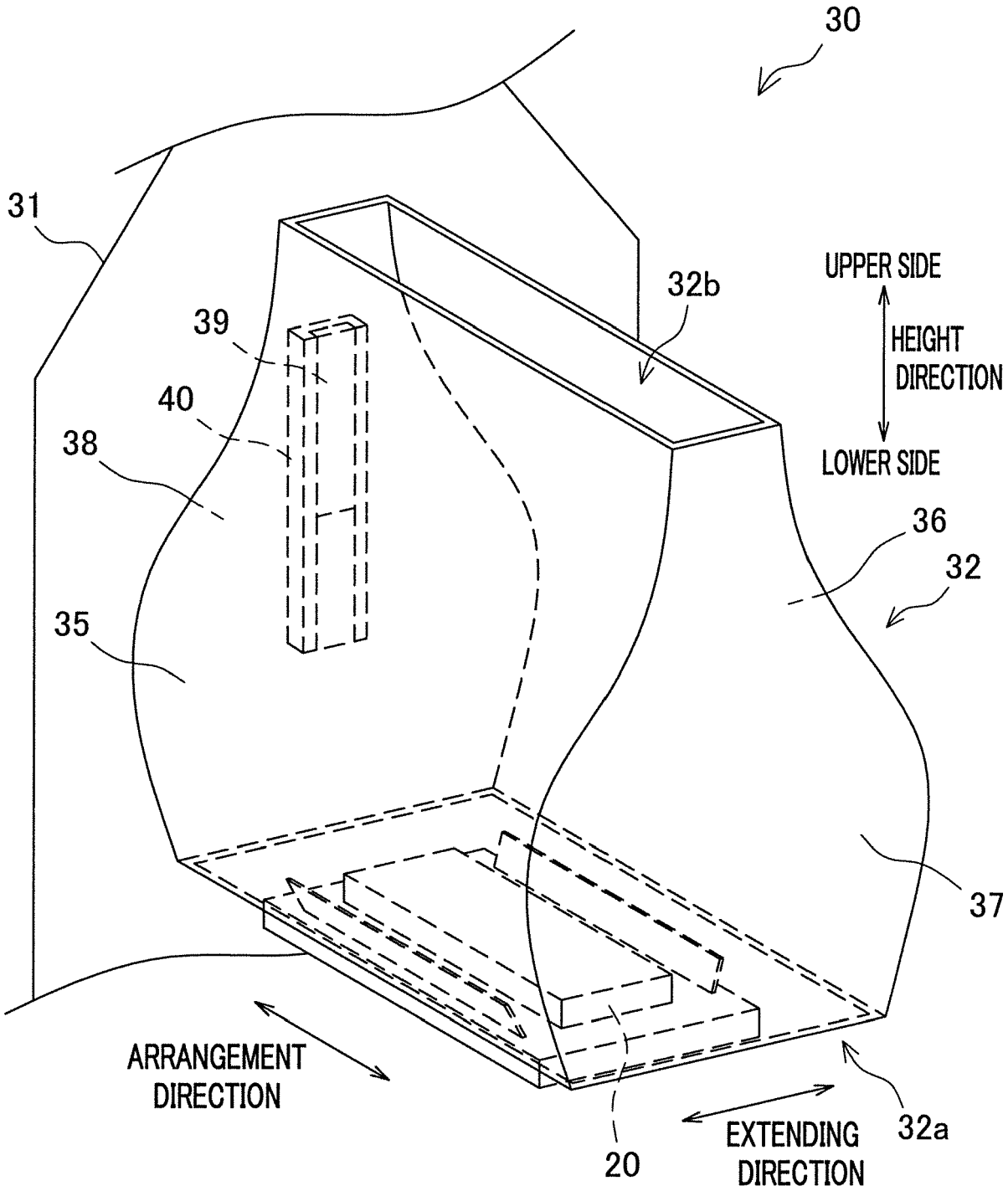

101
SUCTION DEVICE
31a
5
30
32b
31
35b
36b
32
35
36
49
49
UPPER SIDE
HEIGHT DIRECTION
LOWER SIDE
35a
36a
33
34
Y
24a
25
32a
26
23
23
31c
31b
20
21
24(22)
27
EXTENDING DIRECTION

FIG.5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31
32b
UPPER SIDE
HEIGHT DIRECTION
LOWER SIDE
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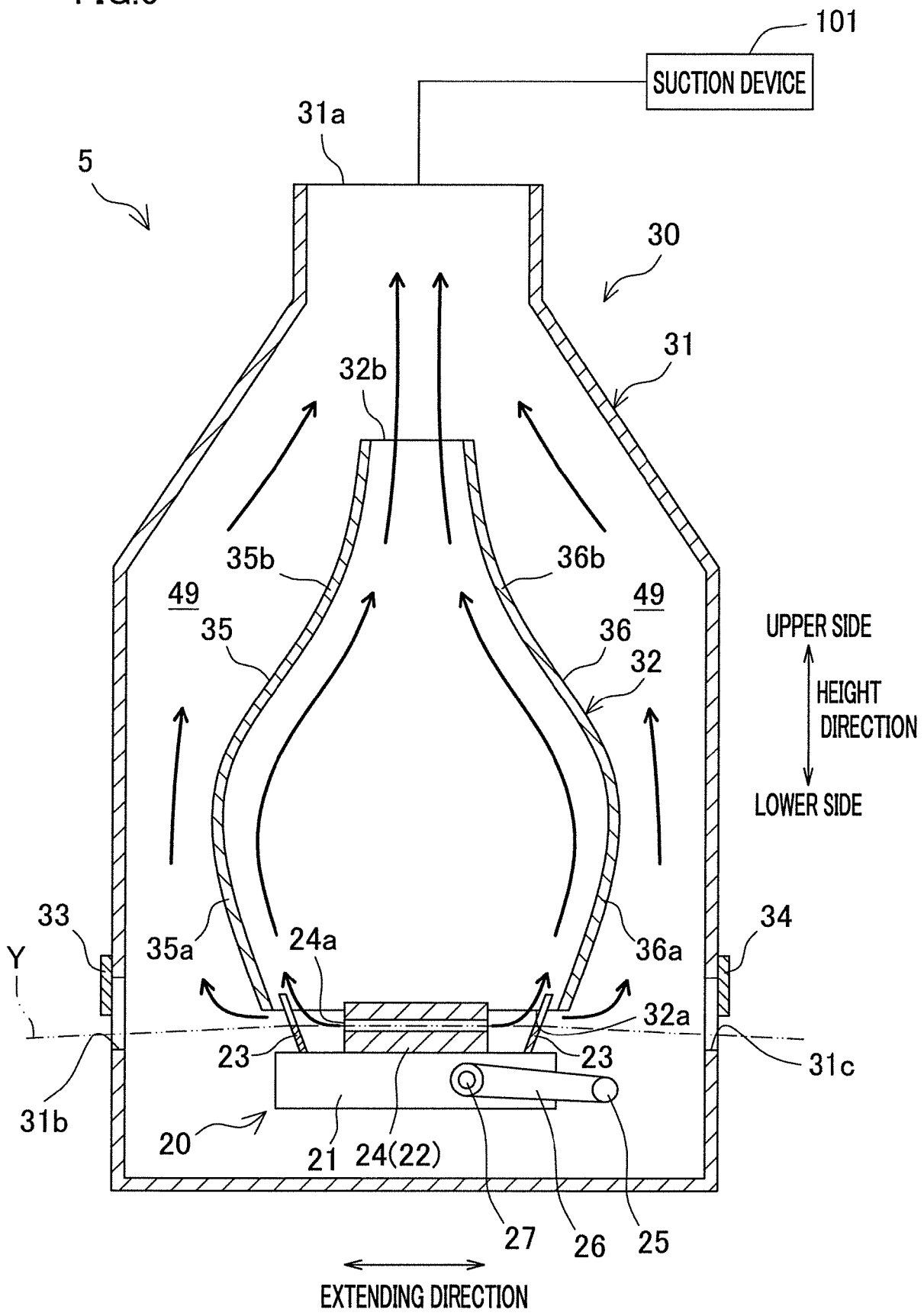
40
38
36
32
35
37
ARRANGEMENT DIRECTION
20
EXTENDING DIRECTION
32a

FIG.6


101
SUCTION DEVICE
31a
5
30
31
32b
35b
36b
49
35
36
49
32
UPPER SIDE
HEIGHT DIRECTION
LOWER SIDE
33
34
Y
35a
24a
36a
32a
23
23
31c
31b
20
21
24(22)
27
26
25
EXTENDING DIRECTION

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EUROPEAN SEARCH REPORT

Application Number
EP 21 19 1677

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	JP S48 23095 B1 (KANEBO CO., LTD.) 11 July 1973 (1973-07-11) * paragraphs [0002], [0003]; figure 1 *	1,6,7, 11,12,15 2-5, 8-10,13, 14	INV. D01D5/096 D01D13/02
A	EP 3 255 185 A1 (TMT MACHINERY INC [JP]) 13 December 2017 (2017-12-13) * paragraphs [0042], [0043], [0057], [0058], [0059]; figures 1,2,4 *	1-15	
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			TECHNICAL FIELDS SEARCHED (IPC) D01D

1 The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 February 2022	Van Beurden-Hopkins

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04-02-2022

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