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(71) Applicant: **MURATA KIKAI KABUSHIKI KAISHA**
Minami-ku
Kyoto-shi
Kyoto 601 (JP)

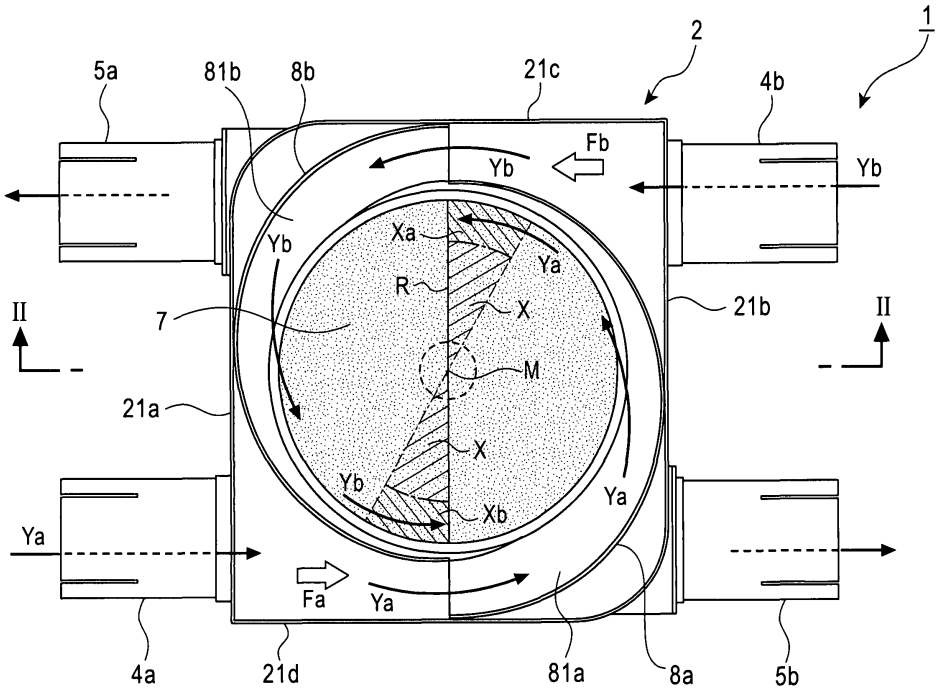
(72) Inventors:
- **Hiroshi, Tsuji**
  Joyo-shi
  Kyoto (JP)
- **Makoto, Tan**
  Uji-shi
  Kyoto (JP)

(74) Representative: **Liedl, Christine et al**
c/o Hansmann & Vogeser,
Albert-Rosshaupter-Strasse 65
81369 München (DE)

(54) Dust collector and travelling cleaner

(57) In a conventional dust collector, an air current flowing into the dust collector is diverged before reaching a filter surface. The air current then passes almost uniformly through the entire filter surface. Impurities thus accumulate almost uniformly all overt the filter surface. This rapidly reduces the effective opening area of the filter to prematurely degrade a dust collecting capability. An object of the present invention is to avoid this problem using a simple configuration. The present invention appropriately configures the shapes and arrangements of guide walls 8a, 8b that guides an air current and of a filter 7 inside a dust collector 1 to reduce the rate of a decrease in the effective opening area of the filter 7 (Fig.1).

FIG. 1



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Description

Field of the Invention

[0001] The present invention relates to a configuration of a dust collector used to remove dust or the like from the air and a traveling cleaner comprising the dust collector.

Background of the Invention

[0002] As means for removing impurities such as dust from the air, dust collectors have been commonly used in which a fan rotates to guide air containing the impurities to a sheet-like filter, which then removes the impurities to exhaust the purified air (see the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 4-281811).

[0003] General dust collectors based on this system are composed of an upstream chamber and a downstream chamber which are separated from each other, and a sheet-like filter provided at the boundary between the upstream chamber and the downstream chamber. Rotation of a fan provided in the downstream chamber allows air to flow into the upstream chamber through a suction port provided in the upstream chamber. The air passes through the filter into the downstream chamber. The filter filters the air to remove impurities from it. The resultant air is exhausted to the outside of the dust collector through an air outlet provided in the downstream chamber.

[0004] With this system, impurities accumulate on the filter, which may thus clog up. This degrades an air supply and exhaust capability achieved under a specified fan driving force, that is, a dust collecting capability. Accordingly, the filter is sometimes cleaned or replaced with a new one to maintain a desired dust collecting capability. In a dust collector installed in a textile machine or the like which generates waste fibers, the dust collector being always operated, the filter is periodically automatically cleaned by a filter accumulated impurities collecting device located outside the dust collector (see the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 7-305240).

[0005] In the above conventional dust collectors, an air current passes almost uniformly through the entire surface of the sheet-like filter. Impurities thus accumulate almost uniformly all over the surface of the filter. This is because before reaching the filter surface, an air flux flowing into the upstream chamber is diffused by being diverged or colliding against a wall surface to scatter. As a result, the effective opening area of the filter decreases sharply to prematurely degrade the air supply and exhaust capability achieved under the specified fan driving force, that is, the dust collecting capability.

[0006] The term "effective opening area of the filter" as used in the present application refers to the area of the fiber surface except a part that has clogged up to prevent air from passing through. The term "fan driving force" refers to energy consumed per unit time to drive the fan. The term "air supply and exhaust capability" refers to the amount of air supplied and exhausted per unit time by the dust collector. The term "dust collecting capability" refers to the amount of impurities caught per unit time by the dust collector.

[0007] As described above, the conventional dust collectors are inconvenient in that the filter must be frequently cleaned or replaced to maintain the desired dust collecting capability. In particular, in the dust collector installed in a textile machine or the like which generates waste fibers, the dust collector being always operated, the dust collecting capability is significantly degraded in a short time. This is disadvantageous.

[0008] To solve this problem, it is possible to improve the air supply and exhaust capability by increasing the fan driving force depending on the level of degradation of the air supply and exhaust capability. However, this method is disadvantageous in that it degrades energy efficiency and requires high costs to improve the performance of the fan.

[0009] A large-sized filter can be used to ensure, for a long time, an effective opening area required to maintain the appropriate dust collecting capability. However, this requires the size of the dust collector to be increased. If the dust collector is to replace one used in an existing dust collecting system, the system needs to be drastically modified. This method is thus disadvantageous in that it cannot sufficiently improve the dust collecting capability in spite of high costs required to produce or modify a dust collector or a dust collecting system or in that it prevents the provision of a space in which the dust collector is installed.

[0010] When impurities accumulating in the filter are to be collected from the outside of the dust collector, the collection requires a long time if the impurities accumulate uniformly all over the filter surface. In particular, the configuration of the dust collector and impurity collecting means such as a suction pipe may limit the area in which the impurities collecting means can approach or contact the filter surface. In this case, it is not easy to collect the impurities accumulated all over the filter surface. For example, if impurities are collected by inserting a recovery pipe into the dust collector from the outside, a very high suction pressure must be exerted in order to reliably collect even impurities accumulated in an area that cannot be directly accessed by the recovery pipe. This is inefficient.

[0011] It is an object of the present invention to provide a dust collector with a new configuration which reduces the rate of a decrease in the effective opening area of the filter in order to avoid the problem of degrading the dust collecting capability. The present invention also facilitates cleaning of the filter.

Summary of the Invention

[0012] A description has been given of the problems to be solved by the present invention. A description will be given of means for solving the problems.

[0013] According to Claim 1, there is provided a dust collector comprising an upstream chamber provided with a suction port, a downstream chamber provided with an air outlet and a fan, a filter provided at a boundary between the upstream chamber and the downstream chamber, and a guide wall provided in the upstream chamber, the dust collector being characterized in that shapes and arrangements of the guide wall and the filter are configured so that an air flux flowing into the upstream chamber through the suction port is guided to a partial area on the filter.

[0014] In a dust collector according to Claim 2, the guide wall joins the suction port with the partial area in a peripheral area of the filter so that a gentle curve that is concave toward the filter is drawn between the suction port and the partial area, and the guide wall is separated from the filter by at least a predetermined distance, from the suction port to a vicinity of a terminal of the guide wall. In the present application, the term "gentle curve" refers to a curve having a curvature sufficient to prevent the divergence of the air flux caused by the interaction between the air flux and the guide wall such as a collision. In the present application, the expression "predetermined distance between the guide wall and the filter" refers to a distance sufficient to prevent the air flux moving along the guide wall from being sucked into the filter under a negative pressure in the filter.

[0015] In a dust collector according to Claim 3, the upstream chamber is provided with an inner wall located opposite and parallel to the boundary between the upstream chamber and the downstream chamber. The suction port is installed so that its axis faces parallel or substantially parallel to the boundary. The filter is convex towards the upstream chamber.

[0016] I n a dust collector according to Claim 4, the upstream chamber is provided with an inner wall located opposite and parallel to the boundary between the upstream chamber and the downstream chamber, and a pair of the suction ports is provided at opposite positions in the upstream chamber so that axes of the suction ports face parallel or substantially parallel to the boundary. The filter is angled by folding a circular filter along its diameter and placed so as to be convex toward the upstream chamber, and a vicinity of a ridge of the filter is the partial area. The device comprises a pair of the guide walls extending from the respective suction ports along an outer periphery of the filter so as to approach the filter in a radial direction of the filter, and the pair of guide walls surrounds the entire outer periphery of the filter.

[0017] In Claim 5, filter accumulated impurities collecting means placed outside the dust collector collects impurities accumulated in the filter, and the partial area on the filter is configured to lie within a range within which the accumulated impurities collecting means can approach or contact a surface of the filter. In the present application, the filter accumulated impurities collecting means is defined as means for collecting impurities by approaching or contacting the filter surface. An example of the filter accumulated impurities collecting means is a recovery pipe provided in a device that sucks and collects accumulated impurities using a negative air pressure.

[0018] According to Claim 6, there is provided a traveling cleaner comprising a dust collector according to any one of Claims 1 to 5. The traveling cleaner is installed in a textile machine such as an automatic winder and travels along the machine to collect fiber dust or the like which occurs in the machine.

[0019] The present invention exerts the following effects.

[0020] The dust collector according to Claim 1 uses the simple configuration of the guide wall and filter to reduce the rate of a decrease in the effective opening area of the filter without resort to an inefficient method of increasing the fan driving force, the size of the dust collector, or the like. This enables the dust collecting capability of the dust collector to be maintained for a long time.

[0021] The dust collector according to Claim 2 uses the simple configuration of the guide wall to reduce the rate of a decrease in the effective opening area of the filter. This enables the dust collecting capability of the dust collector to be maintained for a long time.

[0022] The dust collector according to Claim 3 uses the simple configuration of the filter to reduce the rate of a decrease in the effective opening area of the filter. This enables the dust collecting capability of the dust collector to be maintained for a long time.

[0023] The dust collector according to Claim 4 further reduce the rate of a decrease in the effective opening area of the filter on the basis of the multiplier effect of the shapes and arrangements of the guide wall and filter. This enables the dust collecting capability of the dust collector to be maintained for a longer time.

[0024] In the dust collector according to Claim 5, most impurities accumulate on the filter within the range within which the filter accumulated impurities collecting means can approach or contact the impurities. The collecting means can thus collect the impurities efficiently and easily.

[0025] The dust collector in accordance with the present invention is applied to the traveling cleaner according to Claim 6. This enables a sufficient dust collecting capability to be maintained during traveling impurity collection until the filter accumulated impurities collecting device outside the dust collector periodically cleans the filter.

Brief Description of the Drawings

[0026]

Figure 1 is a plan view of a dust collector 1 in accordance with Embodiment 1 (with a cover removed).
Figure 2 is a sectional view of the dust collector 1 in accordance with Embodiment 1; the sectional view is taken along line II-II in Figure 1.
Figure 3 is a perspective view of the dust collector 1 in accordance with Embodiment 1 as viewed from above.
Figure 4 is a plan view of a dust collector 501 in accordance with Embodiment 2 of the present invention (with a cover mounted).
Figure 5 is a plan view of the dust collector 501 in accordance with Embodiment 2 (with the cover removed).
Figure 6 is a perspective view of the dust collector 501 in accordance with Embodiment 2 as viewed from above.
Figure 7 is a front view of the traveling cleaner 100.
Figure 8 is a side view of the traveling cleaner 100.

Detailed Description of the Preferred Embodiments

[0027] Now, embodiments of the present invention will be described. In Embodiment 1, a description will be given of an example of the configuration of a dust collector in accordance with the present invention. In Embodiment 2, a description will be given of an example of the configuration of a traveling cleaner comprising the dust collector in accordance with Embodiment 1.

[Embodiment 1]

[0028] In the present embodiment, a description will be given of an example of the configuration of a box-shaped dust collector having a pair of suction ports and a pair of air outlets.

[0029] Figure 1 is a plan view of a dust collector 1 in accordance with Embodiment 1 of the present invention. Figure 2 is a sectional view of the dust collector 1 in accordance with Embodiment 1; the sectional view is taken along line A-A in Figure 1. Figure 3 is a perspective view of the dust collector 1 in accordance with Embodiment 1 as viewed from above. In the present application, the upper part of the sectional view in Figure 2 is defined as the upper part of the dust collector 1.

[0030] First, a description will be given of the configuration of the dust collector 1 in accordance with the present embodiment.

[0031] As shown in Figures 1 to 3, the interior of the dust collector 1 is partitioned into an upstream chamber 2 and a downstream chamber 3. Each of the upstream chamber 2 and the downstream chamber 3 is shaped like a substantially rectangular parallelepiped box.

[0032] A partitioning wall 12 is provided at the boundary between the upstream chamber 2 and the downstream chamber 3 to separate the upstream chamber 2 from the downstream chamber 3. A generally circular opening is formed in the center of the partitioning wall 12 so that a filter 7 can be fitted into the opening. A filter mounting frame 13 is also provided along the opening. The filter 7 is mounted in the fitting frame 13.

[0033] A fan 6 is provided in the downstream chamber 3. The fan 6 is rotatively driven to generate an air current flowing from the upstream chamber 2 side to the downstream chamber 3 side.

[0034] As shown in Figure 1, in the upstream chamber 2, suction ports 4a, 4b are provided on a sidewall 21a located in the left of sheet of the drawing and a sidewall 21b located opposite the sidewall 21a, respectively, and each of the suction ports 4a, 4b is provided near the right end of the corresponding wall surface as viewed from the external front of the dust collector 1. In a plan view, the positional relationship between the suction ports 4a, 4b is that they are point-symmetric with respect to a center position M of the filter 7.

[0035] On the other hand, in the downstream chamber 3, air outlets 5a, 5b are provided on sidewalls 31a, 31b, respectively, located under the sidewalls 21a, 21b, respectively. Each of the air outlets 5a, 5b is provided near the left end of the corresponding wall surface as viewed from the external front of the dust collector 1. In a plan view, the positional relationship between the air outlets 5a , 5b is that they are point-symmetric with respect to the center position M of the filter 7.

[0036] A top wall (lying opposite a surface of the filter 7) of the upstream chamber 2 is composed of a removable cover 9. The cover 9 is closed during the operation of the dust collector 1, to serve as an inner wall lying opposite and parallel to the partitioning wall 12. The cover 9 is opened to allow the filter 7 to be cleaned, replaced with a new one, or subjected to any other maintenance operation.

[0037] The filter 7 appears generally circular in a plan view, and the filter 7 is also angled so as to be convex toward the upstream chamber 2 side. A ridge R constituting the top of the angle is on the diameter of the circle in a plan view.

[0038] In other words, the filter 7 is obtained by folding a planar circular filter at its diameter so as to form an appropriate angle. The filter 7 is also installed so that the ridge R extends horizontally to the partitioning wall 12 and substantially parallel to the sidewalls 21a, 21b. The filter 7 is also located slightly higher than the partitioning wall 12 (so as to project toward the upstream chamber 2 side) using the mounting frame 13. The mounting frame 13 completely closes the gap between an outer per i phery of the filter 7 and the partitioning wall 12. Consequently, in moving between the upstream chamber 2 and the downstream chamber 3, air always passes through the filter 7.

[0039] The upstream chamber 2 is also provided with guide walls 8a, 8b that guide an air current in a horizontal direction and guide walls 81a, 81b that guide the air current in a vertical direction. In a plan view, the positional relationship between the guide walls 8a, 8b is that they are point-symmetric with respect to the center position M of the filter 7. Likewise, in a plan view, the positional relationship between the guide walls 81a, 81b is that they are point-symmetric with respect to the center position M of the filter 7.

[0040] The guide walls 8a, 8b are installed perpendicularly to the partitioning wall 12, and each of the guide walls 8a, 8b has a height from the partitioning wall 12 to the upper end of the upstream chamber 2.

[0041] The starting end of each of the guide walls 8a, 8b is located in a substantially intermediate area between a sidewall 21c located in the upper part of Figure 1 and a sidewall 21d located in the lower part of Figure 1. Each of the guide walls 8a, 8b travels halfway round the filter 7 starting from its starting end so as to draw a generally semicircular curve, and as the guide walls 8a, 8b travel round the filter 7, the distances between the guide walls 8a, 8b and the filter 7 decreases gradually. The terminals of the guide walls 8a, 8b are in the vicinity of areas Xa, Xb, respectively, near the ends of a ridge R on the filter 7.

[0042] On the other hand, the guide walls 81a, 81b are inclined to the partitioning wall 12 along the gap between the filter mounting frame 13 and the guide walls 8a, 8b, respectively. The guide walls 81a, 81b join the height of the partitioning wall 12 with the height of the ridge R using gentle slopes. The starting ends and terminals of the guide walls 81a, 81b are located at substantially the same positions as those of the starting ends and terminals of the guide walls 8a, 8b.

[0043] A summary will be given of the dust collector 1, the present embodiment described above. The dust collector 1 comprises the upstream chamber 2, provided with the suction ports 4a, 4b, the downstream chamber 3, provided with the air outlets 5a, 5b, the filter 7, provided at the boundary between the upstream chamber 2 and the downstream chamber 3, and the guide walls 8a, 8b, provided in the upstream chamber 2. The upstream chamber 2 is provided with the cover 9, serving as an inner wall lying opposite and parallel to the boundary between the upstream chamber 2 and the downstream chamber 3. A pair of the suction ports 4a, 4b are provided at the opposite positions in the upstream chamber 2 so that their axes face parallel or substantially parallel to the boundary. The filter 7 is angled by folding a circular filter at its diameter, and the filter 7 is placed so as to be convex toward the upstream chamber 2. The vicinity of the ridge R of the filter 7 is a partial area that guides an air flux flowing into the upstream chamber 2 side. The partial area corresponds to an area X described below and including the above areas Xa, Xb. The guide walls 8a, 8b extend from the suction ports 4a, 4b, respectively, along the outer periphery of the filter 7, and the guide walls 8a, 8b gradually approach the filter 7 in its radial direction. The pair of guide walls 8a, 8b surrounds the outer periphery of the filter 7.

[0044] Now, a description will be given of the flow of air inside the dust collector 1 configured as described above to clarify the characteristic functions of the dust collector 1. The effects of the dust collector 1 will also be described.

[0045] As shown in Figures 1 and 3, the fan 6 rotates to allow a flux of air containing impurities to flow into the upstream chamber 2 through the suction ports 4a, 4b. An air flux Fa flowing in through the suction port 4a is first guided through a passage sandwiched between the sidewall 21d and the guide wall 8b to the terminal of the guide wall 8b while being converged. As shown by arrow Ya, the air flux Fa passes by the terminal of the guide wall 8b in a direction almost parallel to an outer peripheral line of the filter 7.

[0046] The air flux Fa then is guided by the guide wall 8a and the guide wall 81a to travel around the filter 7. The guide wall 8a and the guide wall 81a gradually varies the direction of the air flux Fa along a gentle curve. This substantially prevents the flux from being diverged by the interaction between the air flux Fa and the guide wall 8a or the guide wall 81a, for example, a collision. The guide wall 8a first travels at a sufficient distance from the filter 7 and then gradually approaches the filter 7. Therefor, most of the air flux Fa thus reaches the vicinity of the area Xa without being sucked into the filter 7.

[0047] As described above, most of the air flux Fa is guided to the area Xa along the guide wall 8a and the guide wall 81a as shown by arrow Ya; the flux is almost maintained, that is, it is not substantially diverged, until it reaches the area Xa on the filter 7.

[0048] The spacing between the filter 7 and the cover 9 is narrowest in the area Xa and the slope is a barrier to the average advancing direction of the air flux Fa. Therefor, Most of the air flux Fa guided to the area Xa is sucked into the filter 7 in this area for the first time. The air flux Fa may be inhibited from passing through the filter surface by a net material for the filter 7 or already accumulated impurities. The air flux Fa thus flows over the filter 7. 0n this occasion, the impurities contained in the air flux Fa are mostly captured and accumulated in the area Xa.

[0049] Most of the air flux Fb flowing in through the suction port 4b is similarly guided to the area Xb on the filter 7 along the guide wall 8b and the guide wall 81b as shown by arrow Yb; the flux is almost maintained, that is, it is not

substantially diverged, until it reaches the area Xb on the filter 7. Most of the impurities contained in the air flux Fb are similarly captured and accumulated in the area Xb.

[0050] The air fluxes Fa, Fb partly flow over the areas Xa, Xb, respectively, instead of being sucked into the filter 7. These parts further continue whirling. Consequently, the motion of the air currents described above yields eddy-like whirling currents in the upstream chamber 2, the whirling currents being composed of two main fluxes.

[0051] When the air fluxes Fa, Fb pass by the vicinity of the areas Xa, Xb, respectively, some impurities flow over the filter 7 instead of being captured. These impurities further move on the whirling currents through the upstream chamber 2. Most of these impurities are preferentially captured near the ridge R on the filter 7, where the spacing between the filter 7 and the cover 9 is narrowest. As a result, most of the impurities initially contained in the air fluxes Fa, Fb concentrically accumulate in the areas Xa, Xb, respectively, and most of the remaining impurities not captured in the areas Xa, Xb also accumulate in small areas along the ridge R. The total of these areas nevertheless accounts for only a small percentage of the area of the entire surface of the filter 7. The concentrated impurity accumulated areas are collectively called an area X. As shown in Figure 1, the area X substantially corresponds to the combination of a fan-shaped area including the area Xa and a fan-shaped area including the area Xb; the fan-shaped areas fan out around a center position M and one side of each fan-shaped area is composed of the ridge R.

[0052] As described above, most impurities accumulate locally in the small area X. Thus, in the entire area of the filter 7 except the area X, that is, the most part of the filter 7, impurities are captured and accumulated much more slowly than in the area X. Consequently, the dust collector 1 in accordance with the present invention sharply reduces the rate of a decrease in the effective opening area of the filter 7 compared to the conventional dust collector in which impurities accumulate all over the filter surface. This greatly reduces the rate of degradation of an air supply and exhaust capability under a specified fan driving force, that is, a dust collecting capability. The dust collecting capability can thus be maintained for a long time. This makes it possible to drastically reduce the frequency of cleaning or replacement of the filter, thus improving convenience.

[0053] As described above, the dust collector 1 in accordance with the present invention uses the combination of the filter and guide wall, both of which are easily produced, to sharply increase the time for which the dust collecting capability is maintained. The dust collector 1 in accordance with the present invention can be constructed using the conventional dust collector without the need to significantly modify it. The dust collector 1 in accordance with the present invention is thus applicable to various existing devices comprising dust collectors.

[0054] The configuration of the guide walls in accordance with the present embodiment is characterized in that each guide wall joins the suction port with the partial area in the peripheral portion of the filter so that a gentle curve, that is concave toward the filter side, is drawn between the suction port and the partial area, and the configuration of the guide walls is further characterized in that each guide wall separates from filter by a predetermined distance from the suction port to the vicinity of its terminal. The specific shape and arrangements of the guide walls are selected to be optimum for the shape and arrangement of the filter. In the dust collector comprising the guide walls characterized as described above, the air flux flowing in through the suction port and containing impurities travels along the guide walls while having its direction varied; the flux is almost maintained, that is, it is not substantially diverged. The air flux also moves at a sufficient distance from the filter until it reaches the vicinity of the terminal of the guide wall. Therefor, only a small part of the flux is sucked into the filter before the flux reaches the vicinity of the partial area in the peripheral portion of the filter. As a result, most of the air flux flowing in through the suction port reaches the partial area in the peripheral portion of the filter without being diverged, and the impurities are mostly captured and accumulated in the partial area. Therefore, the impurities can accumulate preferentially locally in the desired area in the peripheral portion of the filter by configuring the guiding walls so that their terminals are located near the desired area as described above. The simple configuration of the guiding walls can thus be used to reduce the rate of a decrease in the effective opening area of the filter. This enables the dust collecting capability of the dust collector device to be maintained for a long time.

[0055] According to the present embodiment, the dust collector is configured so that the inner wall is provided in the upstream chamber so as to lie opposite and parallel to the boundary between the upstream chamber and the downstream chamber, and so that the suction ports are also provided in the upstream chamber so that their axes face parallel or substantially parallel to the boundary. In the dust collector, the configuration of the filter is characterized in that it is convex toward the upstream chamber side. In the above configuration, the air flux flows in almost parallel to the boundary through the suction port. Therefor, a main velocity component of the air flow in the upstream chamber is thus parallel to the boundary. Further, the filter is convex with respect to the inner wall lying opposite and parallel to the boundary. This varies the width of the passage of the air flow sandwiched between the inner wall and the filter. The air flow flowing almost parallel to the boundary is preferentially guided to the narrowest area of the passage on the filter where the filter projects furthest from the boundary, and impurities are preferentially captured and accumulated in this area. Therefore, by placing the desired area at the top of the filter, it is possible to preferentially locally accumulate the impurities in the desired area. The simple configuration of the filter can thus be used to reduce the rate of a decrease in the effective opening area of the filter. This enables the dust collecting capability of the dust collecting device to be maintained for a long time.

[0056] The configuration of the filter 7 in accordance with the present embodiment is an example in which the above guide wall configuration is optimally combined with the filter configuration to further improve the effect of localization of impurities accumulation on the basis of the multiplier effect of these configurations.

[0057] In the present embodiment, the upstream chamber 2 and the downstream chamber 3 are each shaped like a rectangular parallelepiped box. However, the shape of these chambers is not limited to this.

[0058] The dust collector 1 in accordance with the present embodiment has the pair of suction ports and the pair of air outlets. However, the present invention is not limited to the provision of the pairs. The suction ports and air outlets may be arbitrarily configured on the basis of an environment in which the dust collector is used. For example, the suction ports may be provided on one side, while the air outlets may be provided only on the other side. The number and positions of suction ports and air outlets are arbitrary. The appropriate shapes and arrangements of the filter and guide walls are selected on the basis of the number and positions of suction ports.

[0059] In the present embodiment, the fan 6 is provided inside the downstream chamber 3 immediately below the filter 7. However, the fan 6 may be provided outside the downstream chamber 3, for example, in a pipe connected to the air outlets 5a, 5b.

[0060] In the present embodiment, the top wall of the upstream chamber 2 is composed of the cover 9. However, the present invention need not be limited to this configuration. The top wall may be arbitrarily configured on the basis of an environment in which the dust collector is used. For example, the top wall of the upstream chamber 2 may be fixed, while one of its sidewalls may be closable.

[0061] In the present embodiment, the filter 7 appears generally circular in a plan view. The shape of the filter 7 in a plan view need not be limited but may be arbitrary. Further, in the present embodiment, the filter 7 is angled. However, the filter 7 is not limited to this shape. The shape of the filter 7 may be selected to exert the highest synergistic effect in combination with the guide walls. An arbitrary material such as metal or fibers may be used for the filter 7 depending on the application.

[0062] In the present embodiment, the guide wall 8a and the guide wall 81a are independent of each other. However, they may be integrated together. This also applies to the guide wall 8b and the guide wall 81b. Appropriately shaping the inner wall of the upstream chamber 2 enables the inner wall to provide the functions of the guide wall or a part of it.

[Embodiment 2]

[0063] In the present embodiment, a description will be given of a traveling cleaner 100 in accordance with the present invention.

[0064] While a textile machine such as an automatic winder is operating, impurities such as dust or waste fibers may scatter and adhere to yarns or accumulate on the machine main body or floor surface. The traveling cleaner is installed in the textile machine to remove and collect the impurities.

[0065] The traveling cleaner 100 comprises a dust collector 501 in accordance with the present invention to simultaneously achieve long-term maintenance of the dust collecting capability and facilitation of automatic collection of impurities accumulating on the filter. The configuration of the dust collector 501 is almost the same as that of the dust collector 1 in accordance with Embodiment 1.

[0066] Figure 4 is a plan view of the dust collector 501 in accordance with Embodiment 2 of the present invention. Figure 5 is a plan view of the dust collector 501 from which a cover has been removed. Figure 6 is a perspective view of the dust collector in accordance with Embodiment 2 as viewed from above. Figure 7 is a front view of the traveling cleaner 100. Figure 8 is a side view of the traveling cleaner 100. In Embodiment 2, components of the dust collector 501 having the same reference numerals as those in Embodiment 1 are the same as the corresponding ones of the dust collector 1 in Embodiment 1 and provide the same functions as them.

[0067] As shown in Figures 7 and 8, the traveling cleaner 100 comprises the dust collector 501 in accordance with the present invention. A textile machine 300 is a device in which a large number of automatic winders 301 rewinding a yarn from a winding package are arranged in a line.

[0068] A track 110 is laid above the automatic winders 301 to allow the traveling cleaner 100 to travel along the direction in which the automatic winders 301 are arranged in a line. The traveling cleaner 100 reciprocate automatically on the track 110 using wheels provided at the bottom of the dust collector 501.

[0069] In the present embodiment, the traveling cleaner 100 is installed in a textile machine such as an automatic winder. However, the present invention is not limited to this and the traveling cleaner 100 may be used in various textile machines such as a spinning machine.

[0070] Suction pipes 41a, 41b are connected to the suction ports 4a, 4b, respectively, of the dust collector 501. Blow-off pipes 51a, 51b are connected to the air outlets 5a, 5b, respectively. The suction pipes 41a, 41b and the blow-off pipes 51a, 51b all cross over the unit 301 from the top of the textile machine 300 to the vicinity of the floor surface.

[0071] A plurality of spray nozzles 52, 52, ... are formed in the middle of each of the blow-off pipes 51a, 51b, and part of a descending air current exhausted by the dust collector 501 is sprayed against the textile machine 300 to blow off

impurities accumulated on the machine main body or adhering to yarns, onto the floor surface.

[0072] The suction pipes 41a, 41b have openings 42, 42 only at their ends lying opposite the floor, and impurities accumulated on the floor surface are thus sucked through the openings 42, 42 together with the surrounding air and fed to the dust collector 501.

[0073] A filter 507 removes the impurities from the air flowing into the upstream chamber 2 through the suction ports 4a, 4b, and the air then passes through the downstream chamber 3 and is exhausted through the air outlets 5a, 5b.

[0074] The traveling cleaner 100 performs the above operation to collect impurities, while reciprocating through the opposite sides of the automatic winders 301, provided in the textile machine 300.

[0075] A filter accumulated impurities collecting device (hereinafter referred to as a collecting device) 200 is installed at one end of the track 110. Every time the dust collector 501, reciprocating on the track 110, approaches the collecting device 200, the impurities accumulated in the filter 507 are collected using a fixed recovery pipe 210 provided in the collecting device 200. A blower is provided inside the collecting device 200 as means for sucking air through the recovery pipe 210.

[0076] The traveling cleaner 100 comprising the dust collector 501 in accordance with the present embodiment can maintain a sufficient dust collecting capability during the reciprocation. A fatal problem with a traveling cleaner with the conventional dust cleaner is that the filter may clog up while the cleaner is reciprocating, thus degrading the dust collecting capability. In contrast, the traveling cleaner 100 in accordance with the present embodiment solves this problem using the simple configuration.

[0077] The dust collector 1 in accordance with the present invention need not be designed to have a configuration or size markedly different from that of the conventional dust collectors. This enables the dust collector 1 in accordance with the present invention to be applied to an existing traveling cleaner directly or by simply modifying the traveling cleaner. The dust collector 1 in accordance with the present invention is applicable to various devices other than traveling cleaners which comprise dust collectors. This makes it possible to sharply reduce the frequency of cleaning or replacement of the filter. The present invention is very beneficial particularly if the period for cleaning or replacing the filter is limited as in the case of the traveling cleaner 100 in accordance with the present embodiment.

[0078] The traveling cleaner 100 in accordance with the present embodiment has the above features. The traveling cleaner 100 in accordance with the present embodiment also facilitates the collection of impurities accumulated in the filter owing to the dust collector 1 in accordance with the present invention provided in the traveling cleaner 100, as described below in detail.

[0079] As shown in Figures 4 and 6, the dust collector 501 in accordance with the present embodiment has a cover 509 in place of the cover 9 of the dust collector 1 in accordance with Embodiment 1. The cover 509 is provided with an opening 10 through which impurities accumulated in the filter 507 are collected and a door 11 that opens and closes the opening 10. In a plan view, the opening 10 is generally rectangular and its center coincides with the center M of the filter 507. The opening 10 is elongate in the advancing direction (shown by an arrow in the figure) of the dust collector 501. The opening 10 has almost the same width as that of the recovery pipe 210.

[0080] When the traveling cleaner 100 finishes reciprocation and the dust collector 501 nears the recovery pipe 210, the collecting device 200 opens the door 11. This exposes a part (which overlaps the opening 10 in a plan view) of the filter 507. With the filter 507 partly exposed, the dust collector 501 further continues to move toward the collecting device 200 and passes immediately below the opening of the recovery pipe 210. On this occasion, as shown in the plan view in Figure 5, the opening 10 of the dust collector 501 overlaps the opening of the recovery pipe 210. With the filter 507 partly exposed, the blower provided in the collecting device 200 is actuated to start suction through the recovery pipe 210. When the exposed area of the filter 507 passes immediately below the recover pipe 210, impurities on the exposed area are then collected by sucking them through the recovery pipe 210.

[0081] As shown in Figure 5, the center of the filter 507 moves on the center line of the recovery pipe 210 as the traveling cleaner 100 moves. The filter 507 is also installed so that its ridge R1 inclines slightly to the center line. The inclination is set so as to minimize the width W of the area Xl, in which most impurities accumulate, with respect to the moving direction of the traveling cleaner 100. The size of the opening 10 is set so as to reliably expose the area Xl corresponding to the inclination of the ridge R1. In the present embodiment, the ridge R1 of the filter 507 is placed so as to face substantially diagonally to the opening 10. In other words, the filter 507 is placed so that a concentrated impurity accumulated area Xl lies within the range within which the recovery pipe 210 can approach a position immediately above the filter 507.

[0082] Once the opening 10 completely passes immediately below the recovery pipe 210, the dust collector 501 reverses the moving direction. Once the suction and collection in the opposite direction is finished, the collecting device 200 closes the door 11. The series of operations are automatically performed by an interlocking mechanism (not shown in the drawings).

[0083] The dust collector 1 in accordance with the present invention requires concentrated cleaning to be executed mainly on the area X1 in which most impurities accumulate. This configuration enables accumulated impurities to be reliably colleted under a reduced suction pressure. The conventional dust collector requires impurities accumulated all

over the filter surface to be reliably sucked and collected. This requires the suction pressure in the recovery pipe 210 to be greatly increased. This is inefficient. In contrast, the dust collector 501 in accordance with the present invention enables impurities to be efficiently collected under a reduced suction pressure.

[0084] The above advantage of facilitating the collection of impurities is also given by the characteristic of the dust collector in accordance with the present invention that impurities can be locally accumulated in the desired partial area on the filter. In devices other than the traveling cleaner 100 in accordance with the present invention, the configuration of the dust collector and filter accumulated impurities collecting means may limit the range within which the filter accumulated impurities collecting means can directly approach or contact the filter to collect impurities. Even in this case, the collection of impurities can be facilitated by appropriately configuring the dust collector in accordance with the present embodiment

[0085] The embodiments of the present invention have been shown. The dust collector in accordance with the present invention is not limited to the above configurations but may be arbitrarily constructed on the basis of ideas characterizing the present invention. In the above example, the present invention is applied to the traveling cleaner for a textile machine. However, it will be easily understood by those skilled in the art that the dust collector in accordance with the present invention is applicable to various other devices comprising dust collectors.

[0086] In a practical example, the dust collector in accordance with the present invention is applicable to a traveling cleaner or the like which is installed in a textile machine.

Claims

1. A dust collector comprising an upstream chamber provided with a suction port, a downstream chamber provided with an air outlet and a fan, a filter provided at a boundary between the upstream chamber and the downstream chamber, and a guide wall provided in the upstream chamber, the dust collector being **characterized in that** shapes and arrangements of the guide wall and the filter are configured so that an air flux flowing into the upstream chamber through the suction port is guided to a partial area on the filter.

2. A dust collector according to Claim 1, **characterized in that** the guide wall joins the suction port with the partial area in a peripheral area of the filter so that a gentle curve that is concave toward the filter is drawn between the suction port and the partial area, and the guide wall is separated from the filter by at least a predetermined distance, from the suction port to a vicinity of a terminal of the guide wall.

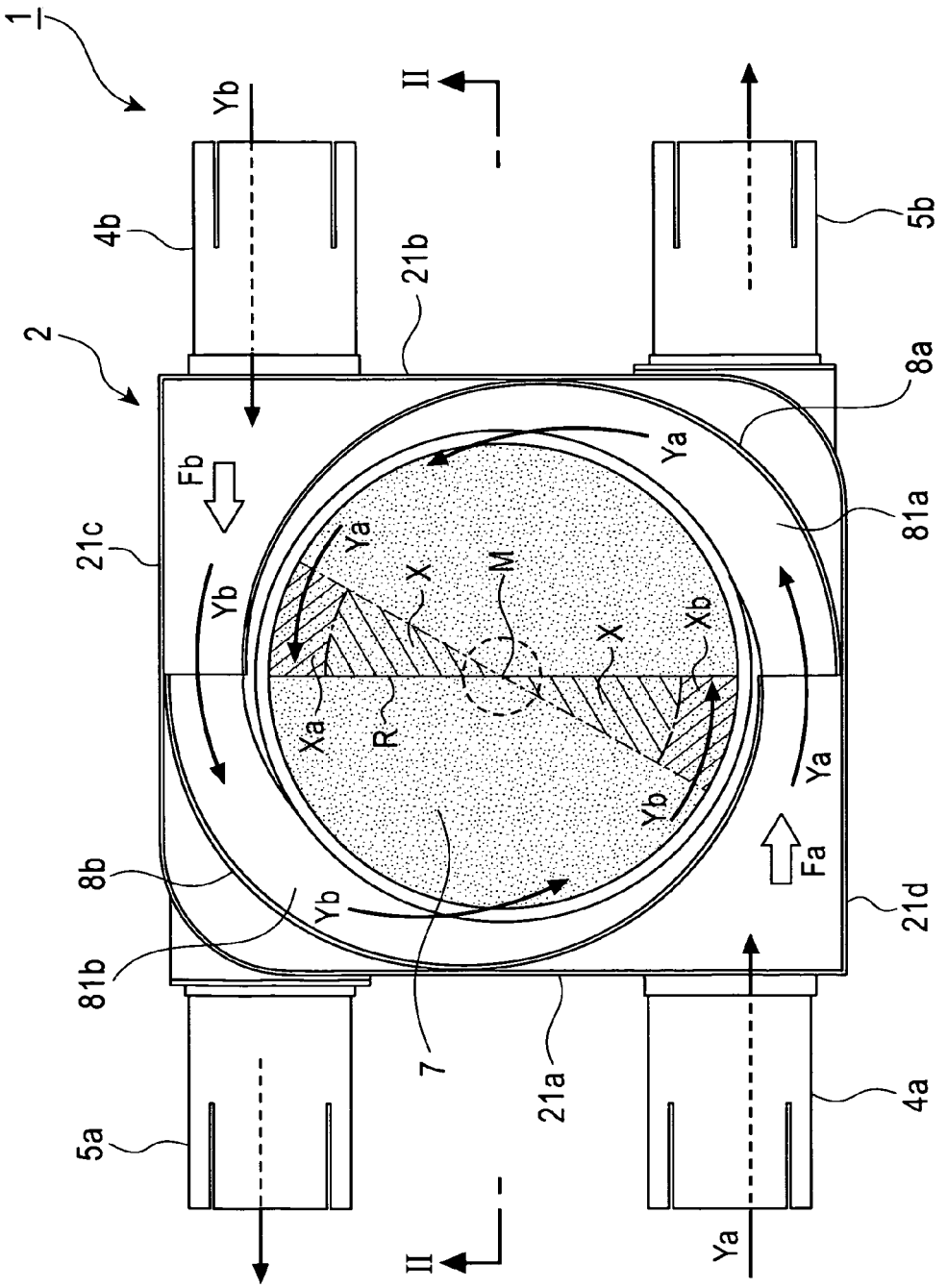
3. A dust collector according to Claim 1 or Claim 2, **characterized in that** the upstream chamber is provided with an inner wall located opposite and parallel to the boundary between the upstream chamber and the downstream chamber, **in that** the suction port is installed so that its axis faces parallel or substantially parallel to the boundary, and **in that** the filter is convex towards the upstream chamber.

4. A dust collector according to Claim 1, **characterized in that** the upstream chamber is provided with an inner wall located opposite and parallel to the boundary between the upstream chamber, and the downstream chamber and a pair of the suction ports is provided at opposite positions in the upstream chamber so that axes of the suction ports face parallel or substantially parallel to the boundary, **in that** the filter is angled by folding a circular filter along its diameter and placed so as to be convex toward the upstream chamber, and a vicinity of a ridge of the filter is the partial area, **in that** the device comprises a pair of the guide walls extending from the respective suction ports along an outer periphery of the filter so as to approach the filter in a radial direction of the filter, and the pair of guide walls surrounds the entire outer periphery of the filter.

5. A dust collector according to any one of Claims 1 to 4, **characterized in that** filter accumulated impurities collecting means placed outside the dust collector collects impurities accumulated in the filter, and the partial area on the filter is configured to lie within a range within which the accumulated impurities collecting means can approach or contact a surface of the filter.

6. A traveling cleaner comprising a dust collector according to any one of Claims 1 to 5.

FIG. 1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II
Ya

FIG. 2

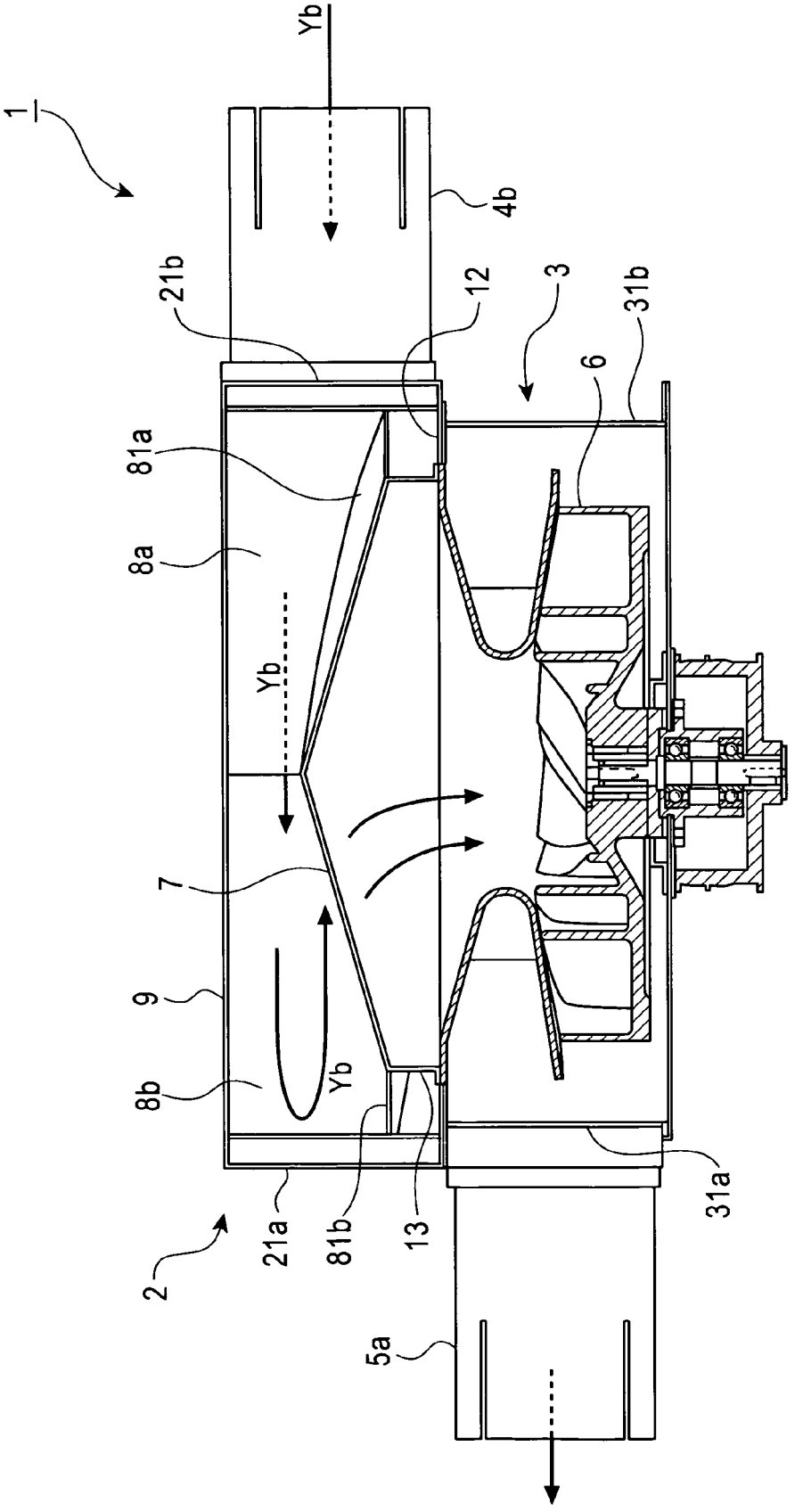
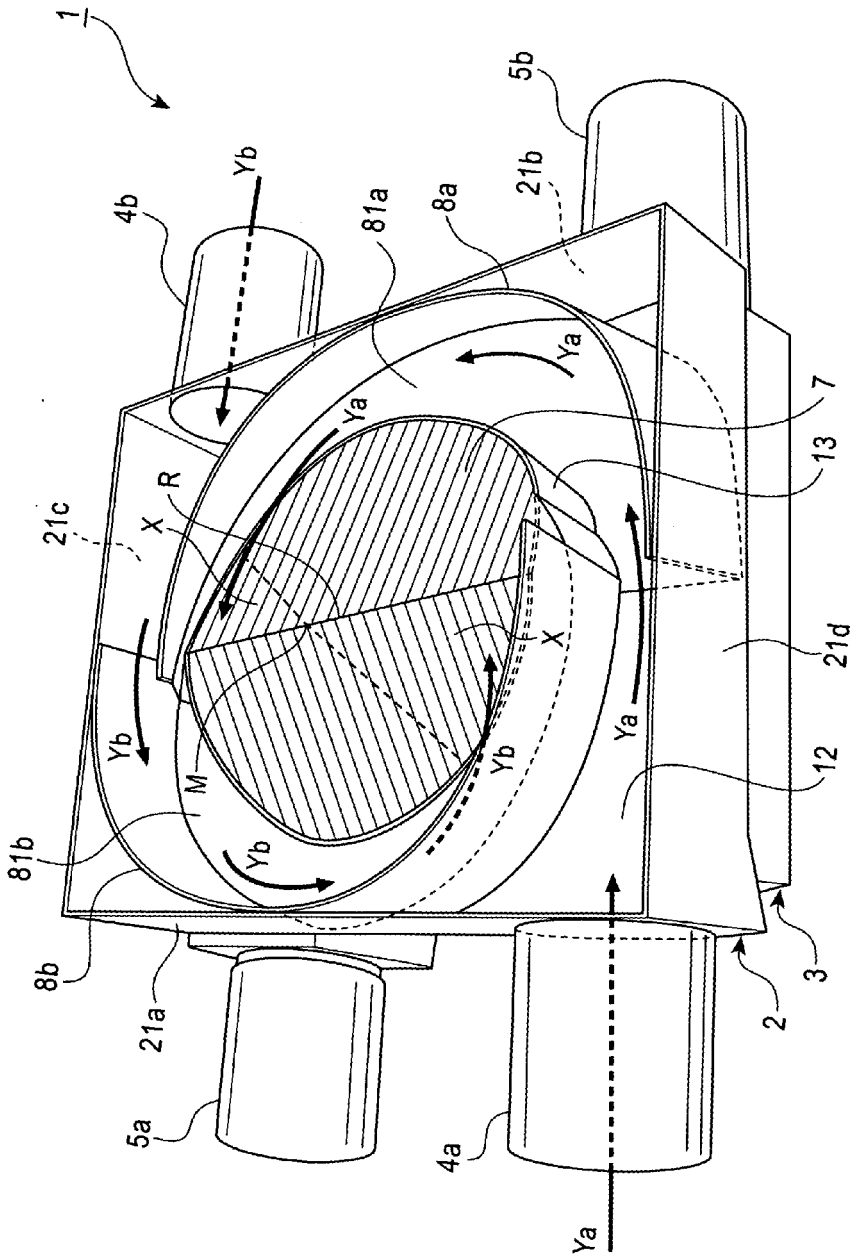


FIG. 3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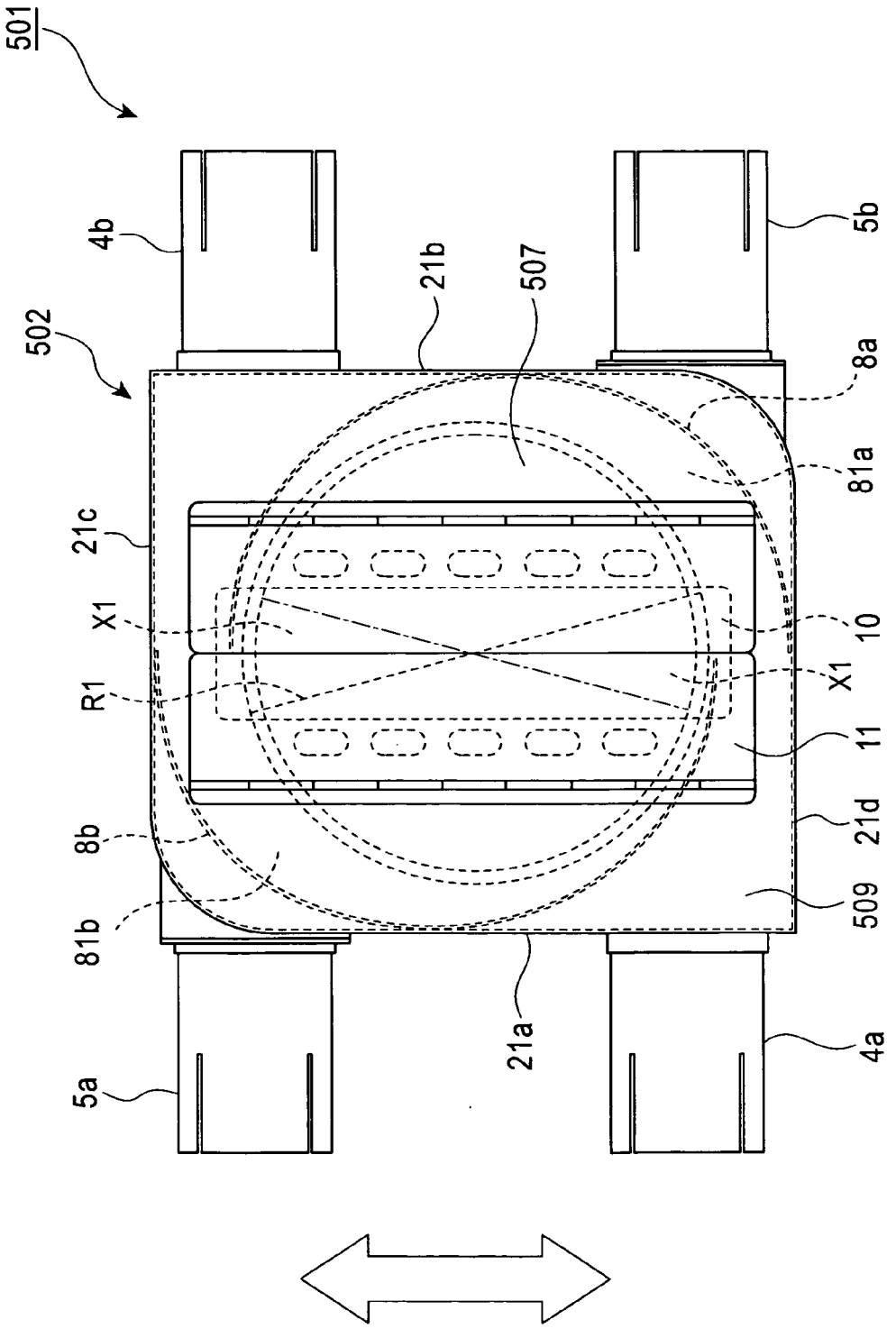
Ya

FIG. 4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R1
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5a

FIG. 5

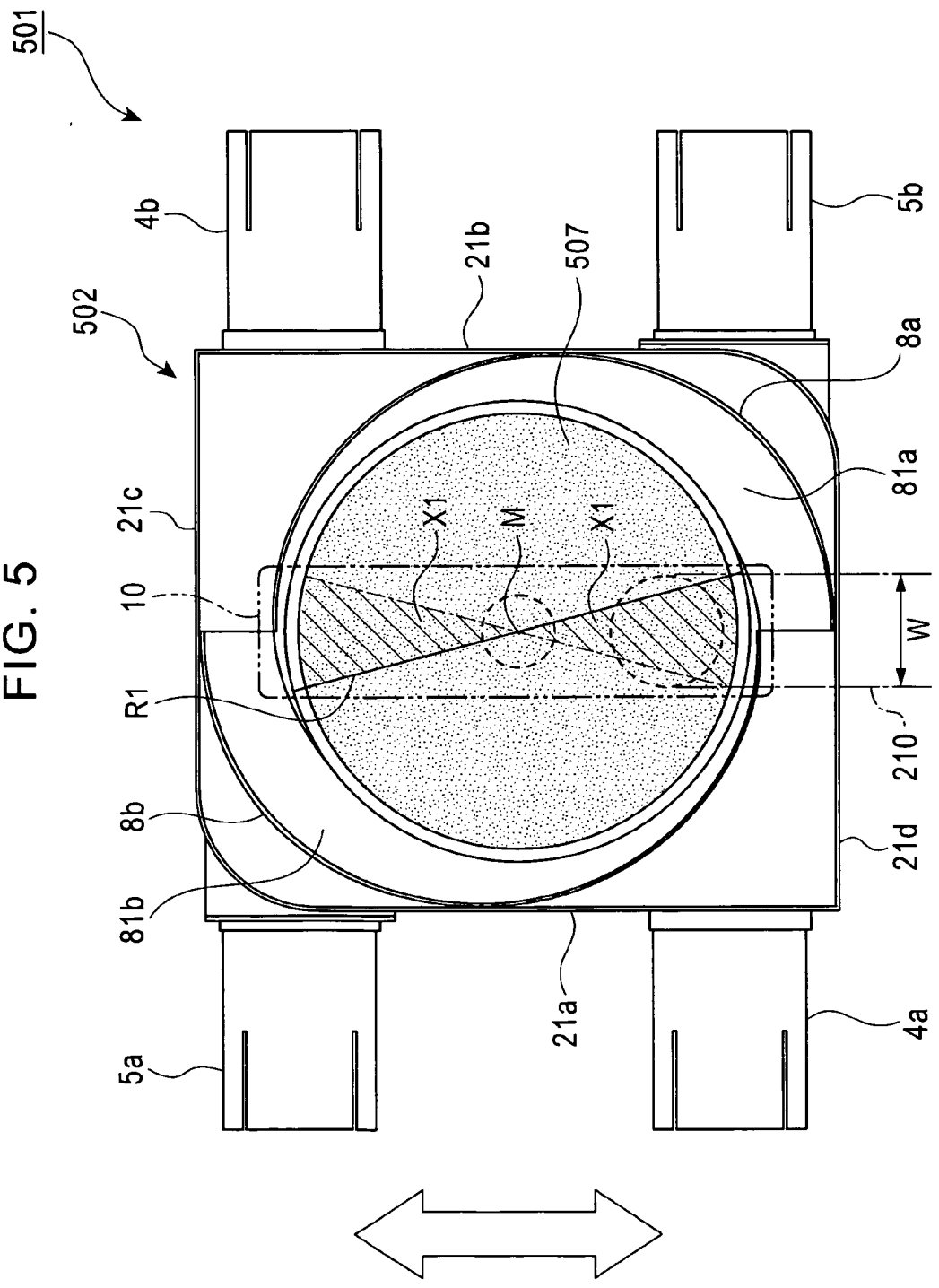
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FIG. 6

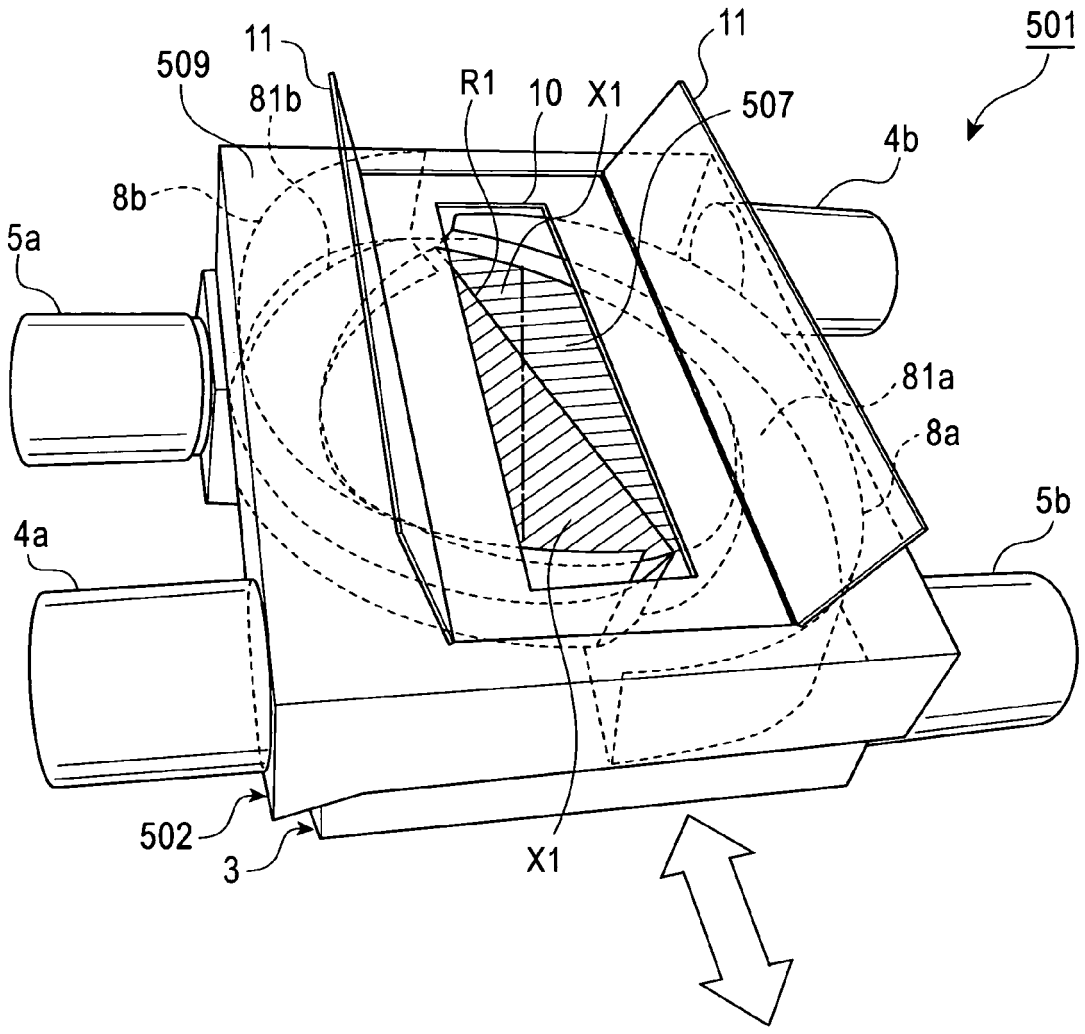

FIG. 7

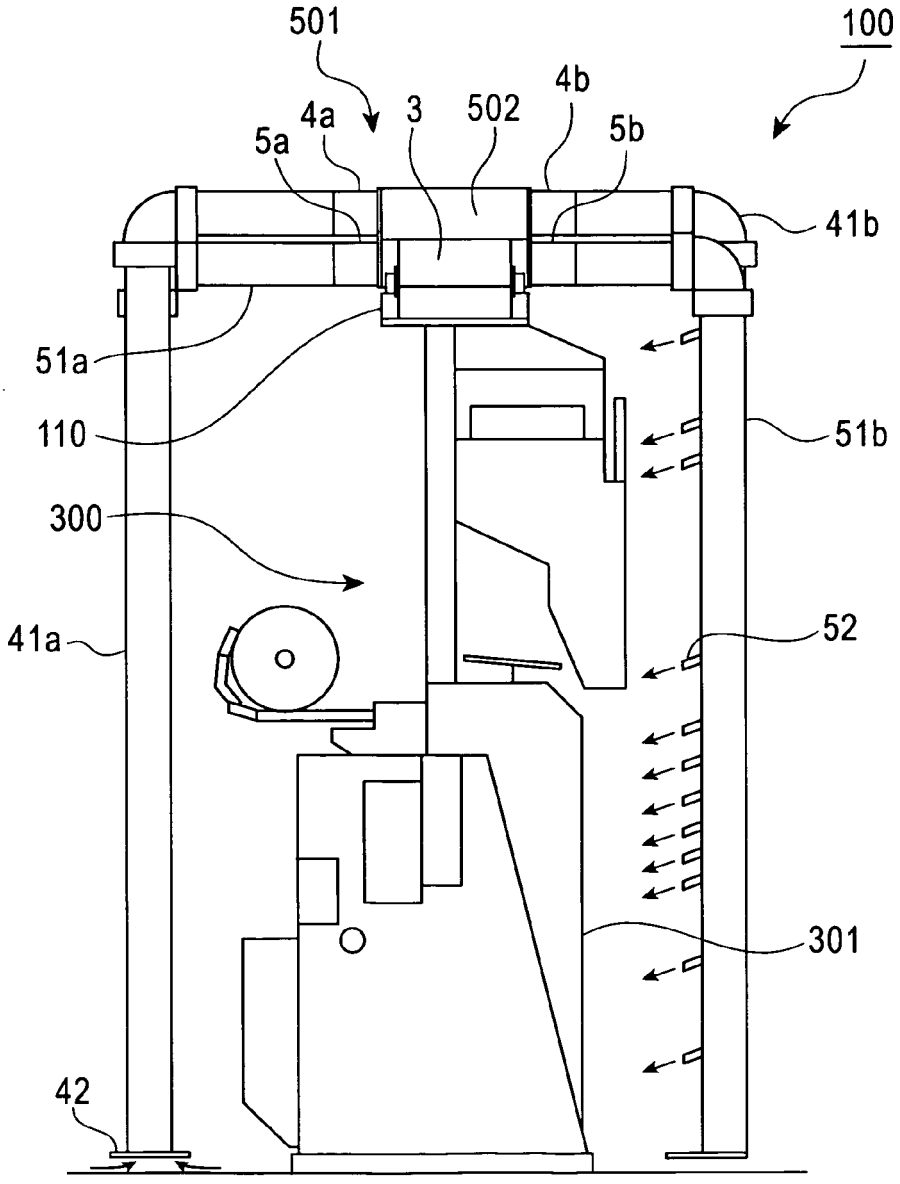

FIG. 8