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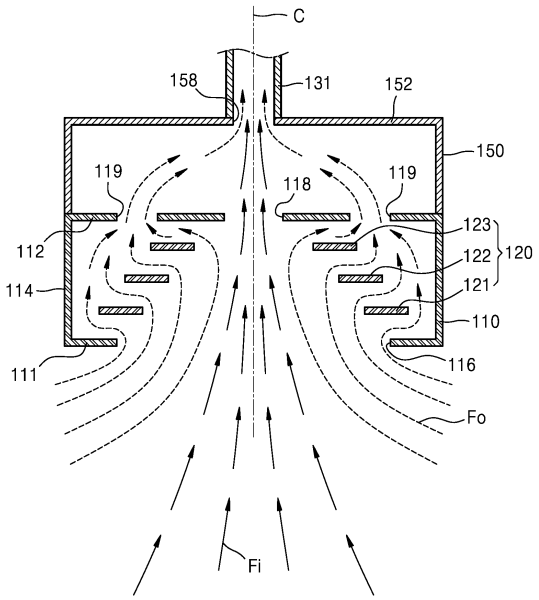
(54) **EXHAUST DEVICE**

(57) Provided is an exhaust device that sucks in polluted air and discharges the sucked-in air to the outside. The exhaust device includes a housing including an intake port and a plurality of exhaust ports, a guide means provided inside the housing and configured to guide air introduced into the housing through the intake port, and an exhaust means directly or indirectly connected to the plurality of exhaust ports. The plurality of exhaust ports include a first exhaust port located at a position corresponding to the center of the intake port and a plurality of second exhaust ports distributed in a rear wall of the housing while being spaced apart from the first exhaust port by an interval. The guide means includes a plurality of guide plates arranged between a front wall and the rear wall of the housing. The plurality of guide plates are concentrically arranged around a central axis of the intake port and each of the plurality of guide plates has a ring shape or an arc shape. Inner radii of the plurality of guide plates are less than an inner radius of the intake port, are greater than an inner radius of the first exhaust port, and gradually decrease from the intake port toward the first exhaust port.

FIG. 1



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Description

Technical Field

[0001] The present disclosure relates to an exhaust device that sucks in polluted air and discharges the sucked-in air to the outside, and more particularly, to an exhaust device capable of improving exhaust efficiency.

Background Art

[0002] In general, exhaust devices are installed in factories or kitchens of homes or restaurants where pollutants such as odors, harmful gases, smoke, and dust are generated, and are used to suck in air containing such pollutants (hereinafter, referred to as polluted air) and discharge the sucked-in air to the outside.

[0003] In an exhaust device used for this purpose in the art, as a distance between a pollution source and the exhaust device increases, the exhaust efficiency of sucking in and discharging polluted air rapidly decreases, and even when the pollution source is located in a wide open space, the exhaust efficiency of the exhaust device decreases.

[0004] Accordingly, in order to improve exhaust efficiency, it is preferable to install the exhaust device as close to the pollution source as possible and block the pollution source from the surrounding space.

[0005] However, there are many cases where it is difficult to install the exhaust device close to the pollution source and where it is difficult to block the pollution source from the surrounding space, and in such cases, satisfactory exhaust efficiency could not be obtained from the exhaust device in the art.

[0006] In the related art, in order to solve these problems, an exhaust fan with an excessively large capacity was used to increase the amount of intake of polluted air, but in this case, noise increased, installation and operation costs were excessive, economic efficiency was low, and satisfactory exhaust efficiency was still not obtained.

[0007] Recently, such a local exhaust device is generally equipped with a swirler provided near an intake port of an exhaust pipe to form a vortex. An air flow generated by the rotation of the swirler forms a vortex around an exhaust flow of polluted air that rises from a pollution source along a central axis of the swirler toward the intake port of the exhaust pipe. The vortex formed in this way functions as an air curtain that blocks the pollution source from the surrounding space, thereby allowing polluted air to be sucked into the exhaust pipe more efficiently.

[0008] Korean Patent No. 10-1606862 discloses an exhaust device including a swirler configured to form a vortex and a guide member configured to vertically expand an air curtain formed by the vortex. The exhaust device has the advantage of improving exhaust efficiency by more easily and efficiently sucking in polluted air relatively far from a polluted air intake port and discharging the sucked-in air to the outside.

[0009] However, the exhaust device should include the swirler with a plurality of blades to form a vortex, a separate motor for rotating the swirler, and the guide member having a somewhat complex structure to guide the vortex, and thus, the exhaust device has the disadvantage of being heavy and having a complex configuration, resulting in high manufacturing costs. Also, the exhaust device has the disadvantage wherein it is difficult to achieve miniaturization due to the complexity of the configuration, making it difficult to install the exhaust device in a kitchen of a home or a restaurant.

Disclosure of Invention

Technical Problem

[0010] The present disclosure is designed to solve the problems of the related art, and therefore the present disclosure is directed to providing an exhaust device that has a relatively simple structure and may improve exhaust efficiency.

Technical Solution

[0011] An exhaust device according to embodiments of the present disclosure includes:

a housing including a front wall having an intake port formed therein and a rear wall facing the front wall and having a plurality of exhaust ports formed therein;

a guide means provided inside the housing and configured to guide air introduced into the housing through the intake port; and

an exhaust means directly or indirectly connected to the plurality of exhaust ports and configured to discharge air introduced into the housing to outside of the housing through the plurality of exhaust ports,

wherein the plurality of exhaust ports include a first exhaust port located at a position corresponding to a center of the intake port and a plurality of second exhaust ports distributed in the rear wall of the housing while being spaced apart from the first exhaust port by an interval,

the guide means includes a plurality of guide plates located between the front wall and the rear wall of the housing, spaced apart from each other by an interval in a direction of a central axis of the intake port, and arranged parallel to the front wall,

the plurality of guide plates are concentrically arranged around the central axis of the intake port and each of the plurality of guide plates has a ring shape or an arc shape, and

inner radii of the plurality of guide plates are less than an inner radius of the intake port, are greater than an inner radius of the first exhaust port, and gradually decrease from the intake port toward the first ex-

haust port.

[0012] According to embodiments of the present disclosure, outer radii of the plurality of guide plates gradually decrease from the intake port toward the first exhaust port, and an outer radius of a guide plate closest to the front wall of the housing from among the plurality of guide plates is greater than the inner radius of the intake port.

[0013] According to embodiments of the present disclosure, the plurality of guide plates may be fixedly arranged inside the housing by being fixed to a side wall or the rear wall of the housing.

[0014] According to embodiments of the present disclosure, each of the plurality of guide plates may include lugs for fixing and may be fixed to the side wall or the rear wall of the housing through the lugs.

[0015] According to embodiments of the present disclosure, the housing may have a rectangular parallelepiped shape or a cylindrical shape.

[0016] According to an embodiment of the present disclosure, the exhaust device may further include an exhaust box coupled to a rear side of the housing and surrounding the plurality of exhaust ports together, wherein at least one common exhaust port is formed in a rear wall of the exhaust box to discharge air introduced into the exhaust box through the plurality of exhaust ports to outside, and at least one exhaust pipe is connected as the exhaust means to the at least one common exhaust port.

[0017] According to another embodiment of the present disclosure, the exhaust device may further include an exhaust box coupled to a rear side of the housing and surrounding the plurality of exhaust ports together, wherein the exhaust box has a height lower than a height of the housing, wherein at least one common exhaust port is formed in a side wall of the exhaust box forming a stepped portion with a corresponding side wall of the housing to discharge air introduced into the exhaust box through the plurality of exhaust ports to outside, and at least one exhaust fan is provided as the exhaust means in the at least one common exhaust port, and
at least one additional exhaust port is formed in the side wall of the housing corresponding to the side wall of the exhaust box in which the common exhaust port is formed to discharge part of air introduced into the housing to outside, and at least one exhaust fan is provided in the at least one additional exhaust port.

[0018] According to another embodiment of the present disclosure, the exhaust device may further include an exhaust box coupled to a rear side of the housing and surrounding the plurality of exhaust ports together, wherein a height of the exhaust box is equal to a height of the housing, wherein at least one integrated exhaust port is formed across the housing and the exhaust box, in one side wall from among side walls of the exhaust box and in a side wall of the housing corresponding to the one side wall, at least one exhaust fan is provided in the at least one integrated exhaust port, and air introduced into the housing and the exhaust box is discharged to outside of the housing and the exhaust box through the at least one integrated exhaust port.

[0019] According to an embodiment of the present disclosure, the intake port may have a circular shape, and the plurality of guide plates may have ring shapes with widths in a radial direction.

[0020] According to an embodiment of the present disclosure, each of the plurality of guide plates may be divided into a plurality of arc-shaped members, and the plurality of arc-shaped members of each of the plurality of guide plates may be arranged together in a ring shape inside the housing.

[0021] According to another embodiment of the present disclosure, the intake port may have a substantially semicircular shape, and the plurality of guide plates may have arc shapes with widths in a radial direction.

[0022] According to another embodiment of the present disclosure, the exhaust device may further include an auxiliary guide plate extending parallel to the central axis from the rear wall toward the front wall of the housing from a position adjacent to an edge of the first exhaust port.

[0023] According to another embodiment of the present disclosure, the auxiliary guide plate may have a width that is greater than a diameter of the first exhaust port but does not interfere with a guide plate closest to the rear wall of the housing from among the plurality of guide plates.

[0024] According to another embodiment of the present disclosure, the exhaust device may further include side guide plates vertically extending from both edges of the auxiliary guide plate to a bottom of the housing.

[0025] According to another embodiment of the present disclosure, the auxiliary guide plate may be spaced apart from the front wall of the housing by a certain interval, and at least one front guide plate may be located within an interval between a front end of the auxiliary guide plate and the front wall of the housing, wherein the at least one front guide plate is spaced apart from the front end of the auxiliary guide plate and the front wall of the housing, has a width in a direction perpendicular to the bottom of the housing, is arranged parallel to the front wall of the housing between the side guide plates, and has both longitudinal ends of the front guide plate fixed to the side guide plates.

[0026] According to another embodiment of the present disclosure, the at least one front guide plate may include a plurality of front guide plates arranged parallel to each other while being spaced apart from each other by an interval, and the plurality of front guide plates may be arranged so that heights of upper ends of the plurality of front guide plates are greater as the plurality of front guide plates are located farther from the front wall of the housing.

[0027] According to another embodiment of the present disclosure, the exhaust device may further include side guide plates vertically extending upward from both

edges of the auxiliary guide plate.

[0028] According to another embodiment of the present disclosure, the auxiliary guide plate may be spaced apart from the front wall of the housing by a certain interval, and a front guide plate vertically extending upward from a front end of the auxiliary guide plate may be located on the front end of the auxiliary guide plate, wherein the front guide plate is arranged parallel to the front wall of the housing while being spaced apart from the front wall of the housing by an interval.

[0029] According to another embodiment of the present disclosure, the side guide plates may extend from the rear wall of the housing to the front wall of the housing, and the front guide plate may be arranged between the side guide plates.

Advantageous Effects of Invention

[0030] According to an exhaust device according to embodiments of the present disclosure, because even polluted air far from the exhaust device may be efficiently sucked in without a swirler that forms a vortex and may be discharged to the outside, exhaust efficiency may be improved.

[0031] Also, because the exhaust device of the present disclosure does not include the swirler, a separate motor for driving the swirler is not provided, and thus, a configuration may be simplified, manufacturing costs may be reduced, and power consumption required to operate the exhaust device may also be reduced.

[0032] Also, because the configuration of the exhaust device of the present disclosure is simplified and the size and weight are reduced, the exhaust device may be miniaturized.

Brief Description of Drawings

[0033]

FIG. 1 is a schematic view for describing a basic configuration and operation of an exhaust device, according to a first embodiment of the present disclosure.

FIG. 2 is a perspective view illustrating an outer appearance of the exhaust device of FIG. 1, showing an example where a central axis is horizontal.

FIG. 3 is a vertical cross-sectional view illustrating the exhaust direction of FIG. 2 in a direction of the central axis.

FIG. 4 is a perspective view illustrating guide plates shown in FIGS. 1 to 3 separated from a housing.

FIG. 5 is a perspective view illustrating a modified example of the housing of FIG. 2.

FIG. 6 is a perspective view illustrating a modified example of the guide plates of FIG. 5.

FIG. 7 is a perspective view illustrating an outer appearance of an exhaust device, according to a second embodiment of the present disclosure, showing an example where a central axis is horizontal.

FIG. 8 is a vertical cross-sectional view illustrating the exhaust device of FIG. 7 in a direction of the central axis.

FIG. 9 is a perspective view illustrating guide plates of FIGS. 7 and 8, separated from a housing.

FIG. 10 is a partial perspective view illustrating a modified example of a portion where an auxiliary guide plate of FIGS. 7 and 8 is provided.

FIG. 11 is a vertical cross-sectional view illustrating the portion of FIG. 10.

FIG. 12 is a partial perspective view illustrating another modified example of a portion where the auxiliary guide plate of FIGS. 7 and 8 is provided.

FIG. 13 is a perspective view illustrating an outer appearance of an exhaust device, according to a third embodiment of the present disclosure, showing an example where a central axis is horizontal.

FIG. 14 is a rear perspective view illustrating the exhaust device of FIG. 13.

FIG. 15 is a vertical cross-sectional view illustrating the exhaust device of FIG. 13 in a direction of the central axis.

FIG. 16 is a schematic view illustrating an example where the exhaust device of FIG. 13 is used as a device for forming an air fence.

FIG. 17 is a perspective view illustrating a modified example of the exhaust device of FIG. 13.

Mode for the Invention

[0034] Hereinafter, an exhaust device according to embodiments of the present disclosure will be described with reference to the attached drawings. In the drawings, the same reference numerals denote the same elements.

[0035] FIG. 1 is a schematic view for describing a basic configuration and operation of an exhaust device, according to a first embodiment of the present disclosure. FIG. 2 is a perspective view illustrating an outer appearance of the exhaust device of FIG. 1, showing an example where a central axis is horizontal. FIG. 3 is a vertical cross-sectional view illustrating the exhaust device of FIGS. 1 to 3 in a direction of the central axis. FIG. 4 is a perspective view illustrating guide plates of FIG. 3 separated from a housing.

[0036] Referring to FIGS. 1 to 4, an exhaust device 100 according to a first embodiment of the present disclosure includes a housing 110 including an intake port 116 and a plurality of exhaust ports (e.g., 118 and 119), a guide means 120 provided inside the housing 110 and configured to guide air introduced into the housing 110 through the intake port 116, and at least one exhaust pipe 131 directly or indirectly connected to the plurality of exhaust ports (e.g., 118 and 119) and configured to function as an exhaust means for discharging air introduced into the housing 110 to the outside of the housing 110 through the plurality of exhaust ports (e.g., 118 and 119).

[0037] The housing 110 preferably has a rectangular parallelepiped shape as shown in FIG. 2, but the present disclosure is not limited thereto, and the housing 110 may have any of other appropriate shapes such as a polygonal shape or a cylindrical shape (see FIG. 5).

[0038] The housing 110 includes a front wall 111 on a side where air is introduced into the housing 110, a rear wall 112 facing the front wall 111 while being spaced apart from the front wall 111 by a certain interval, and side walls 114 located between the front wall 111 and the rear wall 112 and connecting the front wall 111 to the rear wall 112. The intake port 116 through which air is introduced into the housing 110 is formed in the front wall 111 of the housing 110, and the plurality of exhaust ports (e.g., 118 and 119) through which air is discharged from the housing 110 are formed in the rear wall 112.

[0039] Preferably, the intake port 116 may have a circular shape. The plurality of exhaust ports (e.g., 118 and 119) preferably have circular shapes, but the present disclosure is not limited thereto, and the plurality of exhaust ports (e.g., 118 and 119) may have other appropriate shapes such as polygonal shapes, elliptical shapes, or semicircular shapes according to positions of the exhaust ports (e.g., 118 and 119).

[0040] The plurality of exhaust ports (e.g., 118 and 119) may include one first exhaust port 118 and a plurality of second exhaust ports 119. The first exhaust port 118 is located at a position corresponding to the center of the intake port 116. Preferably, the center of the first exhaust port 118 may be the same as the center of the intake port 116, and a central axis C passing through the center of the first exhaust port 118 and the intake port 116 is not only a central axis of the housing 110 but also an overall air flow axis. The plurality of second exhaust ports 119 may be appropriately distributed in the rear wall 112 of the housing 110 while being spaced apart from the first exhaust port 118 by a certain interval.

[0041] As shown in FIG. 1, the exhaust device 100 according to the present disclosure may be arranged so that the central axis C is vertical. Also, as shown in FIGS. 2 and 3, the exhaust device 100 according to the present disclosure may be arranged so that the central axis C is horizontal. Although not shown, the exhaust device 100 according to the present disclosure may be arranged so that the central axis C is inclined at a certain angle. As such, the exhaust device 100 according to the present disclosure may be arranged in any of various directions in which polluted air is determined to be most efficiently sucked in according to a location where the polluted air is generated and a location where the exhaust device 100 is installed. In each of the drawings, the exhaust device 100 according to the present disclosure is arranged in a direction in which a configuration of the exhaust device 100 is more clearly shown.

[0042] Exhaust pipes (not shown) may be respectively directly connected to the plurality of exhaust ports (e.g., 118 and 119), but the present disclosure is not limited thereto. The plurality of exhaust ports (e.g., 118 and 119) may be indirectly connected to one exhaust pipe 131. Also, the plurality of exhaust ports (e.g., 118 and 119) may be indirectly connected to more than one, for example, two or three exhaust pipes (not shown).

[0043] To this end, the exhaust pipe 100 according to the present disclosure may further include an exhaust box 150 coupled to a rear side of the housing 110 and surrounding the plurality of exhaust ports (e.g., 118 and 119) together. A shape of the exhaust box 150 may be the same as that of the housing 110, for example, a rectangular parallelepiped shape, but a size of the exhaust box 150 may be less than a size of the housing 110. For example, a width WB of the exhaust box in a direction of the central axis C may be less than a width WH of the housing.

[0044] A front wall of the exhaust box 150 is the rear wall 112 of the housing 110. That is, the rear wall 112 of the housing 110 is shared between the housing 110 and the exhaust box 150. One common exhaust port 158 is formed in a substantially central portion of a rear wall 152 of the exhaust box 150, and the exhaust pipe 131 is connected to the common exhaust port 158. Accordingly, air discharged from the housing 110 through the plurality of exhaust ports (e.g., 118 and 119) may be combined in the exhaust box 150 and may be discharged through the common exhaust port 158 and the exhaust pipe 131. Although not shown, more than one, for example, two or three common exhaust ports, may be formed in the rear wall 158 of the exhaust box 150, and an exhaust pipe may be connected to each of the common exhaust ports. Although the plurality of exhaust ports (e.g., 118 and 119) include about 6 to 9 exhaust ports (e.g., 118 and 119) for uniform exhaust from the housing 120, only 1 to 3 common exhaust ports 158, which is much smaller than the number of exhaust ports (e.g., 118 and 119), are formed in the exhaust box 150, and thus, the number of exhaust pipes 131 used is also much smaller than the number of exhaust ports (e.g., 118 and 119). Accordingly, complexity caused by multiple exhaust pipes may be reduced.

[0045] As is known, for example, a sirocco fan (not shown), is provided in the exhaust pipe 131. The sirocco fan forms a negative pressure in the housing 110 (and the exhaust box 150) to forcibly suck air outside the housing 110 into the housing 110 and discharge the sucked-in air to the outside through the exhaust pipe 131. The sirocco fan may be provided at an exhaust end side of the exhaust pipe 131. As such, due to the sirocco fan provided in the exhaust pipe 131, an air flow introduced from the outside of the housing 110, passing through the intake port 116 of the front wall 111 of the housing 110, the inside of the housing 110, the exhaust ports (e.g., 118 and 119) of the rear wall 112 of the housing 110, the inside of the exhaust box 150, the common exhaust port 158 of the rear wall 152 of the exhaust box 150, and the exhaust pipe 131, and discharged to the outside is formed.

[0046] The guide means120 is provided inside the housing 110, functions as a means for efficiently guiding

air introduced into the housing 110 through the intake port 118, and may include a plurality of guide plates (e.g., 121, 122, and 123).

[0047] Although three guide plates (e.g., 121, 122, and 123) are illustrated in the drawings, the present disclosure is not limited thereto, and two, or four or more guide plates may be provided inside the housing 110 according to a required exhaust capacity of the exhaust device 100 and/or a size of the housing 110.

[0048] The plurality of guide plates (e.g., 121, 122, and 123) are located between the front wall 111 and the rear wall 112 of the housing 110. The plurality of guide plates (e.g., 121, 122, and 123) may include a first guide plate 121, a second guide plate 122, and a third guide plate 123 that are spaced apart from each other by a certain interval in the direction of the central axis C from the front wall 111 to the rear wall 112, and the first guide plate 121 is spaced apart from the front wall 111, and the third guide plate 123 is spaced apart from the rear wall 112.

[0049] In detail, as shown in FIG. 3, the first guide plate 121 is arranged parallel to the front wall 111 while being spaced apart from the front wall 111 by a first interval G1 in the direction of the central axis C. The second guide plate 122 is arranged parallel to the first guide plate 121 while being spaced apart from the first guide plate 121 by a second interval G2. The third guide plate 123 is arranged parallel to the second guide plate 122 while being spaced apart from the second guide plate 122 by a third interval G3. Also, the third guide plate 123 is arranged parallel to the rear wall 112 while being spaced apart from the rear wall 112 by a fourth interval G4. As such, the front wall 111, three guide plates (e.g., 121, 122, and 123), and the rear wall 112 are arranged parallel to each other while being spaced apart from each other by a certain interval. In this case, in order to optimize an air flow guided by the guide plates (e.g., 121, 122, and 123), the first to fourth intervals G1, G2, G3, and G4 may be the same or different from each other. For example, the first to fourth intervals G1, G2, G3, and G4 may gradually increase or decrease toward the rear wall 112, and may be determined as values showing an optimal air flow through a plurality of experiments. Also, the first to fourth intervals G1, G2, G3, and G4 may be appropriately determined according to the required exhaust capacity of the exhaust device 100 and/or the size of the housing 110.

[0050] As shown in FIG. 4, the first guide plate 121, the second guide plate 122, and the third guide plate 123 have ring shapes each centered on the central axis C and having certain widths W1, W2, and W3 in a radial direction. The widths W1, W2, and W3 may be the same, but the present disclosure is not limited thereto. The guide plates (e.g., 121, 122, and 123) having ring shapes may be fixedly arranged inside the housing 110 by each being fixed to the side wall 114 of the housing 110. To this end, each of the guide plates (e.g., 121, 122, and 123) having ring shapes may include lugs 125 on outer edges and may be fixed to the side wall 114 of the housing 110 through the lugs 125. The lugs 125 may have any appropriate shape and size in addition to a shape and a size illustrated in FIG. 4. Also, the lugs 125 may be fixed to the side wall 114 of the housing 110 through an appropriate fastening means such as screws or an adhesive.

[0051] The guide plates (e.g., 121, 122, and 123) having ring shapes are concentrically arranged with the intake port 116 and the first exhaust port 118. However, the guide plates (e.g., 121, 122, and 123), the intake port 116, and the first exhaust port 118 have different radii.

[0052] In detail, as shown in FIGS. 3 and 4, an inner radius Ri1 of the first guide plate 121 is less than an inner radius Ra of the intake port 116, and an outer radius Ro1 of the first guide plate 121 is greater than the inner radius Ra of the intake port 116. Also, an inner radius Ri2 of the second guide plate 122 is less than the inner radius Ri1 of the first guide plate 131, and an outer radius Ro2 of the second guide plate 122 is greater than the inner radius Ri1 of the first guide plate 121 but less than the outer radius Ro1 of the first guide plate 121. An inner radius Ri3 of the third guide plate 123 is less than the inner radius Ri2 of the second guide plate 122, and an outer radius Ro3 of the third guide plate 123 is greater than the inner radius Ri2 of the second guide plate 122 but less than the outer radius Ro2 of the second guide plate 122. Also, the inner radius Ri3 of the third guide plate 123 is greater than an inner radius Rb of the first exhaust port 118. As such, inner radii of the intake port 116, the first guide plate 121, the second guide plate 122, the third guide plate 123, and the first exhaust port 118 gradually decrease from the intake port 116 toward the first exhaust port 118, and thus, an air flow passage formed therein also gradually narrows. Inner radii and outer radii of the intake port 116, the guide plates (e.g., 121, 122, and 123), and the first exhaust port 118 may be determined as values showing optimal performance through a number of experiments, according to the required exhaust capacity of the exhaust device 100 and/or the size of the housing 110.

[0053] Hereinafter, an operation of the exhaust device 100 according to the first embodiment of the present disclosure having the above configuration will be described.

[0054] Referring to FIG. 1, when the sirocco fan provided in the exhaust pipe 131 begins to operate, a negative pressure is formed inside the housing 110 and air outside the housing 110 is introduced into the housing 110 through the intake port 116. The air introduced into the housing 110 includes external air in a periphery of the housing 110 (this air includes clean air and polluted air) and external air in the direction of the central axis C of the housing 110 (this air is mostly polluted air). The air introduced from the periphery of the housing 110 into the housing 110 forms an outer air flow Fo passing through the first interval G1 between the front wall 111 and the first guide plate 121, the second interval G2 between the first guide plate 121 and the second guide plate 122, the third interval G3 between the second guide plate 122 and the third guide plate 123, and the fourth interval G4 between the third guide plate 123 and the rear

wall 112. The outer air flow Fo formed in this way has a shape that gradually narrows toward the first exhaust port 118 as shown in FIG. 1 due to the arrangement of the guide plates (e.g., 121, 122, and 123) having the above configuration, and thus, an air guide passage having a shape that gradually narrows toward the first exhaust port 118 is formed inside the outer air flow Fo.

[0055] The external air (i.e., mostly polluted air) in the direction of the central axis C of the housing 110 forms an inner air flow Fi while being introduced into the housing 110 toward the first exhaust port 118. The inner air flow Fi is guided toward the first exhaust port 118 through an air guide passage having a shape that gradually narrows formed inside the outer air flow Fo.

[0056] The inner air flow Fi is introduced into the exhaust box 150 through the first exhaust port 118, and the outer air flow Fo is introduced into the exhaust box 150 through the plurality of exhaust ports 119. The inner air flow Fi and the outer air flow Fo are combined in the exhaust box 150 and then are discharged through the common exhaust port 158 and the exhaust pipe 131.

[0057] As described above, in the exhaust device 100 according to the present disclosure, the outer air flow Fo formed to gradually narrow toward the first exhaust port 118 due to the plurality of guide plates (e.g., 121, 122, and 123) surrounds the inner air flow Fi to suppress the inner air flow Fi from being dispersed outward and to smoothly guide the inner air flow Fi toward the first exhaust port 118. Also, due to the outer air flow Fo, a passage through which the inner air flow Fi passes (i.e., an air guide passage formed inside the outer air flow Fo) becomes narrower, and thus, a speed of the inner air flow Fi may increase and a negative pressure may increase, thereby making it possible to effectively collect even polluted air far from the exhaust device 100.

[0058] As described above, the exhaust device 100 may improve exhaust efficiency by efficiently sucking polluted air far from the exhaust device 100 and discharging the sucked-in air to the outside only with a sirocco fan provided in an exhaust pipe, without a conventional swirler that forms a vortex. Also, because the exhaust device 100 does not use a conventional swirler and thus does not include a separate motor for driving the swirler, a configuration may be simplified, manufacturing costs of the exhaust device 100 may be reduced, and power consumption required to operate the exhaust device 100 may also be reduced. Also, because the configuration of the exhaust device 100 is simplified and the size and weight are reduced, the exhaust device 100 may be miniaturized.

[0059] FIG. 5 is a perspective view illustrating a modified example of the housing of FIG. 2.

[0060] The modified example of FIG. 5 is substantially the same as the first embodiment of FIGS. 1 to 4 except for a difference in shapes of a housing and an exhaust box, and thus, only the difference will be described.

[0061] Referring to FIG. 5, as described above, a housing 110' may have a cylindrical shape. The housing 110' includes a front wall 111' in which an intake port 116' is formed, a rear wall 112' in which a plurality of exhaust ports (e.g., 118' and 119') are formed, and a side wall 114' located between the front wall 111' and the rear wall 112' and connecting the front wall 111' to the rear wall 112'.

[0062] Preferably, the intake port 116' may have a circular shape. The plurality of exhaust ports (e.g., 118' and 119') may include one first exhaust port 118' and a plurality of second exhaust ports 119'. The first exhaust port 118' may be located at a position corresponding to the center of the intake port 116', and the plurality of second exhaust ports 119' may be appropriately distributed in the rear wall 112' of the housing 110'.

[0063] An exhaust box 150' surrounding the plurality of exhaust ports (e.g., 118' and 119') together may be coupled to a rear side of the housing 110'. A shape of the exhaust box 150' may be the same as that of the housing 110', for example, a cylindrical shape, but a size of the exhaust box 150' may be less than a size of the housing 110'. For example, a width of the exhaust box 150' in a direction of the central axis C may be less than a width of the housing 110'. At least one common exhaust port 158' is formed in a substantially central portion of a rear wall 152' of the exhaust box 150', and an exhaust pipe 131' is connected to the common exhaust port 158'.

[0064] Although the guide means 120 includes two guide plates (e.g., 121 and 122) having ring shapes in the modified example of FIG. 5, the present disclosure is not limited thereto, and three or more guide plates may be provided inside the housing 110'. An arrangement of the guide plates (e.g., 121 and 122), an interval between the guide plates (e.g., 121 and 22), and inner radii and outer radii of the guide plates (e.g., 121 and 122) are substantially the same as those of the guide plates (e.g., 121, 122, and 123) of FIGS. 1 to 4, and thus, a detailed description thereof will not be repeated.

[0065] FIG. 6 is a perspective view illustrating a modified example of the guide plates of FIG. 5.

[0066] Referring to FIG. 6, each of guide plates (e.g., 121' and 122') has a substantially ring shape, but may be divided into a plurality of members. In detail, a first guide plate 121' includes three partial ring-shaped members, that is, three arc-shaped members 121a', 121b', and 121c'. That is, the first guide plate 121' is divided into three arc-shaped members 121a', 121b', and 121c', and the three arc-shaped members 121a', 121b', and 121c' inside the housing 110' are arranged together in a ring shape to form the first guide plate 121' having a substantially ring shape. Each of the three arc-shaped members 121a', 121b', and 121c' may have a central angle of about 120°. Likewise, a second guide plate 122' includes three arc-shaped members 122a', 122b', and 122c'.

[0067] Although each of the guide plates (e.g., 121' and 122') includes three arc-shaped members in the above, the present disclosure is not limited thereto. For example, each of the guide plates (e.g., 121' and 122') may include two arc-shaped members, and in this case, each of the two arc-shaped members has a central angle of about

180°. Also, each of the guide plates (e.g., 121' and 122') may include four arc-shaped members, and in this case, each of the four arc-shaped members has a central angle of about 90°.

[0068] Each of the arc-shaped members 121a', 121b', and 121c' of the first guide plate 121' may include lugs 125' formed on both ends thereof and may be fixed to the rear wall 112' of the housing 110' having a cylindrical shape shown in FIG. 5 through the lugs 125'. The arc-shaped members 121a', 121b', and 121c' may be fixed to the side wall 114' of the housing 110' of FIG. 5 through the lugs 125 as shown in FIG. 4. The lugs 125' and the lugs 125 (see FIG. 4) may be used together, and thus, the arc-shaped members 121a', 121b', and 121c' may be fixed to the rear wall 112' and the side wall 114' of the housing 110' shown in FIG. 5, thereby improving installation stability. Likewise, the arc-shaped members 122a', 122b', and 122c' of the second guide plate 122' may be fixedly provided inside the housing 110' shown in FIG. 5 through the lugs 125' and/or the lugs 125 (see FIG. 4).

[0069] The arc-shaped members 121a', 121b', and 121c' of the first guide plate 121' may be spaced apart from each other by a certain interval G21 in a circumferential direction. Likewise, the arc-shaped members 122a', 122b', and 122c' of the second guide plate 122' may be spaced apart from each other by a certain interval G22 in the circumferential direction.

[0070] Although the guide plates (e.g., 121' and 122') of FIG. 6 are provided inside the housing 110 having a cylindrical shape shown in FIG. 5, the present disclosure is not limited thereto. For example, the guide plates (e.g., 121, 122, and 123) provided inside the housing 110 having a rectangular parallelepiped shape shown in FIG. 2 may also include a plurality of arc-shaped members.

[0071] FIG. 7 is a perspective view illustrating an outer appearance of an exhaust device, according to a second embodiment of the present disclosure, showing an example where a central axis is horizontal. FIG. 8 is a vertical cross-sectional view illustrating the exhaust device of FIG. 7 in a direction of the central axis. FIG. 9 is a perspective view illustrating guide plates of FIGS. 7 and 8, separated from a housing.

[0072] Referring to FIGS. 7 to 9 together, an exhaust device 200 according to a second embodiment of the present disclosure includes a housing 210 including an intake port 216 and a plurality of exhaust ports (e.g., 218 and 219), a guide means 220 provided inside the housing 210 and configured to guide air introduced into the housing 210 through the intake port 216, and at least one exhaust pipe 231 directly or indirectly connected to the plurality of exhaust ports (e.g., 218 and 219) and configured to function as an exhaust means for discharging air introduced into the housing 210 to the outside of the housing 210 through the plurality of exhaust ports (e.g., 218 and 219).

[0073] As described above, basic elements of the exhaust device 200 according to the second embodiment of the present disclosure are substantially the same as those of the exhaust device 100 according to the first embodiment. However, the exhaust device 200 according to the second embodiment of the present disclosure is configured to more efficiently operate when the exhaust device 200 sucks in air from a partial angular range in front rather than an entire range in front, for example, when there is an obstacle such as a vertical wall near to the exhaust device 200 in which the central axis C is vertical or when the exhaust device 200 in which the central axis C is horizontal sucks in polluted air generated from a horizontal floor or table.

[0074] Accordingly, as described below in detail, there are some differences between the exhaust device 200 according to the second embodiment of the present disclosure and the exhaust device 100 according to the first embodiment, and the differences will be mainly described. Accordingly, the same features will not be described or will be briefly described.

[0075] It is preferable that the housing 210 has a rectangular parallelepiped shape, but the present disclosure is not limited thereto. For example, the housing 210 may have a semicircular cylindrical shape corresponding to the intake shape 216 having a semicircular shape described below. The housing 210 includes a front wall 211 on a side where air is introduced into the housing 210, a rear wall 212 facing the front wall 211 while being spaced apart from the front wall 211 by a certain interval, and side walls 214 between the front wall 211 and the rear wall 212. The intake port 216 through which air is introduced into the housing 210 is formed in the front wall 211 of the housing 210, and the plurality of exhaust ports (e.g., 218 and 219) through which air is discharged from the housing 210 are formed in the rear wall 212.

[0076] The intake port 216 may have a substantially semicircular shape, and in this regard, is different from the intake port 116 of FIG. 2. Preferably, the intake port 216 is defined by an arc portion 216a having a central angle of substantially 180° and a linear portion 216b connecting both ends of the arc portion 216a.

[0077] It is preferable that the plurality of exhaust ports (e.g., 218 and 219) have circular shapes, but the present disclosure is not limited thereto, and the plurality of exhaust ports (e.g., 218 and 219) may have other appropriate shapes such as polygonal shapes, elliptical shapes, or semicircular shapes according to positions of the exhaust ports 218 and 219.

[0078] The plurality of exhaust ports (e.g., 218 and 219) may include one first exhaust port 218 and a plurality of second exhaust ports 219. The center of the first exhaust port 218 may preferably be the same as the center of the intake port 216. The plurality of second exhaust ports 219 may be appropriately distributed in the rear wall 212 of the housing 210 while being spaced apart from the first exhaust port 218 by a certain interval.

[0079] Although the exhaust device 200 is arranged so that the central axis C is horizontal in FIG. 7, the present disclosure is not limited thereto. As described above, the

exhaust device 200 may be arranged so that the central axis C is vertical, or may be arranged so that the central axis C is inclined at a certain angle.

[0080] Exhaust pipes (not shown) may be respectively directly connected to the plurality of exhaust ports (e.g., 218 and 219), but the present disclosure is not limited thereto. As described above, the plurality of exhaust ports (e.g., 218 and 219) may be indirectly connected to the at least one exhaust pipe 231 through an exhaust box 250 coupled to a rear side of the housing 210 and surrounding the exhaust ports 218 and 219 together and at least one common exhaust port 258 formed in a rear wall 252 of the exhaust box 250. The center of the common exhaust port 258 may be the same as the central axis C, but the present disclosure is not limited thereto. For example, the common exhaust port 258 may be formed at a substantially central portion of the rear wall 252 of the exhaust box 250.

[0081] The exhaust pipe 231 is the same as the exhaust pipe 131 of the exhaust device 100 according to the first embodiment, and thus, a detailed description thereof will be omitted.

[0082] The guide means 220 is provided inside the housing 210 and functions as a means for efficiently guiding air introduced into the housing 210 through the intake port 118, and may include a plurality of guide plates, preferably but not limited to, three guide plates (e.g., 221, 222, and 223). That is, the guide means may include two, or four or more guide plates.

[0083] The plurality of guide plates (e.g., 221, 222, and 223) are located between the front wall 211 and the rear wall 212 of the housing 210. The plurality of guide plates (e.g., 221, 222, and 223) may include a first guide plate 221, a second guide plate 222, and a third guide plate 223 that are spaced apart from each other by a certain interval in a direction of the central axis C from the front wall 211 to the rear wall 212, and the first guide plate 221 is spaced apart from the front wall 211 and the third guide plate 223 is spaced apart from the rear wall 212.

[0084] A specific arrangement of and an interval between the plurality of guide plates (e.g., 221, 222, and 223) are the same as those of the guide plates (e.g., 121, 122, and 123) of the exhaust device 100 according to the first embodiment of the present disclosure, and thus, a detailed description thereof will be omitted.

[0085] As shown in FIG. 9, the first guide plate 221, the second guide plate 222, and the third guide plate 223 have substantially arc shapes each centered on the central axis C and having certain widths W1, W2, and W3 in a radial direction. In detail, the plurality of guide plates (e.g., 221, 222, and 223) preferably have arc shapes having a central angle of about 180° to about 210°. The widths W1, W2, and W3 of the plurality of guide plates (e.g., 221, 222, and 223) may be the same, but the present disclosure is not limited thereto. As such, the guide plates (e.g., 221, 222, and 223) are different from the guide plates (e.g., 121, 122, and 123) in that the guide plates (e.g., 221, 222, and 223) have arc shapes whereas the guide plates (e.g., 121, 122, and 123) have ring shapes shown in FIG. 4.

[0086] The guide plates (e.g., 221, 222, and 223) having arc shapes may be fixedly arranged inside the housing 210 by each being fixed to the side wall 214 of the housing 210. To this end, each of the guide plates (e.g., 221, 222, and 223) having arc shapes may include lugs 225 for fixing on outer edges of both ends and may be fixed to the side wall 214 of the housing 210 through the lugs 225.

[0087] The guide plates (e.g., 221, 222, and 223) having arc shapes are concentrically arranged with the intake port 216 and the first exhaust port 218. However, the guide plates (e.g., 221, 222, and 223), the intake port 216, and the first exhaust port 218 have difference radii. A size relationship between an inner radius of the intake port 216, an inner radius of the first exhaust port 218, and inner radii Ri1, Ri2, and Ri3 and outer radii Ro1, Ro2, and Ro3 of the guide plates (e.g., 221, 222, and 223) is the same as a size relationship between the inner radius Ra of the intake port 116, the inner radius Rb of the first exhaust port 118, and the inner radii Ri1, Ri2, and Ri3 and the outer radii Ro1, Ro2, and Ro3 of the guide plates (e.g., 121, 122, and 123), and thus a detailed description thereof will be omitted.

[0088] As described above, even in the second embodiment of the present disclosure, inner radii of the intake port 216, the first guide plate 221, the second guide plate 222, the third guide plate 223, and the first exhaust port 218 gradually decrease from the intake port 216 toward the first exhaust port 218, and thus, an air flow passage formed therein also gradually narrows.

[0089] An operation of the exhaust device 200 according to the second embodiment of the present disclosure having the above configuration is substantially the same as that of the exhaust device 100 according to the first embodiment described above in detail, and thus, advantages of the exhaust device 200 are also the same as those of the exhaust device 100 according to the first embodiment.

[0090] In particular, even in the exhaust device 200 according to the second embodiment, because the intake port 216 has a semicircular shape and the guide plates (e.g., 221, 222, and 223) have arc shapes, as described above, the exhaust device 200 may more efficiently operate when the exhaust device 200 sucks in air from a partial angular range in front rather than an entire range in front, for example, when there is an obstacle such as a vertical wall near the exhaust device 200 in which the horizontal axis C is vertical or when the exhaust device 200 in which the central axis C is horizontal sucks in polluted air generated from a horizontal floor or table.

[0091] The exhaust device 200 may additionally include an auxiliary guide plate 245 and side guide plates 246.

[0092] The auxiliary guide plate 245 extends parallel to the central axis C from the rear wall 212 toward the front wall 211 of the housing 210. In an example where the

auxiliary guide plate 245 is provided, the first exhaust port 218 may be formed in a semicircular shape corresponding to the intake port 216, instead of a circular shape, and the auxiliary guide plate 245 may horizontally extend from a position adjacent to an edge of the first exhaust port 218 to the front wall 211. Although the auxiliary guide plate 245 has a width greater than a diameter of the first exhaust port 218, the width of the auxiliary guide plate 245 is less than or equal to twice the inner radius Ri3 of the third guide plate 223 so that the auxiliary guide plate 245 does not interfere with the third guide plate 223. The auxiliary guide plate 245 smoothly guides an inner air flow Fi introduced into the housing 210 through the intake port 216 toward the first exhaust port 218.

[0093] The side guide plates 246 vertically extend downward from both edges of the auxiliary guide plate 245 to the bottom of the housing 210. The side guide plates 246 smoothly guide an outer air flow Fo introduced into the housing 210 toward the second exhaust ports 219 located on both sides of the first exhaust port 218.

[0094] FIG. 10 is a partial perspective view illustrating a modified example of a portion where the auxiliary guide plate of FIGS. 7 and 8 is provided. FIG. 11 is a vertical cross-sectional view illustrating the portion of FIG. 10.

[0095] Referring to FIGS. 10 and 11 together, the auxiliary guide plate 245 extends from the rear wall 212 toward the front wall 211 of the housing 210, but does not extend to the front wall 211 and is spaced apart from the front wall 211 by a certain interval. At least one front guide plate, for example, two front guide plates (e.g., 247 and 248), may be located between a front end of the auxiliary plate 245, that is, an end close to the intake port 216, and the front wall 211.

[0096] The front guide plates (e.g., 247 and 248) have certain widths W11 and W12 in a direction perpendicular to the bottom of the housing 210, extend parallel to the front wall 211 between the side guide plates 246, and have both longitudinal ends fixed to the side guide plates 246. The widths W11 and W12 of the front guide plates (e.g., 247 and 248) may be the same, but the present disclosure is not limited thereto. The front guide plates (e.g., 247 and 248) are not only spaced apart from the front end of the auxiliary guide plate 245 and the front wall 211 but also spaced apart from each other by a certain interval. That is, a first front guide plate 247 is arranged parallel to the front wall 211 while being spaced apart from the front wall 211 by a first interval G11, and a second front guide plate 248 is arranged parallel to the first front guide plate 247 while being spaced apart from the first front guide plate 247 by a second interval G12. Also, the second front guide plate 248 is spaced apart from an end of the auxiliary guide plate 245 by a third interval G13.

[0097] A height of an upper end of the first front guide plate 247 may be higher than or equal to that of the linear portion 216b of the intake port 216 formed in the front wall 211, and a height of an upper end of the second front guide plate 248 may be higher than that of the upper end of the first front guide plate 247 and equal to that of the auxiliary guide plate 245. That is, the front guide plates (e.g., 247 and 248) may be arranged so that heights of upper ends of the front guide plates are higher as the front guide plates are located farther from the front wall 211 of the housing.

[0098] When only one front guide plate is provided, for example, when only the first front guide plate 247 is provided, the first front guide plate247 may be arranged so that a height of an upper end of the first front guide plate 247 is higher than or equal to that of the linear portion 216b of the intake port 216 formed in the front wall 211 and equal to or lower than that of the auxiliary guide plate 245.

[0099] The widths W11 and W12 and heights of the front guide plates (e.g., 247 and 248) may be determined as values showing an optimal air flow through a plurality of experiments according to a required exhaust capacity of the exhaust device 200 and/or a size of the housing 210.

[0100] As shown in FIG. 11, the front guide plates (e.g., 247 and 248) smoothly guide an outer air flow Fo introduced into the housing 210 beyond the linear portion 216b of the intake port 216 from a front lower side of the front wall 211 of the housing 210 toward the second exhaust port 219 located at a lower portion of the rear wall 212, and further smoothly guide an inner air flow Fi traveling toward the first exhaust port 218.

[0101] FIG. 12 is a partial perspective view illustrating another modified example of a portion where the auxiliary guide plate of FIGS. 7 and 8 is provided.

[0102] Referring to FIG. 12, the auxiliary guide plate 245 extends from the rear wall 212 toward the front wall 211 of the housing 210, but does not extend to the front wall 211 and is spaced apart from the front wall 211 by a certain interval. In this modified example, the auxiliary guide plate 245 is slightly moved toward the bottom of the housing 210 in order to increase the area of the first exhaust port 218, compared to the embodiments of FIGS. 7 to 11. Accordingly, the first exhaust port 218 does not have a semicircular shape as shown in FIGS. 7 to 11, but may have a shape between a semicircular shape and a complete circular shape or a complete circular shape as shown in FIG. 12.

[0103] In addition, a front guide plate 249 vertically extending upward from a front end of the auxiliary guide plate 245, that is, an end close to the intake port 216, may be located on the front end of the auxiliary guide plate 245, that is, the end close to the intake port 216. The front guide plate 249 is fixed to the end of the auxiliary guide plate 245, and extends parallel to the front wall 211 while being spaced apart from the front wall 211 by a certain interval G21. The front guide plate 249 is arranged so that a height of an upper end of the front guide plate 249 is equal to that of the linear portion 216b of the intake port 216 formed in the front wall 211.

[0104] Part of an air flow introduced into the housing 210 beyond the linear portion 216b from a front lower side of the front wall 211 of the housing 210 passes through

the interval G21 between the front guide plate 249 and the front wall 211 and is guided toward the second exhaust port 219 located at a lower portion of the rear wall 212 of the housing 210.

[0105] Side guide plates 261 vertically extending upward from both edges of the auxiliary guide plate 245 may be located on the both edges of the auxiliary guide plate 245. The front guide plate 249 may be located between the side guide plates 261. The side guide plates 261 smoothly guide an inner air flow Fi introduced into the housing 210 toward the first exhaust port 218, unlike the side guide plates 246 of FIG. 7. A height of an upper end of the side guide plate 261 may be higher than that of the linear portion 216b of the intake port 216 formed in the front wall 211, but the present disclosure is not limited thereto. For example, a height of an upper end of the side guide plate 261 may be the same as that of the linear portion 216b of the intake port 216. Also, a height of the side guide plates 261 may be equal to that of the front guide plate 249 or higher than that of the front guide plate 249.

[0106] The side guide plates 261 may extend from the rear wall 212 to the front wall 211 of the housing 210, and front ends of the side guide plates 261 may be connected to a cover plate 263 covering part of both sides of the intake port 216. The cover plate 263 may be formed when the front wall 211 of the housing 210 extends upward from both side portions of the linear portion 216b of the intake port 216 to a certain height. The cover plate 263 facilitates an air flow near a corner where the arc portion 216a and the linear portion 216b of the intake port 216 having an arc shape meet each other.

[0107] The side guide plates 261 or the front guide plate 249 may be selectively located on the auxiliary guide plate 245, but preferably, the side guide plates 261 and the front guide plate 249 are located together. In this case, a height of the side guide plate 261 may be equal to or higher than that of the front guide plate 249.

[0108] FIG. 13 is a perspective view illustrating an outer appearance of an exhaust device, according to a third embodiment of the present disclosure, showing an example where a central axis is horizontal. FIG. 14 is a rear perspective view illustrating the exhaust device of FIG. 13. FIG. 15 is a vertical cross-sectional view illustrating the exhaust device of FIG. 13 in a direction of the central axis. FIG. 16 is a schematic view illustrating an example where the exhaust device of FIG. 13 is used as a device for forming an air fence.

[0109] Referring to FIGS. 13 to 16 together, an exhaust device 300 according to a third embodiment of the present disclosure includes a housing 310 including the intake port 216 and a plurality of exhaust ports (e.g., 318 and 319), a guide means 320 provided inside the housing 310 and configured to guide air introduced into the housing 310 through the intake port 216, and an exhaust means directly or indirectly connected to the plurality of exhaust ports (e.g., 318 and 319) and configured to discharge air introduced into the housing 310 to the outside of the housing 210 through the plurality of exhaust ports (e.g., 318 and 319).

[0110] As described above, basic elements of the exhaust device 200 according to the second embodiment of the present disclosure are substantially the same as those of the exhaust device 200 according to the above embodiments, especially, the second embodiment. Accordingly, in FIGS. 13 to 15, the same elements as those of the exhaust device 200 according to the second embodiment of the present disclosure are denoted by the same reference numerals. However, as described below in detail, there are some differences between the exhaust device 300 according to the third embodiment of the present disclosure and the exhaust device 200 according to the second embodiment, and the differences will be mainly described. Accordingly, the same features will not be described or will be briefly described.

[0111] The exhaust device 300 according to the third embodiment of the present disclosure includes an exhaust box 350 coupled to a rear side of the housing 310 and surrounding the plurality of exhaust ports (e.g., 318 and 319) together, like in the above embodiments, and the exhaust box 350 has a height H2 lower than a height H1 of the housing 310. Accordingly, a stepped portion is formed between one side wall 314 of the housing 310 and one side wall 354 of the exhaust box 350 corresponding to the side wall 314, that is, facing in the same direction.

[0112] In the exhaust box 350, at least one, preferably, two common exhaust ports 358, may be formed in one side wall 354 from among side walls, that is, the side wall 354 forming the stepped portion with the corresponding side wall 314 of the housing 314, rather than a rear wall 352 of the exhaust box 350. An exhaust fan 331, instead of the exhaust pipe 231 (see FIG. 7), may be provided as the exhaust means in each of the common exhaust ports 358. Accordingly, as shown in FIG. 15, air introduced into the exhaust box 350 through the plurality of exhaust ports (e.g., 318 and 319) from the housing 310, that is, an inner air flow Fi introduced into the exhaust box 350 through the first exhaust port 218 and an outer air flow Fo introduced into the exhaust box 350 through the second exhaust ports 219, is discharged to the outside through the common exhaust ports 358 and the exhaust fans 331. Also, air introduced into the exhaust box 350 is discharged from the exhaust box 350 in a direction substantially perpendicular to an introduced direction, not in a direction parallel to the introduced direction.

[0113] Also, the exhaust device 300 according to the third embodiment of the present disclosure further includes at least one, preferably, two additional exhaust ports 371, formed in one side wall 314 from among side walls of the housing 310, that is, the side wall 310 of the housing 310 corresponding to the side wall 354 of the exhaust box 350 in which the common exhaust ports 358 are formed, and an exhaust fan 332 for discharging part of air introduced into the housing 310 may be provided in each of the additional exhaust ports 371. As shown in FIG. 15, part of the outer air flow Fo introduced into the

housing 310 through the intake port 216 and guided by the plurality of guide plates (e.g., 221, 222, and 223) is introduced into the exhaust box 350 through the second exhaust ports 219, but the remaining part is discharged to the outside of the housing 310 through the additional exhaust ports 371 and the exhaust fans 332. Accordingly, air discharged through the additional exhaust ports 371 from among air introduced into the housing 310 is discharged from the housing 310 in a direction substantially perpendicular to a direction in which the air is introduced into the housing 310, not in a direction parallel to the direction in which the air is introduced into the housing 310.

[0114] The modified examples of FIGS. 10 to 12 may also be applied to the exhaust device 300 according to the third embodiment of the present disclosure having the above configuration.

[0115] The exhaust device 300 may be used as a device for forming an air fence as shown in FIG. 16.

[0116] In more detail, the exhaust device 300 may be provided so that a central axis is perpendicular to an inlet side of a ceiling CE of a work space WS where polluted air is generated. Also, next to the exhaust device 300, the exhaust device 200 according to the second embodiment of the present disclosure may be provided at an inner position of the work space WS than the exhaust device 300, that is, between the exhaust device 300 and an inner wall SW of the work space WS. Although one exhaust device 200 and one exhaust device 300 are illustrated in FIG. 16, a plurality of exhaust devices 200 and a plurality of exhaust devices 300 may be arranged side by side in a row according to an inlet width of the work space WS. Also, the exhaust device 100 according to the first embodiment may be provided instead of the exhaust device 200 according to the second embodiment of the present disclosure.

[0117] As described above, because a direction of an air flow introduced into the exhaust device 300 and a direction of an air flow discharged from the exhaust device 300 are substantially perpendicular to each other, as shown in FIG. 16, a circulating air flow may be formed in front of the work space WS, and the air flow mostly includes clean air outside the work space WS, not polluted air inside the work space WS, and forms an air fence Fa that blocks the inside and the outside of the work space WS. The air fence Fa may block polluted air inside the work space WS from escaping to the outside of the work space WS. Also, the air fence FA may block air outside the work space WS from entering the work space WS, thereby increasing the exhaust efficiency of the exhaust device 200. Polluted air introduced into the exhaust device 200 is discharged through the exhaust pipe 231.

[0118] FIG. 17 is a perspective view illustrating a modified example of the exhaust device of FIG. 13.

[0119] An exhaust device 300' of FIG. 17 is different from the exhaust device 300 of FIGS. 13 and 15 in that a height of an exhaust box 350' is the same as that of the housing 310 and an integrated exhaust port 372 in which a common exhaust port and an additional exhaust port are integrated is formed without separately forming common exhaust ports and additional exhaust ports.

[0120] In detail, the exhaust box 350' of the exhaust device 300' has a height H2 equal to a height H1 of the housing 310. Accordingly, the side wall 314 of the housing 310 and a side wall 354' of the exhaust box 350' form one plane. At least one, preferably, two integrated exhaust ports 372, are formed in one side wall 314 from among side walls of the housing 310 and the side wall 354' of the exhaust box 350' corresponding to the side wall 314 across the housing 310 and the exhaust box 350'. An exhaust fan 333 is provided as an exhaust means in each of the integrated exhaust ports 372.

[0121] According to the above configuration, part of an outer air flow Fo introduced into the housing 310 through the intake port 216 and guided by the plurality of guide plates (e.g., 221, 222, and 223) is discharged to the outside of the housing 310 through the exhaust fan 333 and a portion of the exhaust port 372 formed in the side wall 314 of the housing 310, and air introduced into the exhaust box 350 through the plurality of exhaust ports (e.g., 318 and 319) from the housing 310 is discharged to the outside of the exhaust box 350' through the exhaust fan 333 and a portion of the integrated exhaust port 372 formed in the side wall 354' of the exhaust box 350'.

[0122] The modified examples of FIGS. 10 and 12 may also be applied to the exhaust device 300' having the above configuration.

[0123] As described above, the exhaust device 300' of FIG. 17 has an advantage in that the number of exhaust ports is less than that of the exhaust device 300 of FIGS. 13 to 16 and thus, the number of exhaust fans is also reduced.

[0124] While the present disclosure has been particularly shown and described with reference to embodiments shown in the drawings, it will be understood by one of ordinary skill in the art that various modifications and equivalent other embodiments may be made therein. Accordingly, the true technical scope of the present disclosure should be defined by the following claims.

Claims

1. An exhaust device comprising:

a housing comprising a front wall having an intake port formed therein and a rear wall facing the front wall and having a plurality of exhaust ports formed therein;

a guide means provided inside the housing and configured to guide air introduced into the housing through the intake port; and

an exhaust means directly or indirectly connected to the plurality of exhaust ports and con-

figured to discharge air introduced into the housing to outside of the housing through the plurality of exhaust ports,

wherein the plurality of exhaust ports comprise a first exhaust port located at a position corresponding to a center of the intake port and a plurality of second exhaust ports distributed in the rear wall of the housing while being spaced apart from the first exhaust port by an interval,

the guide means comprises a plurality of guide plates located between the front wall and the rear wall of the housing, spaced apart from each other by an interval in a direction of a central axis of the intake port, and arranged parallel to the front wall,

the plurality of guide plates are concentrically arranged around the central axis of the intake port and each of the plurality of guide plates has a ring shape or an arc shape, and

inner radii of the plurality of guide plates are less than an inner radius of the intake port, are greater than an inner radius of the first exhaust port, and gradually decrease from the intake port toward the first exhaust port.

2. The exhaust device of claim 1, wherein outer radii of the plurality of guide plates gradually decrease from the intake port toward the first exhaust port, and an outer radius of a guide plate closest to the front wall of the housing from among the plurality of guide plates is greater than the inner radius of the intake port.

3. The exhaust device of claim 1, wherein the plurality of guide plates are fixedly arranged inside the housing by being fixed to a side wall or the rear wall of the housing.

4. The exhaust device of claim 3, wherein each of the plurality of guide plates comprises lugs for fixing and is fixed to the side wall or the rear wall of the housing through the lugs.

5. The exhaust device of claim 1, wherein the housing has a rectangular parallelepiped shape or a cylindrical shape.

6. The exhaust device of claim 1, further comprising an exhaust box coupled to a rear side of the housing and surrounding the plurality of exhaust ports together, wherein at least one common exhaust port is formed in a rear wall of the exhaust box to discharge air introduced into the exhaust box through the plurality of exhaust ports to outside, and at least one exhaust pipe is connected as the exhaust means to the at least one common exhaust port.

7. The exhaust device of claim 1, further comprising an exhaust box coupled to a rear side of the housing and surrounding the plurality of exhaust ports together, wherein the exhaust box has a height lower than a height of the housing, wherein at least one common exhaust port is formed in a side wall of the exhaust box forming a stepped portion with a corresponding side wall of the housing to discharge air introduced into the exhaust box through the plurality of exhaust ports to outside, and at least one exhaust fan is provided as the exhaust means in the at least one common exhaust port, and

at least one additional exhaust port is formed in the side wall of the housing corresponding to the side wall of the exhaust box in which the common exhaust port is formed to discharge part of air introduced into the housing to outside, and at least one exhaust fan is provided in the at least one additional exhaust port.

8. The exhaust device of claim 1, further comprising an exhaust box coupled to a rear side of the housing and surrounding the plurality of exhaust ports together, wherein a height of the exhaust box is equal to a height of the housing, wherein at least one integrated exhaust port is formed across the housing and the exhaust box, in one side wall from among side walls of the exhaust box and in a side wall of the housing corresponding to the one side wall, at least one exhaust fan is provided in the at least one integrated exhaust port, and air introduced into the housing and the exhaust box is discharged to outside of the housing and the exhaust box through the at least one integrated exhaust port.

9. The exhaust device of any one of claims 1 to 6, wherein the intake port has a circular shape, and the plurality of guide plates have ring shapes with widths in a radial direction.

10. The exhaust device of claim 9, wherein each of the plurality of guide plates is divided into a plurality of arc-shaped members, and the plurality of arc-shaped members of each of the plurality of guide plates are arranged together in a ring shape inside the housing.

11. The exhaust device of any one of claims 1 to 8, wherein the intake port has a substantially semicircular shape, and the plurality of guide plates have arc shapes with widths in a radial direction.

12. The exhaust device of claim 11, further comprising an auxiliary guide plate extending parallel to the central axis from the rear wall toward the front wall of the housing from a position adjacent to an edge of the first exhaust port.

13. The exhaust device of claim 12, wherein the auxiliary guide plate has a width that is greater than a diameter of the first exhaust port but does not interfere with a guide plate closest to the rear wall of the housing from among the plurality of guide plates.

14. The exhaust device of claim 11, further comprising side guide plates vertically extending from both edges of the auxiliary guide plate to a bottom of the housing.

15. The exhaust device of claim 14, wherein the auxiliary guide plate is spaced apart from the front wall of the housing by a certain interval, and at least one front guide plate is located within an interval between a front end of the auxiliary guide plate and the front wall of the housing,
wherein the at least one front guide plate is spaced apart from the front end of the auxiliary guide plate and the front wall of the housing, has a width in a direction perpendicular to the bottom of the housing, is arranged parallel to the front wall of the housing between the side guide plates, and has both longitudinal ends of the front guide plate fixed to the side guide plates.

16. The exhaust device of claim 15, wherein the at least one front guide plate comprises a plurality of front guide plates arranged parallel to each other while being spaced apart from each other by an interval, and the plurality of front guide plates are arranged so that heights of upper ends of the plurality of front guide plates are greater as the plurality of front guide plates are located farther from the front wall of the housing.

17. The exhaust device of claim 12, further comprising side guide plates vertically extending upward from both edges of the auxiliary guide plate.

18. The exhaust device of claim 17, wherein the auxiliary guide plate is spaced apart from the front wall of the housing by a certain interval, and a front guide plate vertically extending upward from a front end of the auxiliary guide plate is located on the front end of the auxiliary guide plate, wherein the front guide plate is arranged parallel to the front wall of the housing while being spaced apart from the front wall of the housing by an interval.

19. The exhaust device of claim 18, wherein the side guide plates extend from the rear wall of the housing to the front wall of the housing, and the front guide plate is arranged between the side guide plates.

FIG. 1

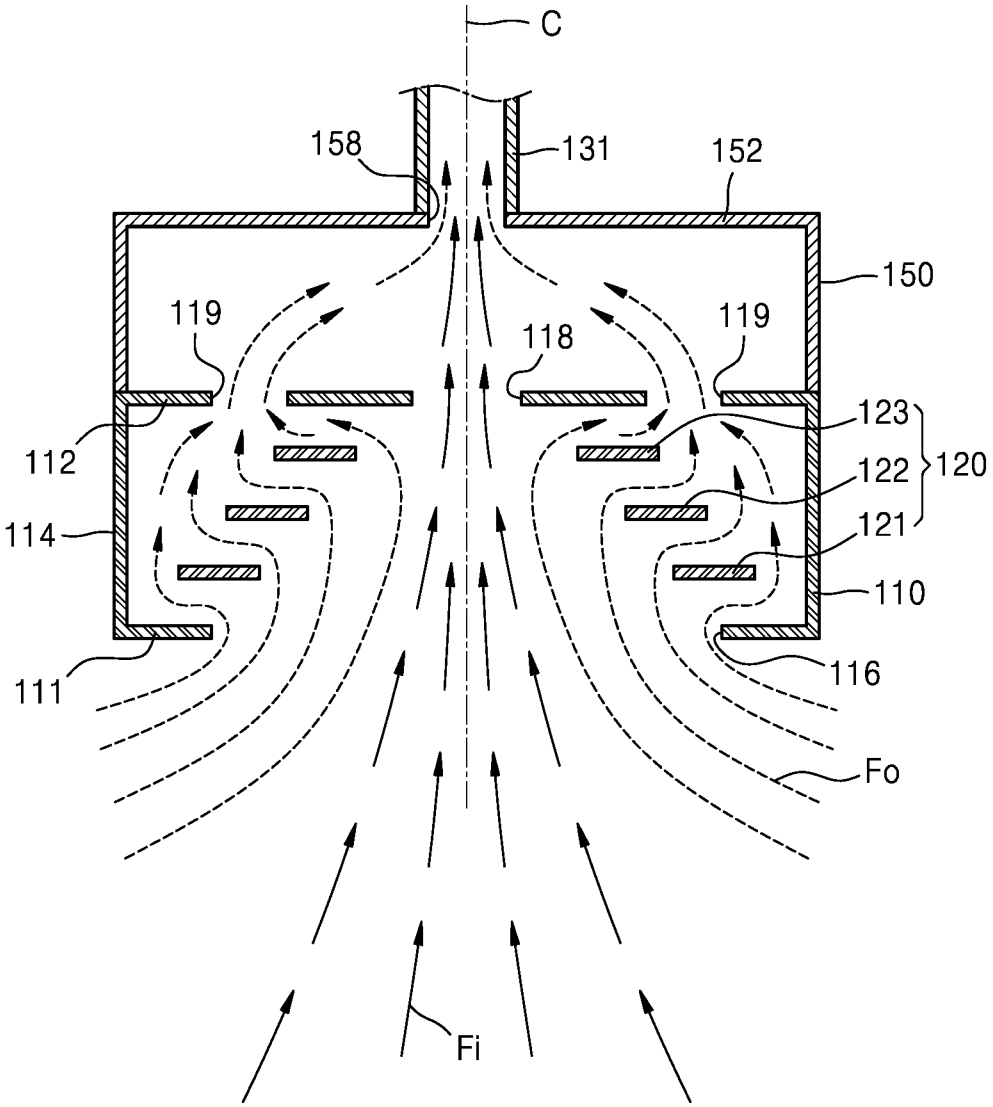
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FIG. 2

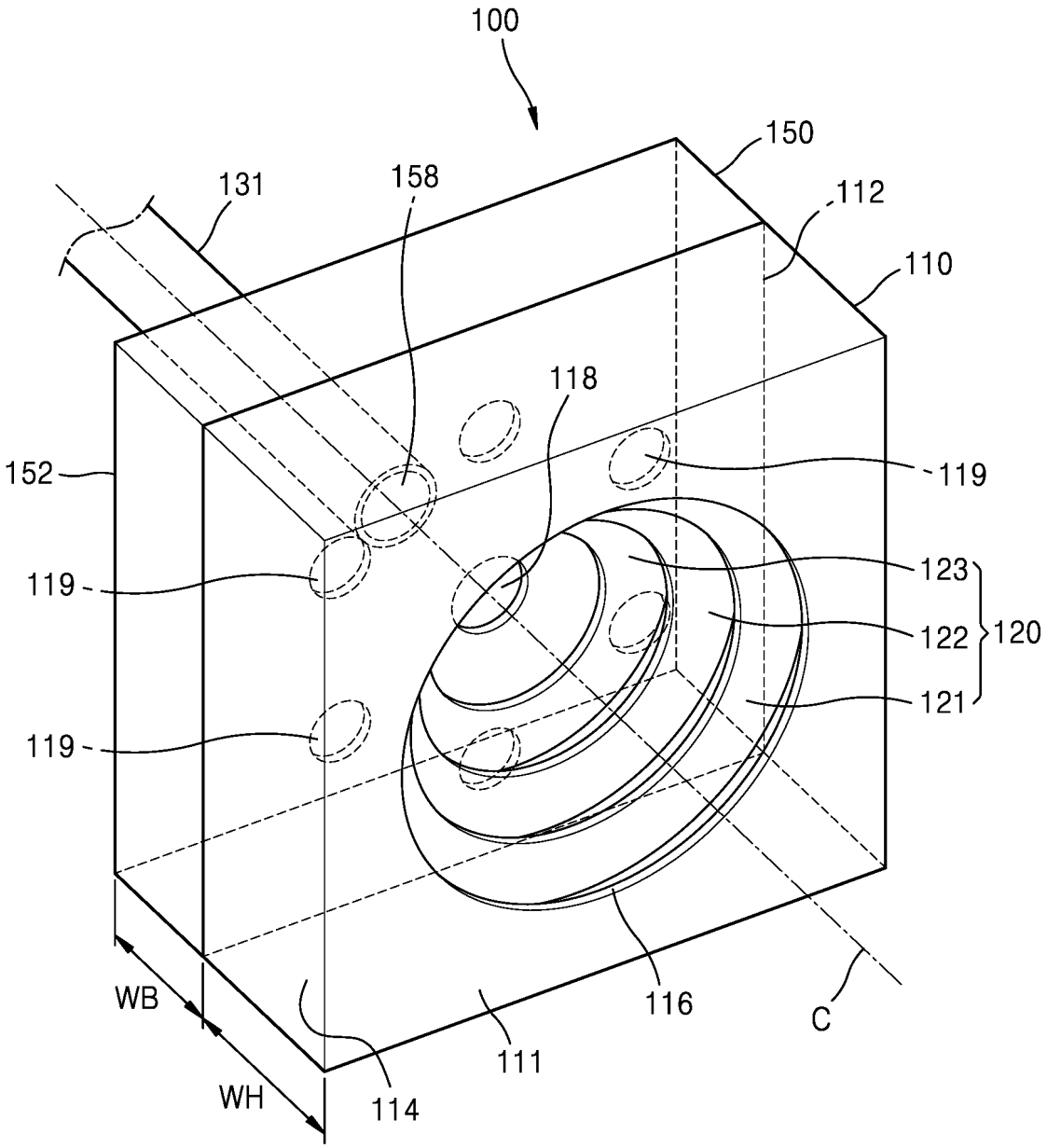
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FIG. 3

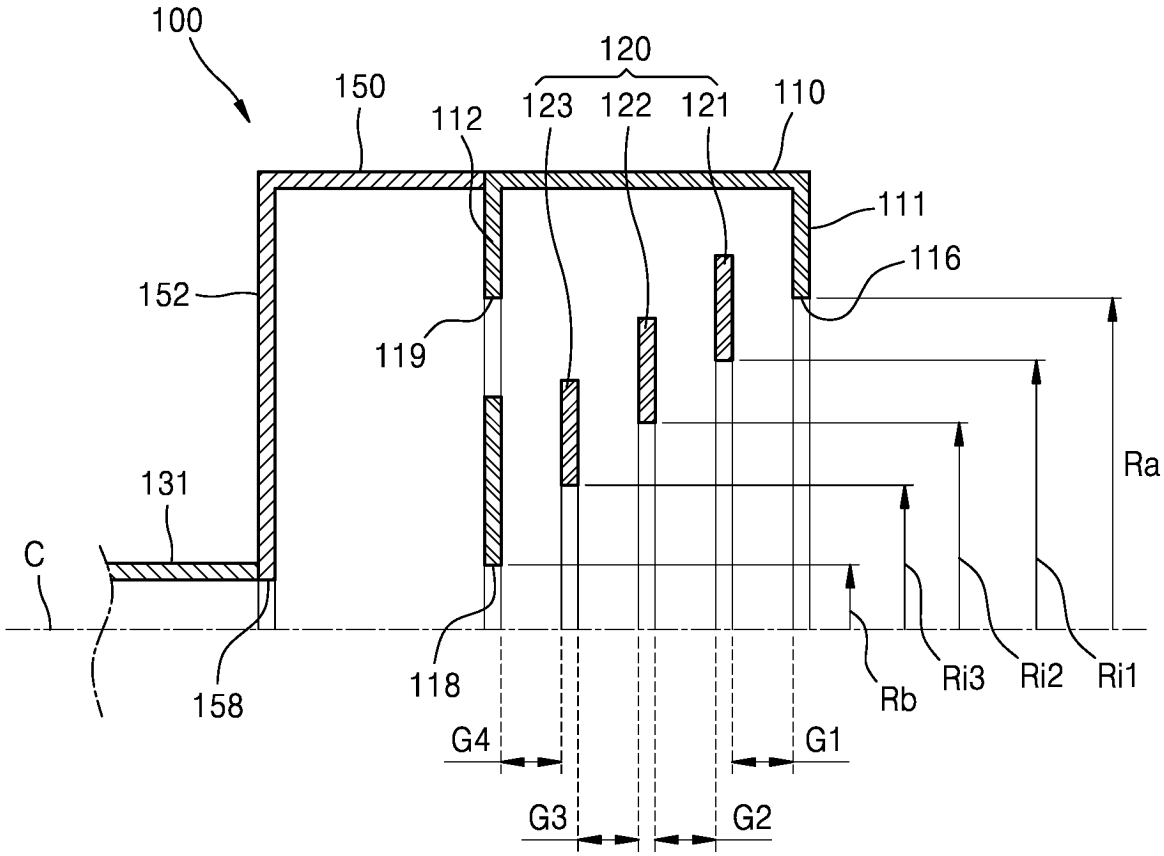
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FIG. 4

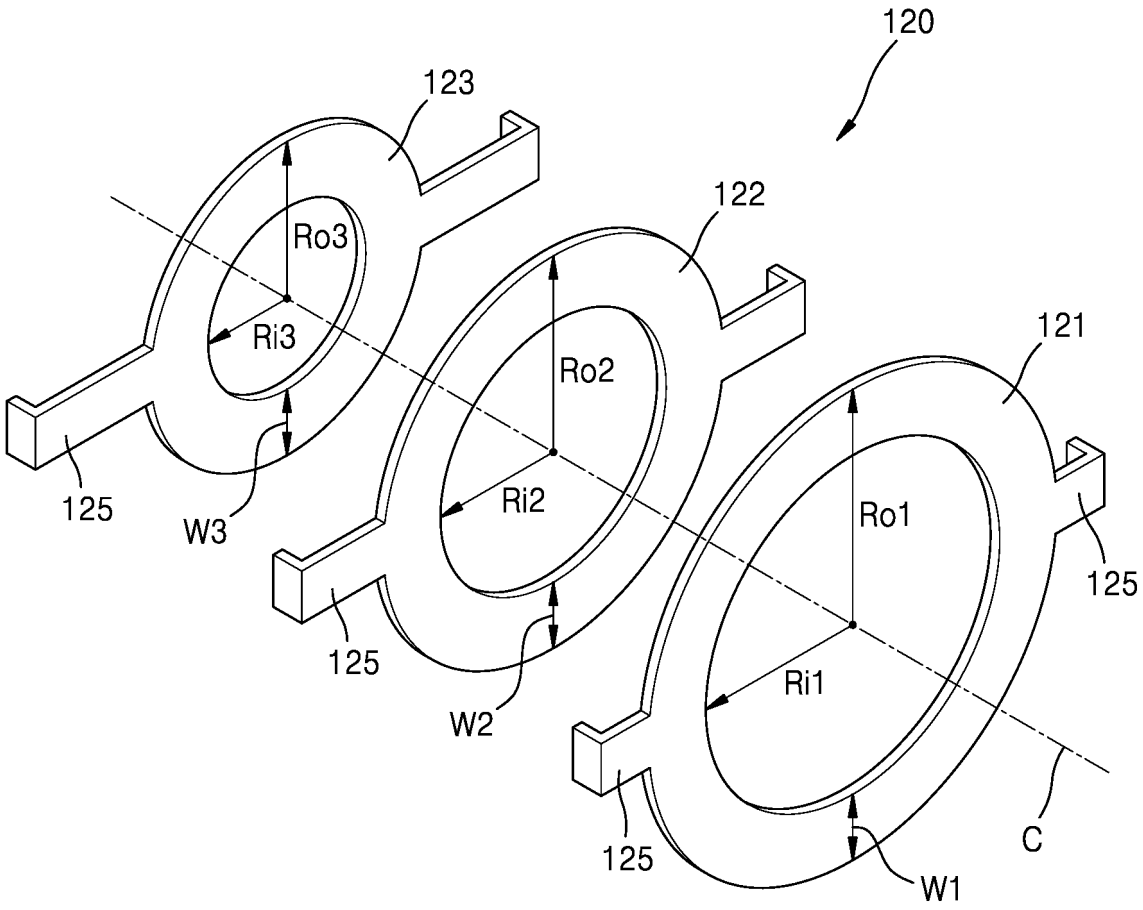

FIG. 5

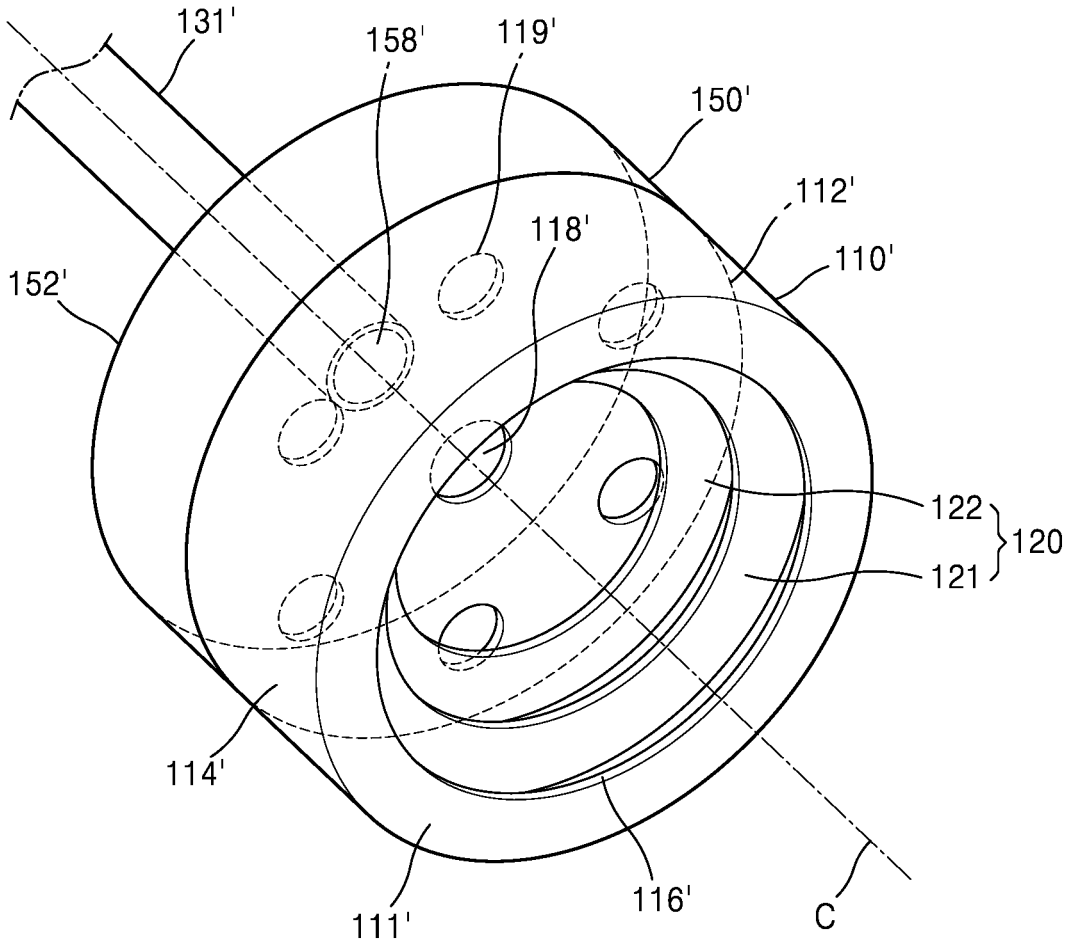

FIG. 6

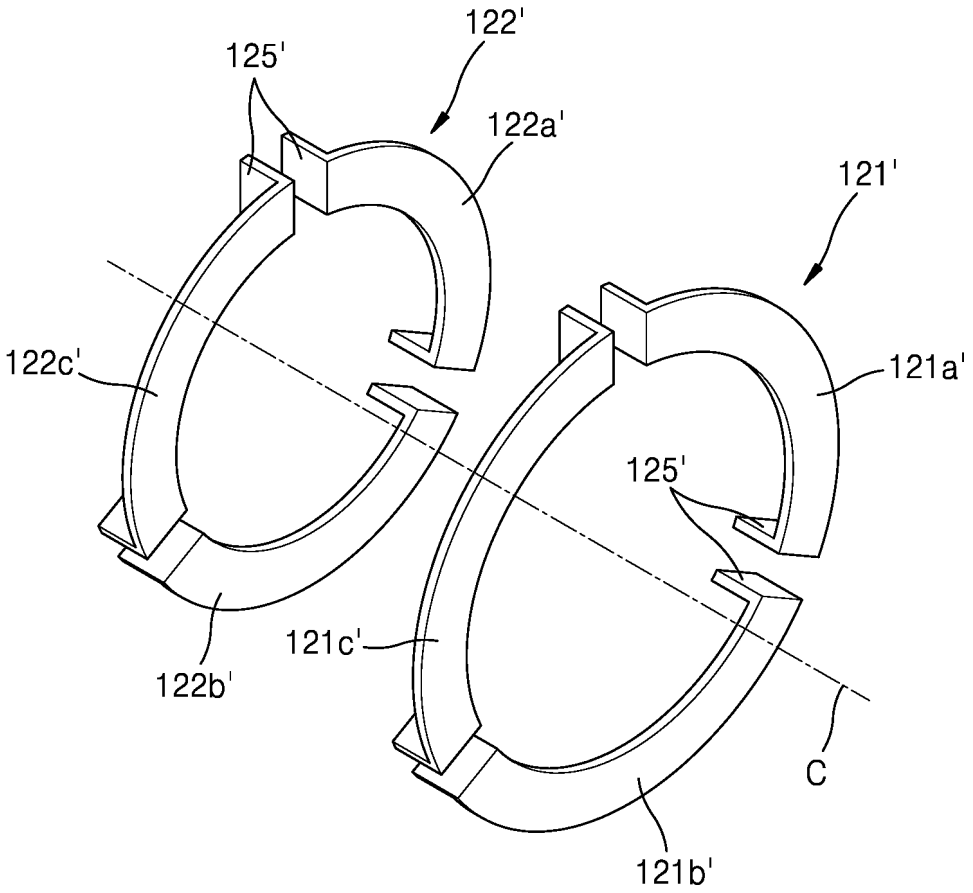

FIG. 7

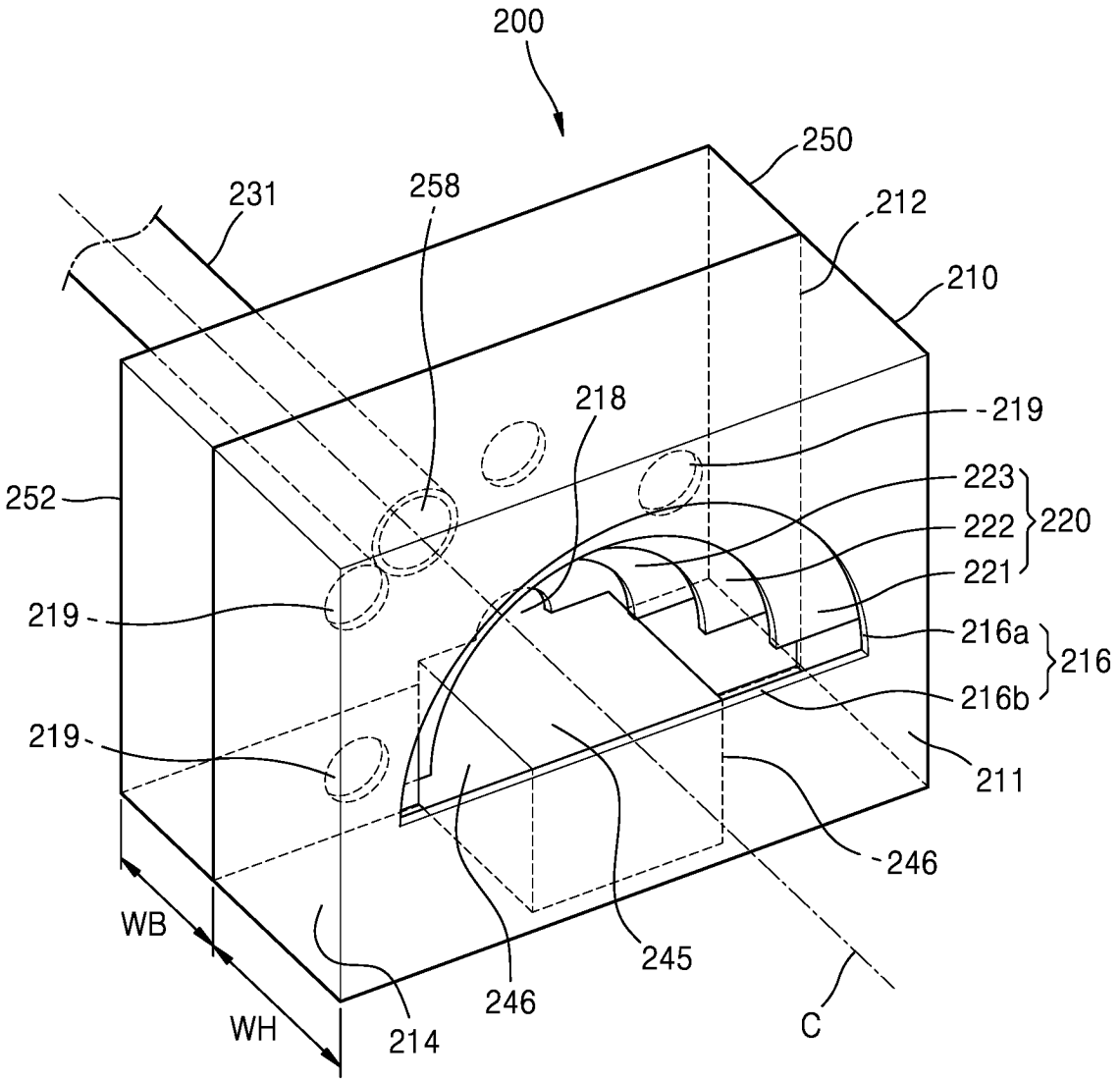
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FIG. 8

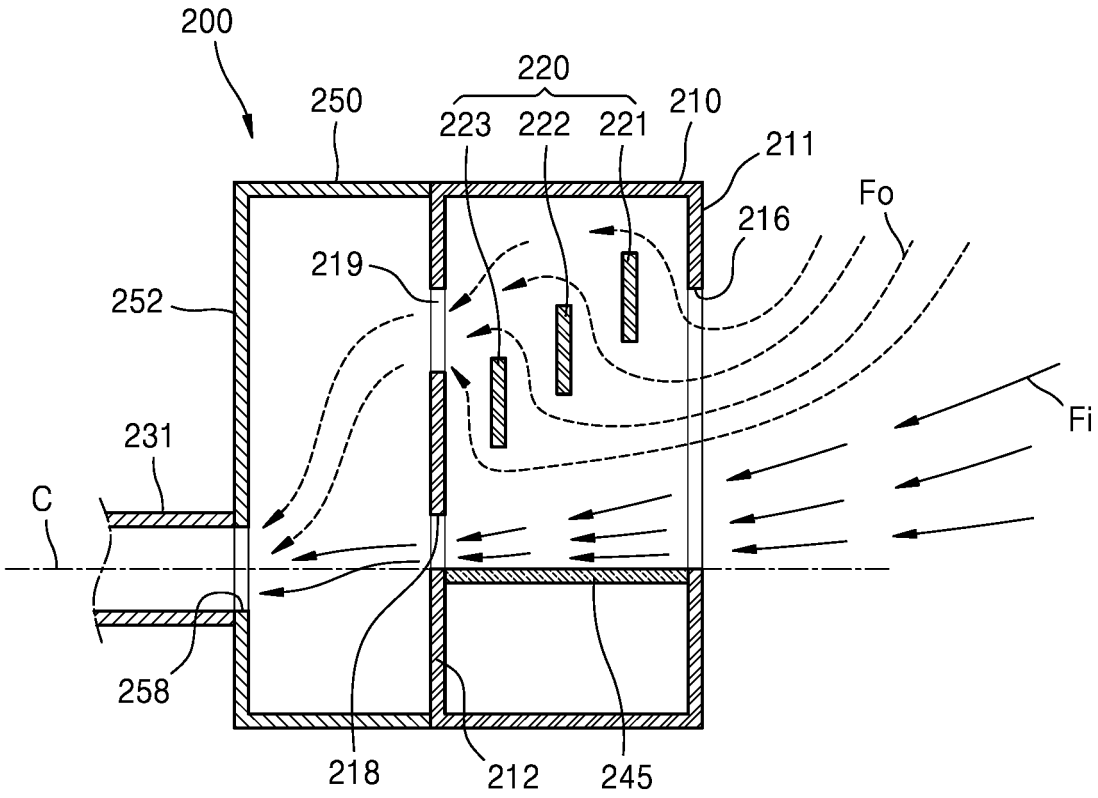
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FIG. 9

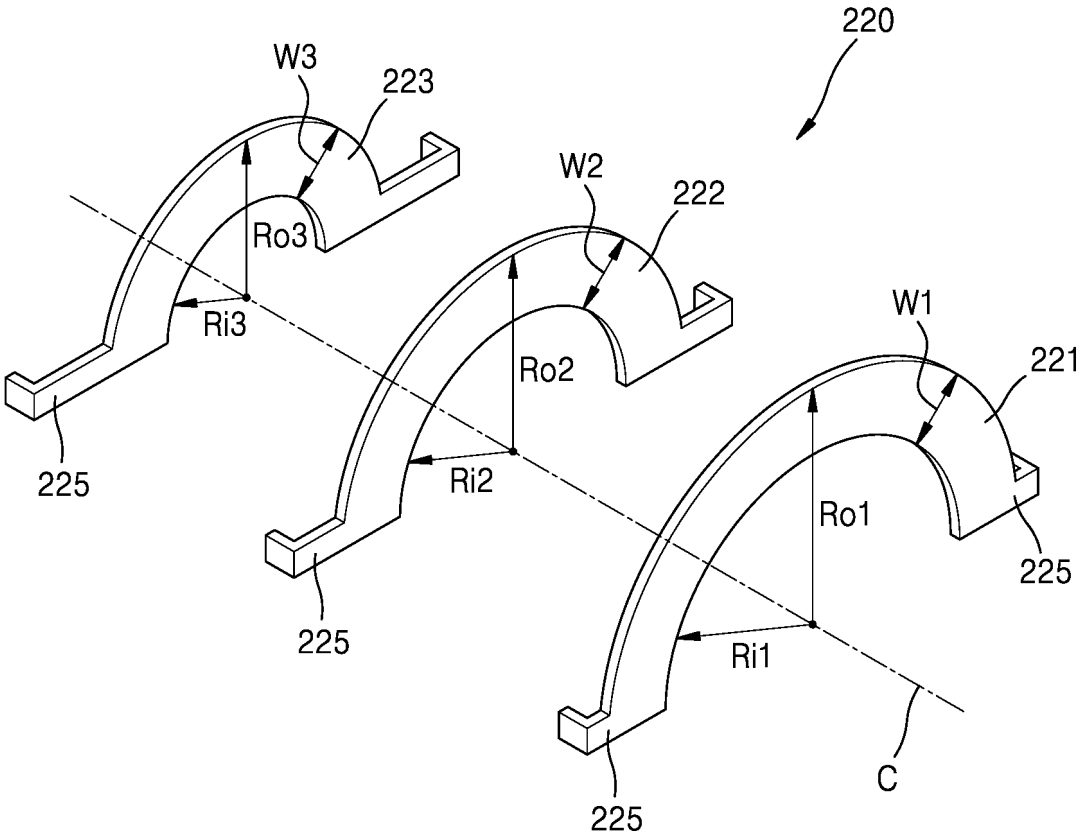
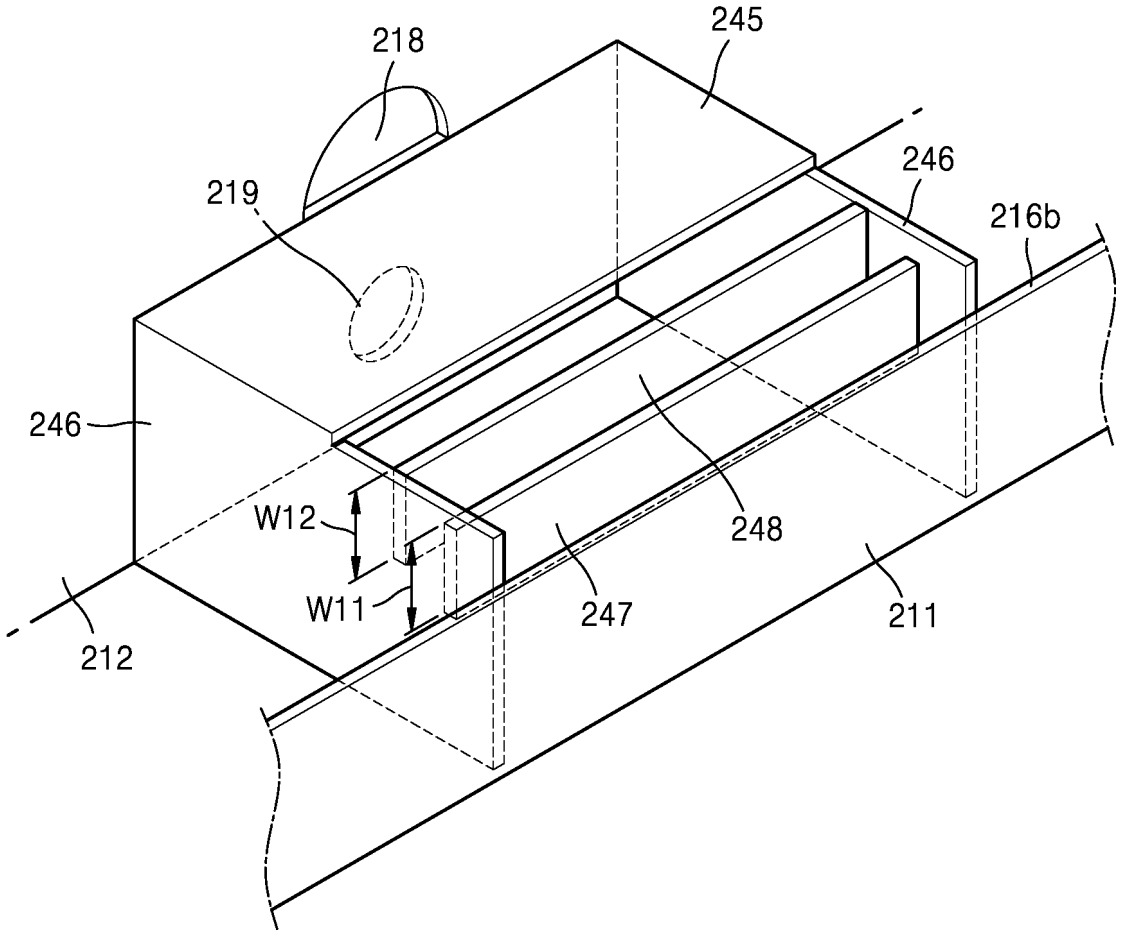


FIG. 10



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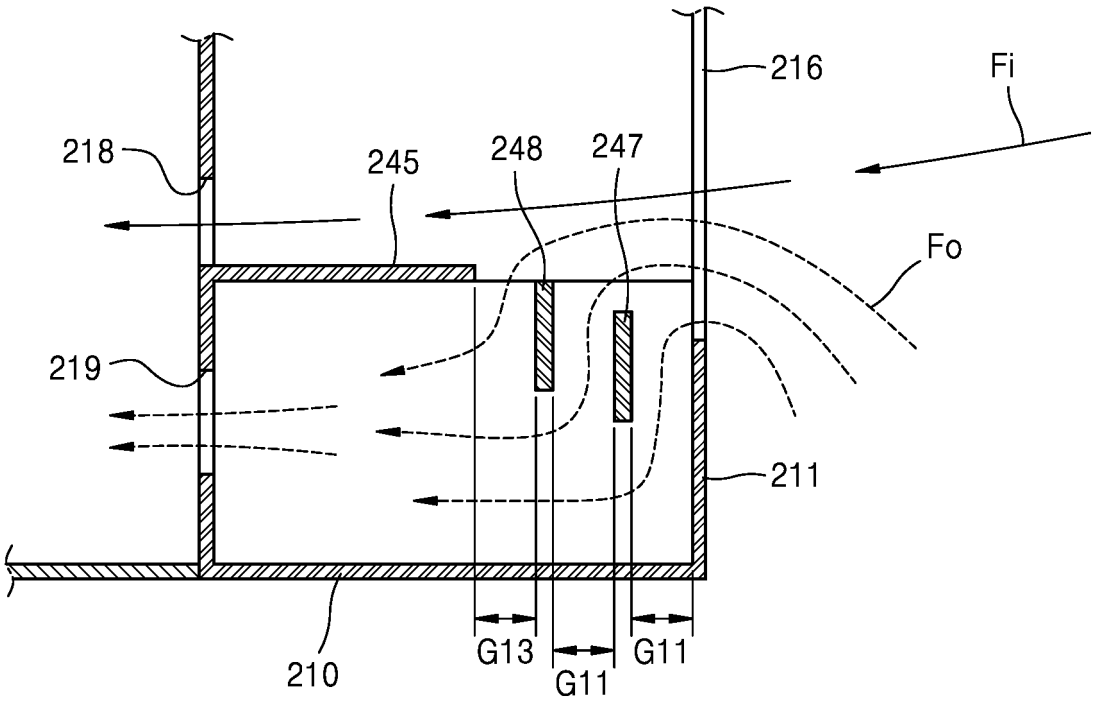

FIG. 12

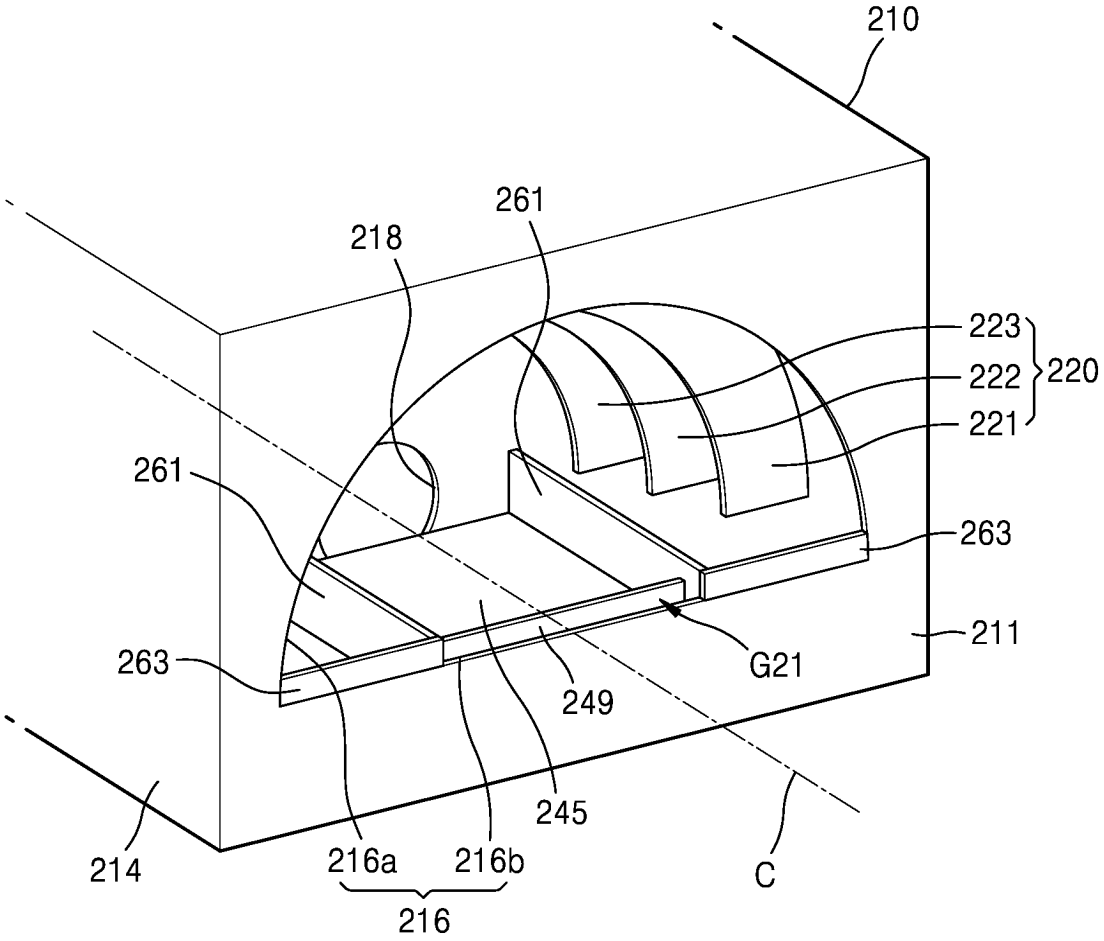
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FIG. 13

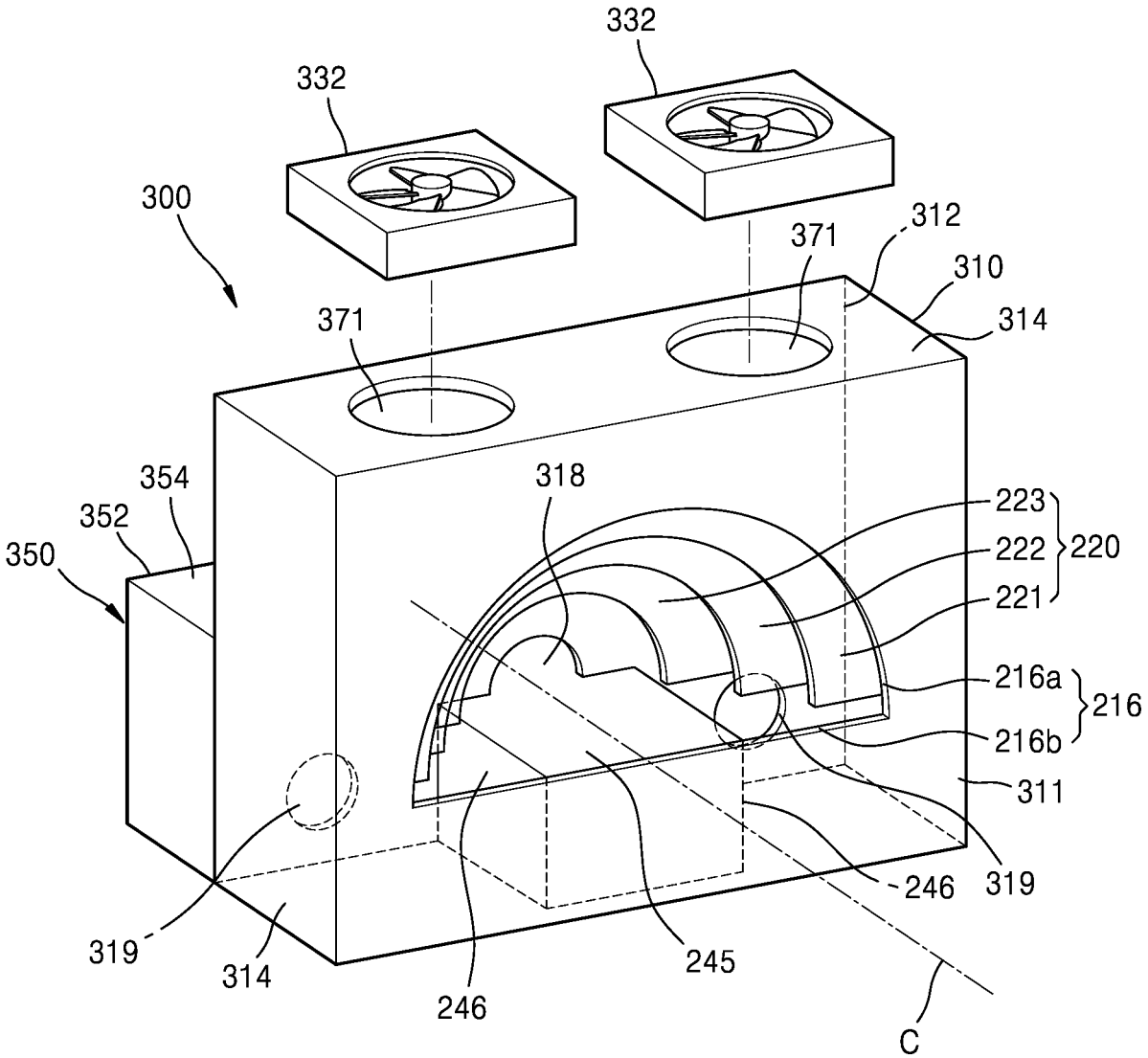
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FIG. 14

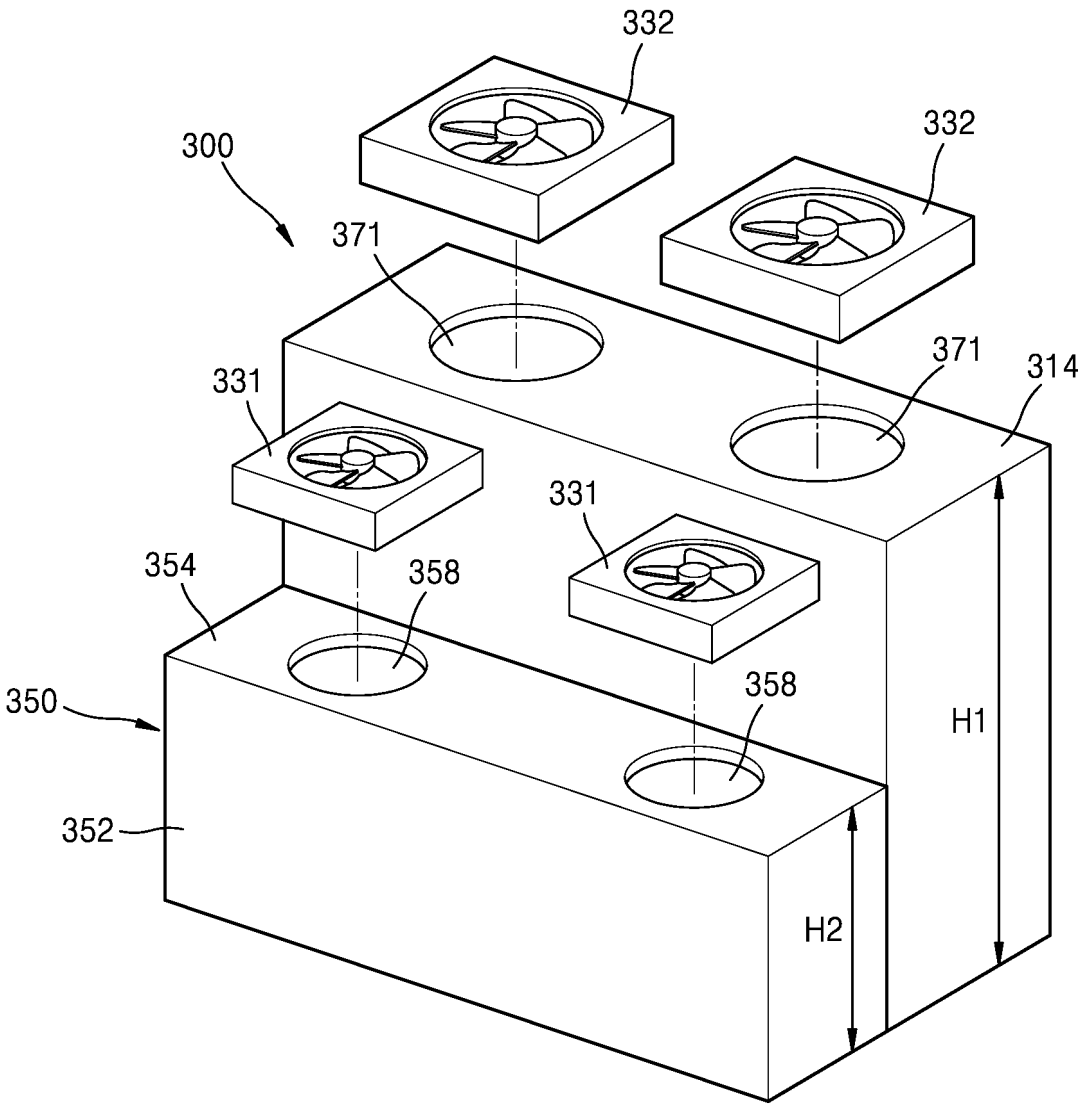


FIG. 15

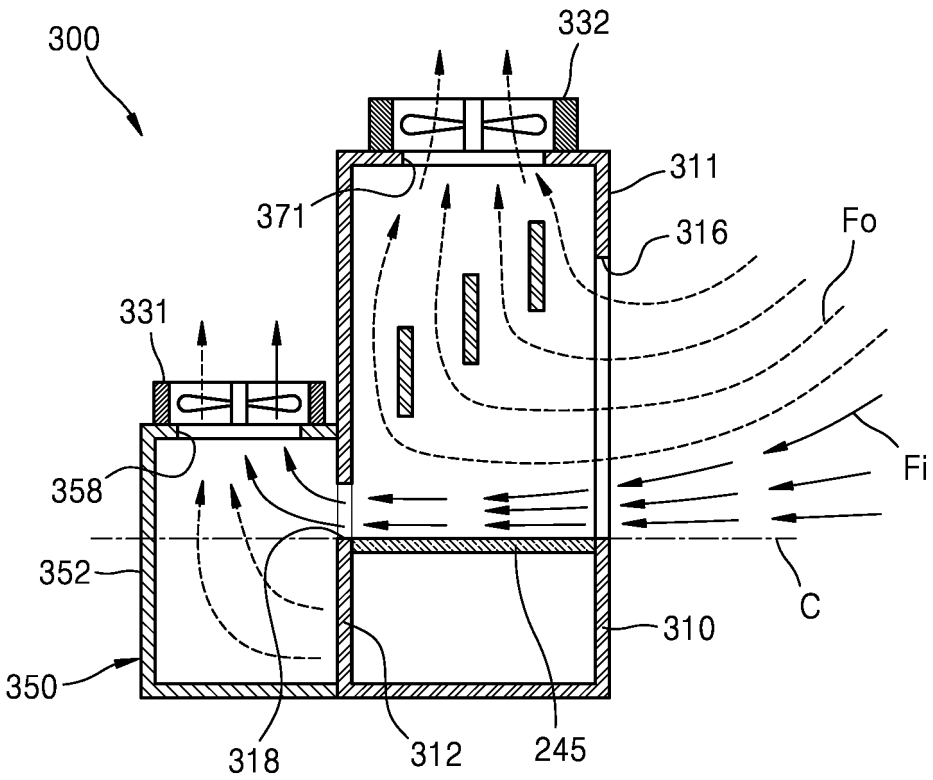


FIG. 16

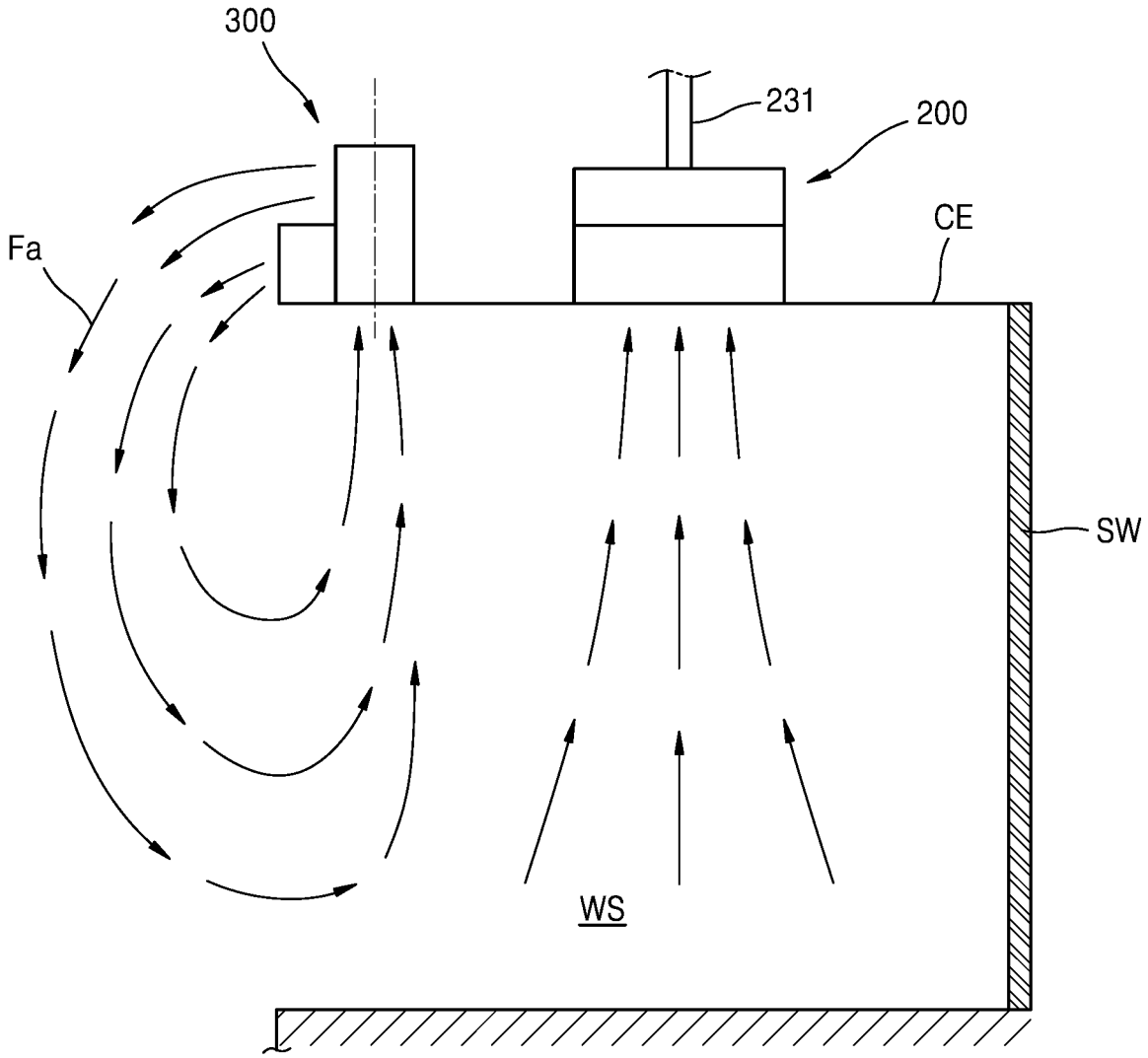
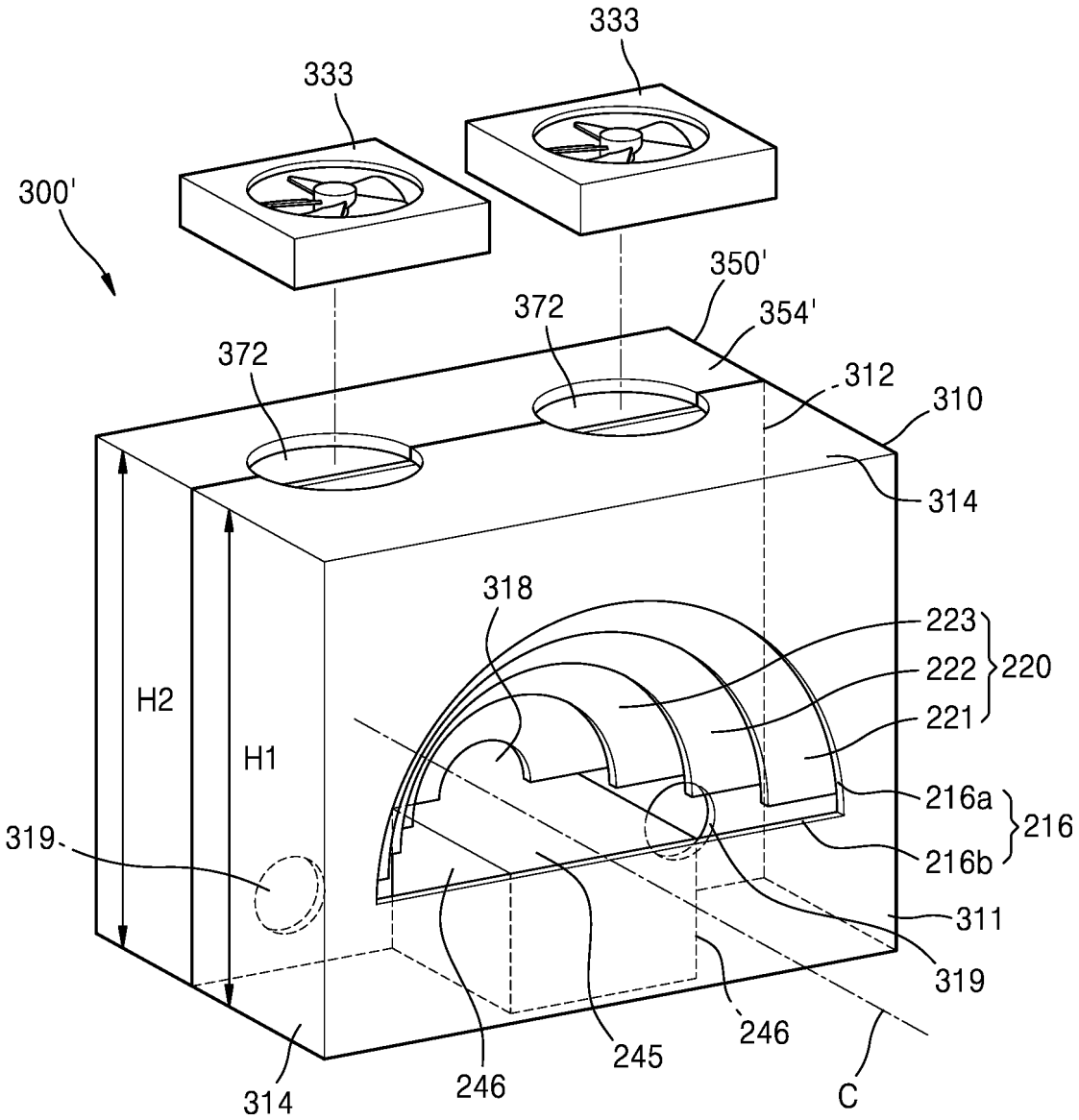


FIG. 17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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/005609

A. CLASSIFICATION OF SUBJECT MATTER

F24F 7/06(2006.01)i; **F24F 13/08**(2006.01)i; **F24F 13/20**(2006.01)i; **F24F 7/00**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F 7/06(2006.01); A01K 1/00(2006.01); F23B 99/00(2006.01); F24B 1/02(2006.01); F24F 13/06(2006.01); F24F 13/08(2006.01); F24F 13/14(2006.01); F24F 9/00(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 배기(exhaust), 하우징(housing), 박스(box), 흡기구(inlet), 다단(multi-stage), 안내판(guiding plate), 러그(lug), 팬(fan)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2020-0009374 A (KIM, Ji Ha) 30 January 2020 (2020-01-30) See paragraphs [0052], [0080], [0133]-[0134], [0141]-[0146] and [0153] and figures 11-15.	1-2,5-7
A		3-4,8-19
Y	JP 2007-285660 A (IKEDA, Akira) 01 November 2007 (2007-11-01) See paragraphs [0017] and [0019] and figure 3.	1-2,5-7
A	KR 10-1995976 B1 (CHOI, Hyun Il) 03 July 2019 (2019-07-03) See paragraphs [0037]-[0038] and figures 1-2.	1-19
A	KR 10-2017-0065768 A (IM, Nack-Mo) 14 June 2017 (2017-06-14) See paragraphs [0023]-[0039] and figures 3-5a.	1-19
A	KR 10-2016-0089739 A (KIM, Ji Ha) 28 July 2016 (2016-07-28) See paragraphs [0040]-[0055] and figures 1-3.	1-19

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
25 July 2023	**25 July 2023**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208**	
Facsimile No. **+82-42-481-8578**	Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/005609

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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		KR 10-2146057 B1	19 August 2020
		WO 2020-017726 A1	23 January 2020
JP 2007-285660 A	01 November 2007	None	
KR 10-1995976 B1	03 July 2019	None	
KR 10-2017-0065768 A	14 June 2017	KR 10-1785903 B1	16 October 2017
KR 10-2016-0089739 A	28 July 2016	KR 10-1709278 B1	23 February 2017
		WO 2016-117921 A1	28 July 2016

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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