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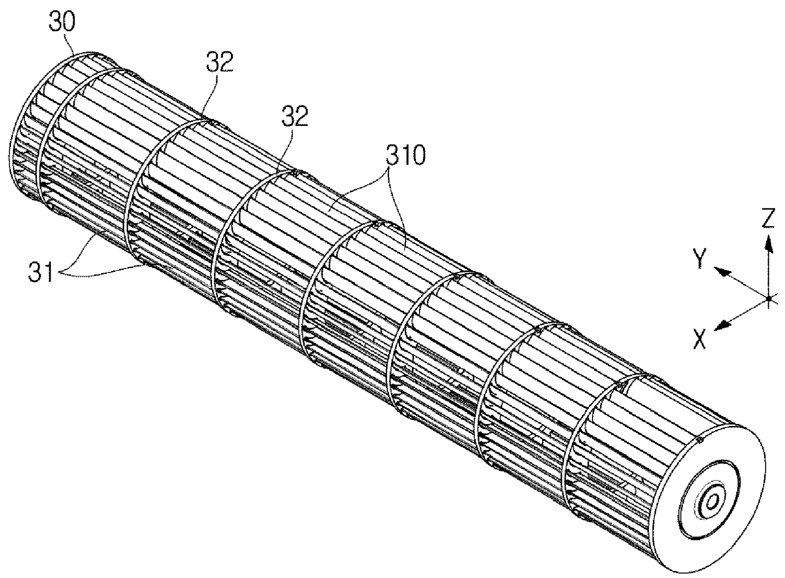
(54) AIR CONDITIONER

(57) Disclosed herein is an air conditioner equipped with a stabilizer having an improved structure to reduce air-blowing noise. The air conditioner includes a main body having a suction port and a discharge port; a heat exchanger provided in the main body. A crossflow fan is configured to discharge air heat-exchanged by the heat exchanger to the discharge port. A stabilizer is located adjacent to the crossflow fan and comprises a guide section having a first guide portion configured to guide airflow flowing in the main body by the crossflow fan to a suction region and a second guide portion configured to guide the airflow to a discharge region. A flow separation section is connected to the guide section, wherein a location of the flow separating section varies in an axial direction of the crossflow fan and in a rotational direction of the crossflow fan.

FIG. 3



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Description

[0001] The present disclosure relates to an air conditioner provided with a stabilizer having an improved structure to allow air-blowing noise to be reduced.

[0002] As an air conditioner, there is a stand-type air conditioner installed upright on a floor of a room for cooling or heating a relatively large indoor space and a wall-mounting type air conditioner installed on a wall of the room for cooling or heating a small indoor space.

[0003] The air conditioner is a device including a refrigeration cycle device mounted therein and composed of a compressor, a condenser, a capillary tube, a heat exchanger and an electronic expansion valve, and suctioning air in the room and discharging the air into the room to cool or heat the room.

[0004] In the air conditioner, there is an integral type air conditioner in which an indoor unit and an outdoor unit are formed integrally with each other, and a separate type air conditioner in which the indoor unit and the outdoor unit are separately provided. In recent years, the separate type air conditioner has been widely used.

[0005] The outdoor unit of the separate type air conditioner includes a compressor and a condenser which usually generate a lot of noise, and the indoor unit includes a heat exchanger, a drain tray unit for collecting and draining condensate generated in the heat exchanger, a crossflow fan and a stabilizer.

[0006] When power is supplied to the air conditioner, indoor air is suctioned into a main body by rotation of the crossflow fan, and the air suctioned into the main body by the crossflow fan is heat-exchanged by the heat exchanger and is then discharged again through a discharge port by the crossflow fan.

[0007] In the case of cooling, a process of circulating the heat-exchanged cold air, which is discharged into the room, in the room and suctioning the air into the indoor unit of the air conditioner again is repeated to keep the indoor space in a pleasant condition.

[0008] Since the indoor unit of the air conditioner is installed in the room, the discharged airflow need to be stabilized, the air volume to be discharged needs to be large and a silence characteristic is desirable.

[0009] To address the above-discussed deficiencies, it is an object to provide an air conditioner in which a cross-sectional structure of a stabilizer is improved in the light of a flow characteristic of air discharged by a crossflow fan.

[0010] Another aspect of the present disclosure discloses an air conditioner in which an arrangement structure of a stabilizer is improved so as to reduce flow loss caused by flow fluctuation generated by the stabilizer.

[0011] Yet another aspect of the present disclosure discloses an air conditioner in which a shape of a stabilizer is improved so as to reduce interference of air discharged by a crossflow fan generated between a plurality of unit fans of a crossflow fan.

[0012] In accordance with one aspect of the present disclosure, an air conditioner includes a main body having a suction port and a discharge port; a heat exchanger provided in the main body; a crossflow fan configured to discharge air heat-exchanged by the heat exchanger to the discharge port; and a stabilizer placed adjacent to the crossflow fan and including a guide section having a first guide portion configured to guide airflow flowing in the main body by the crossflow fan to a suction region and a second guide portion configured to guide the airflow to a discharge region, and a flow separation section connected to the guide section, wherein a location of the flow separating section varies in an axial direction of the crossflow fan and in a rotational direction of the crossflow fan.

[0013] The flow separation section may have a plurality of curved surfaces in the axial direction of the crossflow fan.

[0014] The flow separation section may include fan counterparts connected to the first guide portion and configured to extend in the axial direction of the crossflow fan, and the fan counterparts may be disposed at different locations in the axial direction of the crossflow fan and have different lengths in the rotational direction of the crossflow fan.

[0015] The crossflow fan may include a plurality of unit fans connected to each other in the axial direction of the crossflow fan and a plurality of connecting plates, each of which is disposed between and connects the plurality of the unit fans, the fan counterpart may include a first portion corresponding to a centre of each of the plurality of unit fans and a second portion corresponding to each of the plurality of connecting plates, and a length of the second portion in the rotational direction of the crossflow fan may be greater than a length of the first portion in the rotational direction of the crossflow fan.

[0016] The length of the fan counterpart in the rotational direction of the crossflow fan may be increased in the axial direction of the crossflow fan from the first portion toward the second portion.

[0017] The fan counterpart may be spaced a constant distance from one end of the crossflow fan in a radial direction of the crossflow fan.

[0018] The fan counterpart may have a plurality of curved surfaces in the axial direction of the crossflow fan.

[0019] An angle in the rotational direction of the crossflow fan between a first imaginary line connecting a centre of the crossflow fan and the first portion and a second imaginary line connecting the centre of the crossflow fan and the second portion on the same plane may be at most 15°.

[0020] The flow separation section may include a plurality of ribs arranged in the axial direction of the crossflow fan.

[0021] The plurality of ribs may be arranged at different intervals in the axial direction of the crossflow fan.

[0022] The plurality of ribs may have different thicknesses in the axial direction of the crossflow fan.

[0023] The plurality of ribs may be inclinedly arranged in the axial direction of the crossflow fan.

[0024] In accordance with another aspect of the present disclosure, an air conditioner includes a main body having a suction port and a discharge port; a heat exchanger provided in the main body; a crossflow fan configured to discharge air heat-exchanged by the heat exchanger to the discharge port and including a plurality of unit fans and a plurality of connecting plates connecting the plurality of unit fans in an axial direction of the crossflow fan; and a stabilizer including a first guide portion configured to guide airflow flowing to an air suction region in the main body by the crossflow fan, a second guide portion configured to guide the airflow to a discharge region and a flow separation section disposed between the first guide portion and the second guide portion and configured to connect the first guide portion to the second guide portion, wherein the flow separation section includes a fan counterpart having a length which is increased in the axial direction of the crossflow fan and in a rotational direction of the crossflow fan from a first portion connected to the first guide portion and corresponding to a centre of each of the plurality of unit fans towards a second portion corresponding to each of the plurality of connecting plates, and the fan counterpart is spaced a constant distance from one end of a blade of the crossflow fan in a radial direction of the crossflow fan.

[0025] The flow separation section may include a plurality of ribs arranged at intervals in the axial direction of the crossflow fan.

[0026] In accordance with yet another aspect of the present disclosure, an air conditioner includes a main body having a suction port and a discharge port; a crossflow fan configured to discharge air, which is suctioned through the suction port, through the discharge port; and a stabilizer including a plurality of ribs arranged at intervals in an axial direction of the crossflow fan and a flow separation section whose location is changed in the axial direction of the crossflow fan and in a rotational direction of the crossflow fan.

[0027] The flow separation section may be spaced a constant distance from a centre of the crossflow fan in a radial direction of the crossflow fan.

[0028] The flow separation section may have a plurality of curved surfaces in the axial direction of the crossflow fan.

[0029] Before undertaking the description below, it may be advantageous to set forth definitions of certain words and phrases used throughout this patent document: the terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation; the term "or," is inclusive, meaning and/or; the phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like; and the term "controller" means any device, system or part thereof that controls at least one operation, such a device may be implemented in hardware, firmware or software, or some combination of at least two of the same. It should be noted that the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely.

[0030] Moreover, various functions described below can be implemented or supported by one or more computer programs, each of which is formed from computer readable program code and embodied in a computer readable medium. The terms "application" and "program" refer to one or more computer programs, software components, sets of instructions, procedures, functions, objects, classes, instances, related data, or a portion thereof adapted for implementation in a suitable computer readable program code. The phrase "computer readable program code" includes any type of computer code, including source code, object code, and executable code. The phrase "computer readable medium" includes any type of medium capable of being accessed by a computer, such as read only memory (ROM), random access memory (RAM), a hard disk drive, a compact disc (CD), a digital video disc (DVD), or any other type of memory. A "non-transitory" computer readable medium excludes wired, wireless, optical, or other communication links that transport transitory electrical or other signals. A non-transitory computer readable medium includes media where data can be permanently stored and media where data can be stored and later overwritten, such as a rewritable optical disc or an erasable memory device.

[0031] Definitions for certain words and phrases are provided throughout this patent document, those of ordinary skill in the art should understand that in many, if not most instances, such definitions apply to prior, as well as future uses of such defined words and phrases.

[0032] For a more complete understanding of the present disclosure and its advantages, reference is now made to the following description taken in conjunction with the accompanying drawings, in which like reference numerals represent like parts:

FIG. 1 is a perspective view of an air conditioner in accordance with one embodiment of the present disclosure;

FIG. 2 is a side view of the air conditioner in accordance with one embodiment of the present disclosure;

FIG. 3 is a perspective view of a crossflow fan in the air conditioner in accordance with one embodiment of the present disclosure;

FIG. 4 is a side view of the crossflow fan in the air conditioner in accordance with one embodiment of the present disclosure;

FIG. 5 is a diagram illustrating a flow characteristic of air discharged by the crossflow fan in the air conditioner in accordance with one embodiment of the present disclosure;

FIG. 6 is a perspective view of a stabilizer in the air conditioner in accordance with one embodiment of the present disclosure;

FIG. 7 is a longitudinal sectional view of the crossflow fan and the stabilizer in the air conditioner in accordance with one embodiment of the present disclosure;

FIG. 8 is a cross-sectional view of the crossflow fan and the stabilizer in the air conditioner in accordance with one embodiment of the present disclosure; and

FIGS. 9A and 9B are views of a stabilizer including a plurality of ribs in an air conditioner in accordance with another embodiment of the present disclosure.

FIGS. 1 through 9B, discussed below, and the various embodiments used to describe the principles of the present disclosure in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the disclosure. Those skilled in the art will understand that the principles of the present disclosure may be implemented in any suitably arranged system or device.

[0033] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0034] FIG. 1 is a perspective view of an air conditioner in accordance with one embodiment of the present disclosure. FIG. 2 is a side view of the air conditioner in accordance with one embodiment of the present disclosure.

[0035] As shown in FIG. 1, an air conditioner 1 may include a main body 10 having a suction port 11 formed on an upper portion, a discharge port 12 formed on a lower portion and a predetermined space formed therein.

[0036] The main body 10 may have an approximately rectangular parallelopiped shape. On one side of the main body 10, a display section (not shown) may be provided to display an operating status of the air conditioner 1 and to allow a user to control an operation of the air conditioner 1.

The suction port 11 may be provided on the upper portion of the main body 10 to correspond to an area of a corresponding portion of the main body 10. The suction port 11 may be provided not only on the upper portion of the main body 10 but also on a front surface of the main body 10 to correspond to an area of a corresponding portion.

[0037] The suction port 11 may have a shape of a grille and may be provided to correspond to the entire area of the upper portion of the main body 10. The suction port 11 may include a plurality of suction vanes corresponding to a transverse length of the main body 10 and arranged in a longitudinal direction of the main body 10. The suction port 11 may be provided so that the maximum amount of air is suctioned into a heat exchanger 20.

[0038] The discharge port 12 may be provided at a lower end of the main body 10 and have an approximately long rectangular shape. The discharge port 12 may be formed by a stabilizer 50 and a rear guide 40. At a lower end of the discharge port 12, a discharge guide (not shown) capable of adjusting a direction of the air discharged into the room may be formed.

[0039] As shown in FIG. 2, the main body 10 may include the heat exchanger 20 provided therein for heat-exchanging air through a cooling or a heating and a crossflow fan 30 placed at a centre of an interior thereof to generate a vortex.

[0040] The main body 10 may include the rear guide 40 provided therein to restore the vortex formed by the crossflow fan 30 to constant positive pressure and the stabilizer 50 provided therein to divide an internal region of the main body 10 into a suction region A and a discharge region B together with the rear guide 40.

[0041] A flow passage may be formed by the rear guide 40 and the stabilizer 50 to communicate with the discharge port 12. The stabilizer 50 may be provided inside the discharge port 12.

[0042] The heat exchanger 20 may cool or heat air by making the air be in contact with and be heat-exchanged with a surface thereof. The heat exchanger 20 may be inclinedly installed below the suction port 11, and may function as an evaporator during a cooling operation of the air conditioner and as a condenser during a heating operation.

[0043] A plurality of heat exchangers 20 may be provided. Two or three heat exchangers 20 may be provided. The plurality of heat exchangers 20 may be disposed in a bent state in which the heat exchangers form an angle with each other for obtaining maximum heat exchange efficiency in a limited inner region of the main body 10.

[0044] The heat exchanger 20 may include a tube (not shown) through which a refrigerant flows and a heat exchange fin (not shown) which is in contact with the tube (not shown) to enlarge a heat-radiating area. The air suctioned by the crossflow fan 30 from an indoor space may become in contact with the tube (not shown) and the heat exchange fin (not shown) of the heat exchanger 20 to be heat-exchanged.

[0045] The heat exchanger 20 may be provided with a filter section (not shown). The filter section (not shown) may remove dust, bacteria and the like contained in contaminated air suctioned through the suction port 11 by the crossflow fan 30. Besides a single filter, in recent years, various filters are combined according to purposes and are then used as the filter section (not shown).

[0046] The fan of the air conditioner 1 may be classified into a low-pressure fan and a high-pressure fan according to the discharge pressure of the air, and the air conditioner 1 may be classified into a centrifugal type air conditioner, an axial-flow type air conditioner and a crossflow type air conditioner and the like according to a shape of a blade 310.

[0047] In the crossflow fan 30, there is no suction flow of the air in an axial direction Y of the crossflow fan 30, but suction and discharge of the air may be occurred in a plane perpendicular to the axial direction Y of the crossflow fan 30.

[0048] The crossflow fan 30 is generally advantageous in generating constant positive pressure of the air and a large amount of air volume, and a regular flow of the air may be generated in the axial direction Y of the crossflow fan 30. Therefore, the crossflow fan 30 may be widely used in the air conditioner 1, in particular, a window-type air conditioner or a ceiling-type air conditioner.

[0049] The crossflow fan 30 placed below the heat exchanger 20 generates a vortex when suctioning the air and it may not be suitable to directly discharge the air, which is suctioned and forms the vortex, into the room.

[0050] Therefore, the rear guide 40 for reducing the pressure of the air made by the vortex to a constant pressure may be provided on a rear surface of the air conditioner 1.

[0051] In order for the crossflow fan 30 to perform both the function of suctioning the air and the function of discharging the air using one fan, the rear guide 40 may be formed to have a curved surface over an inner rear surface of the main body 10. The rear guide 40 may have a curved surface shape in which an intermediate portion protrudes, and the curved surface shape may form an inflection point (not shown).

[0052] The rear guide 40 may divide the internal region of the main body 10 into the suction region A and the discharge region B together with the stabilizer 50, and an upper portion of the inflection point (not shown) of the rear guide 40 may become the suction region A and a lower portion may become the discharge region B.

[0053] A drain tray may be disposed below the heat exchanger 20. The drain tray may collect and discharge condensate flowing down from the heat exchanger 20 in the process of heat-exchanging the air suctioned by the crossflow fan 30.

[0054] The drain tray may perform the function of guiding the air discharged by the crossflow fan 30 to the discharge port 12.

[0055] The drain tray may be formed to be extended from an inner surface of the main body 10 toward the crossflow fan 30. The drain tray may include a receiving space formed at an upper portion thereof for receiving the condensate. The drain tray may be formed integrally with the main body 10 through an injection molding, and may also be formed independently of the main body 10.

[0056] The stabilizer 50 may be placed at an end of the drain tray. Together with the rear guide 40, the stabilizer 50 may divide the internal region of the main body 10 into the suction region A and the discharge region B of the air suctioned and discharged by the crossflow fan 30.

[0057] The stabilizer 50 may be placed adjacent to a circumferential surface of the crossflow fan 30. The stabilizer 50 may be formed along a long transverse surface of the discharge port 12.

[0058] FIG. 3 is a perspective view of the crossflow fan in the air conditioner in accordance with one embodiment of the present disclosure. FIG. 4 is a side view of the crossflow fan in the air conditioner in accordance with one embodiment of the present disclosure. FIG. 5 is a diagram illustrating a flow characteristic of the air discharged by the crossflow fan in the air conditioner in accordance with one embodiment of the present disclosure.

[0059] As shown in FIG. 3, the crossflow fan 30 performing the function of suctioning and discharging the air may be provided inside the heat exchanger 20. The crossflow fan 30 may be widely used in an indoor unit of the air conditioner 1 since the crossflow fan has low noise and high air volume and may have a direction in which the air is suctioned and a direction in which the air is discharged at a constant angle.

[0060] The crossflow fan 30 may include a plurality of blades 310 arranged in a radial direction R. A drive motor (not shown) capable of rotating the crossflow fan 30 at a high speed may be coupled to one end portion of the crossflow fan 30.

[0061] The crossflow fan 30 may be integrally formed. The crossflow fan 30 may include a plurality of unit fans 31 connected to each other in the axial direction Y of the crossflow fan 30 and a plurality of connecting plates 32, each of the plurality of connecting plates being arranged between two of the plurality of unit fans 31 and connecting two of the plurality of unit fans 31.

[0062] In order for the plurality of blades 310 to be coupled to the plurality of connecting plates 32, insertion protrusions (not shown) may be formed at both end portions of each of the plurality of blades 310 and insertion recesses (not shown) into which insertion protrusions (not shown) of the plurality of blades 310 are inserted may be formed on the plurality of connecting plates 32.

[0063] The plurality of unit fans 31 may be connected to each other by the plurality of connecting plates 32 so that the plurality of blades 310 of each of the plurality of unit fans 31 are aligned in a line in the axial direction Y of the crossflow fan 30.

[0064] The plurality of blades 310 of the crossflow fan 30 arranged in a line may cause air-blowing noise due to intensive discharge of air when the air is discharged by the crossflow fan 30.

[0065] In order to reduce the air-blowing noise, therefore, the plurality of unit fans 31 may be connected to each other in series through the plurality of connecting plates 32 at locations at which the plurality of unit fans are rotated with respect to each other by a predetermined angle in a rotational direction W of the crossflow fan 30.

[0066] The plurality of blades 310 of the crossflow fan 30 in which the plurality of unit fans 31 are connected to each other at locations at which the plurality of unit fans are rotated with respect to each other by a predetermined angle may disperse the air volume of the air discharged by the crossflow fan 30 so that the air-blowing noise may be reduced.

[0067] As shown in FIG. 4, each of the plurality of unit fans 31 of the crossflow fan 30 may include the plurality of blades 310 curved in the rotational direction W of the crossflow fan 30. The plurality of blades 310 may be arranged at intervals on the circumference of the crossflow fan 30 in the rotational direction W of the crossflow fan 30.

[0068] The plurality of blades 310 may be arranged at equidistant intervals or non-equidistant intervals on the same circumference. When the plurality of blades 310 are arranged at equidistant intervals, specific frequency noise (NZ noise) expressed by the product of the number N of the plurality of blades and the number Z of rotation may be generated from the crossflow fan 30.

[0069] Therefore, in order to reduce the air-blowing noise including the specific frequency noise, the plurality of blades 310 may be arranged at non-equidistant intervals.

[0070] Due to the arrangement of the plurality of blades 310 spaced at non-equidistant intervals, a first spacing G1 at which a distance between the plurality of blades 310 is relatively narrow and a second spacing G2 at which a distance between the plurality of blades 310 is relatively large may be formed in each of the plurality of unit fans 31 of the crossflow fan 30.

[0071] Discharge flow velocity of the air may be relatively low at the first spacing G1 and discharge flow velocity of the air may be relatively high at the second spacing G2.

[0072] Owing to the above phenomenon, a location where the maximum flow velocity is generated may differ for each of the plurality of unit fans 31 of the crossflow fan 30, so that flow fluctuation of the air discharged by the crossflow fan 30 may occur.

[0073] As shown in FIG. 5, since the crossflow fan 30 has a configuration in which the plurality of unit fans 31 are connected to each other in series, the air discharged from each of the plurality of unit fans 31 affects the plurality of unit fans 31 with each other, so that the flow characteristic of the air discharged by the crossflow fan 30 may be changed.

[0074] The air discharged by the crossflow fan 30 may have a flow velocity distribution in which the air flow is the fastest at a centre of each of the plurality of unit fans 31 and is the slowest at the plurality of connecting plates 32. The flow velocity of the air discharged by the crossflow fan 30 may be increased from each of the plurality of connecting plates 32 toward the centre of each of the plurality of unit fans 31 in the axial direction Y of the crossflow fan 30.

[0075] The flow characteristic of each of the plurality of unit fans 31 may have a curved surface shape and the overall flow characteristic of the crossflow fan 30 in which the plurality of unit fans 31 are connected to each other may have a shape in which the curved surfaces are connected to each other in the axial direction Y of the crossflow fan 30.

[0076] Due to the above configuration, the flow of the air discharged around the plurality of connecting plates 32 at which the flow velocity of the air is relatively low may be interfered by the air discharged around the plurality of unit fans 31 at which the flow velocity of the air is relatively high.

Due to flow interference caused by the flow velocity difference of the air discharged by the crossflow fan 30 between the plurality of unit fans 31 and the plurality of connecting plates 32 of the crossflow fan 30, the flow of the air discharged by the crossflow fan 30 may become considerably unstable.

[0077] Unstable airflow may cause considerable air-blowing noise and may ultimately degrade the performance of the crossflow fan 30.

[0078] Depending on the arrangement location of the plurality of unit fans 31 of the crossflow fan 30, the flow velocities of the discharged air at the plurality of unit fans 31 differ from each other.

[0079] The flow velocity of the air discharged by the unit fan 31 arranged at a central portion of the arrangement of the plurality of unit fans 31 in the axial direction Y of the crossflow fan 30 may be higher than those of the air discharged by the unit fans 31 arranged at both side end portions of the crossflow fan 30.

[0080] FIG. 6 is a perspective view of the stabilizer in the air conditioner in accordance with one embodiment of the present disclosure. FIG. 7 is a longitudinal sectional view of the crossflow fan and the stabilizer in the air conditioner in accordance with one embodiment of the present disclosure. FIG. 8 is a cross sectional view of the crossflow fan and the stabilizer in the air conditioner in accordance with one embodiment of the present disclosure.

[0081] As shown in FIG. 6, the stabilizer 50 may have a small thickness and may be formed in a hollow shape. The stabilizer 50 may be formed of a lightweight material having resilience, such as plastic.

[0082] The stabilizer 50 may include a flow separation section 52 capable of dividing the internal region of the main body 10 into the suction region A and the discharge region B of the air suctioned or discharged by the crossflow fan 30.

[0083] The flow separation section 52 may have a plurality of curved surfaces in the axial direction Y of the crossflow fan 30. A location of the flow separation section 52 may be changed in the axial direction Y of the crossflow fan 30 in the rotational direction W of the crossflow fan. Therefore, the flow separation section 52 may have a three-dimensional curved surface shape.

[0084] As shown in FIG. 7, the flow separation section 52 may include a fan counterpart 520 spaced apart from and corresponding to the crossflow fan 30. The fan counterpart 520 may include a first portion 521 corresponding to a centre of each of the plurality of unit fans 31 and a second portion 522 corresponding to each of the plurality of connecting plates 32.

[0085] In the flow separation section 52, the locations of the first portion 521 and the second portion 522 may be arranged differently in the light of the flow characteristic of the air discharged by the plurality of unit fans 31 and the plurality of connecting plates 32.

[0086] The flow rate of the air discharged by the crossflow fan 30 may be increased or decreased by adjusting a spacing between the flow separation section 52 and the crossflow fan 30.

[0087] By increasing the corresponding spacing between the crossflow fan 30 and the first portion 521 corresponding to the centre of each of the plurality of unit fans 31 at which the flow velocity of the air discharged by the crossflow fan 30 is relatively high, it is possible to secure a space through which the air discharged by the crossflow fan 30 may flow, thereby reducing the flow velocity of the discharged air.

[0088] On the contrary, by reducing the corresponding spacing between the crossflow fan 30 and the second portion 522 corresponding to each of the plurality of connecting plates 32 at which the flow velocity of the air discharged by the crossflow fan 30 is relatively low, it is possible to restrain flow loss of the air discharged by the crossflow fan 30 and to increase the flow velocity of the air.

[0089] A length of the second portion 522 in the rotational direction W of the crossflow fan 30 may be greater than that of the first portion 521 in the rotational direction W of the crossflow fan 30. A length of the fan counterpart 520 in the rotational direction W of the crossflow fan 30 may be increased in the axial direction Y of the crossflow fan 30 from the first portion 521 toward the second portion 522.

[0090] As shown in FIG. 8, the stabilizer 50 may be configured to have an approximately triangular cross section. However, the cross section is not an exact triangular shape, but may be formed with a smooth curve in order to stabilize the vortex of the air caused by the crossflow fan 30 and to reduce the noise.

[0091] The flow separation section 52 having the curved surface may reduce blade passing frequency noise (BPF noise) and turbulence flow noise of an eccentric vortex formed by the crossflow fan 30 and may be employed on a surface of the stabilizer 50 facing the crossflow fan 30 to disturb a turbulence flow.

[0092] The stabilizer 50 may include a guide section 51 for guiding airflow flowing in the main body 10 by the crossflow fan 30.

[0093] The guide section 51 may include a first guide portion 511 for guiding the airflow flowing in the main body 10 by the crossflow fan 30 to the suction region A and a second guide portion 512 for guiding the airflow flowing in the main body 10 by the crossflow fan 30 to the discharge region B.

[0094] The flow separation section 52 is connected to the guide section 51, and may be arranged adjacent to the crossflow fan 30 so that the air discharged to the discharge region B by the crossflow fan 30 may be discharged into the room through the discharge port 12 without being re-introduced into the suction region A.

[0095] The flow separation section 52 may include the fan counterpart 520 connected to the first guide portion 511 and extending in the axial direction Y of the crossflow fan 30. The fan counterparts 520 may have locations which differ from each other in the axial direction Y of the crossflow fan 30.

[0096] The fan counterparts 520 may be disposed to have different lengths in the rotational direction W of the crossflow fan 30. The fan counterparts 520 may have a plurality of curved surfaces in the axial direction Y of the crossflow fan 30.

[0097] A length of the fan counterpart 520 may be varied in response to a change of an angle θ in the rotational direction W of the crossflow fan 30 between a first imaginary line L1 connecting a centre O of the crossflow fan 30 and the first portion 521 and a second imaginary line L2 connecting the centre O of the crossflow fan 30 and the second portion 522 on the same plane.

[0098] The angle θ in the rotational direction W of the crossflow fan 30 between the first imaginary line L1 and the second imaginary line L2 on the same plane may be o to at most 15°. Preferably, the angle θ in the rotational direction W of the crossflow fan 30 between the first imaginary line L1 and the second imaginary line L2 on the same plane may be at most about 10°.

[0099] It is necessary to determine a location at which the stabilizer 50 is arranged after appropriately considering a spacing between the stabilizer 50 and the crossflow fan 30.

[0100] Influence of the spacing between the stabilizer 50 and the crossflow fan 30 may be determined by a locational relation between the crossflow fan 30 and the flow separation section 52.

[0101] When a spacing between the flow separation section 52 and the crossflow fan 30 is small, an air-blowing effect is improved, but the air-blowing noise may be easily generated. When the spacing between the flow separation section 52 and the crossflow fan 30 is large, although the air-blowing noise may be reduced, the air-blowing effect may be deteriorated.

[0102] The spacing between the flow separation section 52 and the crossflow fan 30 may be appropriately adjusted in the light of size and operation speed of the crossflow fan 30, and the like.

[0103] When the flow separation section 52 has a curved surface shape in the axial direction Y of the crossflow fan 30 for considering the flow characteristic of the air discharged by the crossflow fan 30, a spacing between the portion corresponding to each of the plurality of unit fans 31 and the crossflow fan 30 may be greatly different from a spacing between the portion corresponding to each of the plurality of connecting plates 32 and the crossflow fan 30.

[0104] If the spacing between the portion corresponding to each of the plurality of unit fans 31 and the crossflow fan 30 is greatly different from the spacing between the portion corresponding to each of the plurality of connecting plates 32 and the crossflow fan 30, the flow characteristic is considered, but the flow rate of the air discharged by the crossflow fan 30 may be influenced depending on the location.

[0105] In order to minimize the influence on the flow rate of the air discharged while considering the flow characteristic of the air discharged by the crossflow fan 30, a length of the fan counterpart 520 may be changed in the axial direction Y of the crossflow fan 30 in the rotational direction W of the crossflow fan 30.

[0106] In other words, the fan counterpart 520 and the crossflow fan 30 may have a first space H having a constant distance in a radial direction R of the crossflow fan 30. The fan counterpart 520 may have the first space H having the constant distance from ends of the blades 310 of the crossflow fan 30 in the radial direction R of the crossflow fan 30.

[0107] The fan counterpart 520 may be arranged to be spaced from the crossflow fan 30 by the first space H having a constant distance from the centre O of the crossflow fan 30 in the radial direction R of the crossflow fan 30.

[0108] FIGS. 9A and 9B are views of a stabilizer including a plurality of ribs in an air conditioner in accordance with another embodiment of the present disclosure.

[0109] As shown in FIGS. 9A and 9B, the flow separation section 52 may include a plurality of ribs 500 arranged in the axial direction Y of the crossflow fan 30.

[0110] A portion of the vortex generated by the crossflow fan 30 flows along smooth curved portions of the plurality of ribs 500 of the stabilizer 50, and remaining portion flows along a spacing between the plurality of ribs 500 so that the vortex may be further stabilized and the noise may be reduced.

[0111] The plurality of ribs 500 may not be formed on the flow separation section 52 corresponding to the centre of each of the plurality of unit fans 31.

[0112] The plurality of ribs 500 may be arranged at regular intervals in the axial direction Y of the crossflow fan 30. The plurality of ribs 500 may be arranged at intervals, which differ from each other, in the axial direction Y of the crossflow fan 30.

[0113] The plurality of ribs 500 having the same thickness may be arranged in the axial direction Y of the crossflow fan 30. The plurality of ribs 500 having different thicknesses may be arranged in the axial direction Y of the crossflow fan 30.

[0114] In other words, size and thickness of each of the plurality of ribs 500, a spacing between the plurality of ribs 500, and the like may be variously determined in the light of the shape of each air conditioner 1, the characteristic of the crossflow fan 30 and the like.

[0115] The plurality of ribs 500 may be arranged at right angles in the axial direction Y of the crossflow fan 30. The plurality of ribs 500 may be arranged to be inclined with respect to the axial direction Y of the crossflow fan 30.

[0116] When the plurality of ribs 500 are inclined with respect to the axial direction Y of the crossflow fan 30 to form an angle, as compared with the configuration in which the plurality of ribs 500 are arranged at right angles with respect to the axial direction Y of the crossflow fan 30, the noise generated when the vortex formed by the crossflow fan 30 hits against the plurality of ribs 500 may be further reduced.

[0117] In other words, the air discharged by the crossflow fan 30 disturbs the turbulence while passing the gentle curved shape of the plurality of ribs 500 which are inclinedly arranged at a certain angle and the spacing between two of the plurality of ribs 500 so that the flow of the air is further stabilized and guided to the discharge port 12. Therefore, the BPF noise is reduced and the turbulence flow noise is also reduced, so that overall noise may be reduced.

[0118] Hereinafter, operation and effect of the air conditioner 1 according to the embodiment of the present disclosure are described.

[0119] In the air conditioner 1 according to the present disclosure, when power is applied, the crossflow fan 30 starts to be driven by the drive motor (not shown), and the air may be suctioned through the suction port 11 by the crossflow fan 30 and be then introduced into the main body 10.

[0120] The air introduced into the main body 10 by the crossflow fan 30 passes through the filter (not shown) provided on a front surface of the heat exchanger 20, and dust and bacteria contained in the air are filtered. Then, the air may be heat-exchanged while passing through the heat exchanger 20.

[0121] The air that has been heat-exchanged by the heat exchanger 20 generates a vortex while passing through the crossflow fan 30, and flow of the vortex may be slightly stabilized by the rear guide 40 formed on a rear surface of the air conditioner 1 to be restored to the positive pressure.

[0122] The air discharged by the crossflow fan 30 may pass through the rear guide 40 and be then discharged into the room through the discharge port 12 formed by the stabilizer 50 and the rear guide 40.

[0123] By improving the structure, arrangement and shape of the stabilizer 50, it is possible to reduce the flow loss and the noise caused by the flow fluctuation in the process of converting the dynamic pressure of the vortex generated by the crossflow fan 30 into the positive pressure, and it is possible to reduce the air-blowing noise up to about 1.5 dB on the basis of the same air volume.

[0124] In the air conditioner according to the present disclosure, the cross-sectional structure of the stabilizer is improved so that it is possible to suppress the flow fluctuation of the air discharged by the crossflow fan as much as possible.

[0125] In the air conditioner according to the present disclosure, the arrangement structure of the stabilizer is improved so that the flow loss of the air discharged by the crossflow fan may be reduced, thereby securing the flow rate.

[0126] In the air conditioner according to the present disclosure, the shape of the stabilizer is improved to reduce the interference of the air discharged by the crossflow fan, which is generated between the plurality of unit fans of the crossflow fan, so that the air-blowing noise may be reduced.

[0127] Although the present disclosure has been described with exemplary embodiments, various changes and modifications may be suggested to one skilled in the art. It is intended that the present disclosure encompass such changes and modifications as fall within the scope of the appended claims.

Claims

1. An air conditioner (1), comprising:

   a main body (10) having a suction port (11) and a discharge port (12);
   a heat exchanger (20) provided in the main body;
   a crossflow fan (30) configured to discharge air heat-exchanged by the heat exchanger to the discharge port; and
   a stabilizer (50) placed adjacent to the crossflow fan and comprising a guide section (51) having a first guide portion (511) configured to guide an airflow flowing in the main body by the crossflow fan to a suction region (A) and a second guide portion (512) configured to guide the airflow to a discharge region (B); and a flow separation section (520) connected to the guide section, wherein a location of the flow separation section varies in an axial direction of the crossflow fan and in a rotational direction of the crossflow fan.

2. The air conditioner of claim 1, wherein the flow separation section has a plurality of curved surfaces in the axial direction of the crossflow fan.

3. The air conditioner of claim 1 or 2, wherein the flow separation section comprises fan counterparts connected to the first guide portion and configured to extend in the axial direction of the crossflow fan.

4. The air conditioner of claim 3, wherein, the fan counterparts are disposed at different locations in the axial direction of the crossflow fan and have different lengths in the rotational direction of the crossflow fan.

5. The air conditioner of claim 4, wherein the crossflow fan comprises a plurality of unit fans connected to each other in the axial direction of the crossflow fan and a plurality of connecting plates, each of which is disposed between and connects the plurality of the unit fans.

6. The air conditioner of claim 5, wherein the fan counterparts comprise a first portion corresponding to a centre of each of the plurality of unit fans and a second portion corresponding to each of the plurality of connecting plates.

7. The air conditioner of claim 6, wherein a length of the second portion in the rotational direction of the crossflow fan is greater than a length of the first portion along the rotational direction of the crossflow fan.

8. The air conditioner of claim 6 or 7, wherein a length of the fan counterpart in the rotational direction of the crossflow fan is increased in the axial direction of the crossflow fan from the first portion toward the second portion.

9. The air conditioner of any one of claims 3 to 8, wherein the fan counterparts are spaced a constant distance from one end of the crossflow fan in a radial direction of the crossflow fan.

10. The air conditioner of any one of claims 3 to 9, wherein the fan counterparts have a plurality of curved surfaces in the axial direction of the crossflow fan.

11. The air conditioner of any one of claims 6 to 10, wherein an angle in the rotational direction of the crossflow fan between a first imaginary line connecting a centre of the crossflow fan and the first portion and a second imaginary line connecting the centre of the crossflow fan and the second portion on the same plane is at most 15°.

12. The air conditioner of any one of the preceding claims, wherein the flow separation section comprises a plurality of ribs arranged in the axial direction of the crossflow fan.

13. The air conditioner of claim 12, wherein the plurality of ribs are arranged at different intervals in the axial direction of the crossflow fan.

14. The air conditioner of claim 12 or 13, wherein the plurality of ribs have different thicknesses in the axial direction of the crossflow fan.

15. The air conditioner of any one of claims 12 to 14, wherein the plurality of ribs are inclinedly arranged in the axial direction of the crossflow fan.

FIG. 1

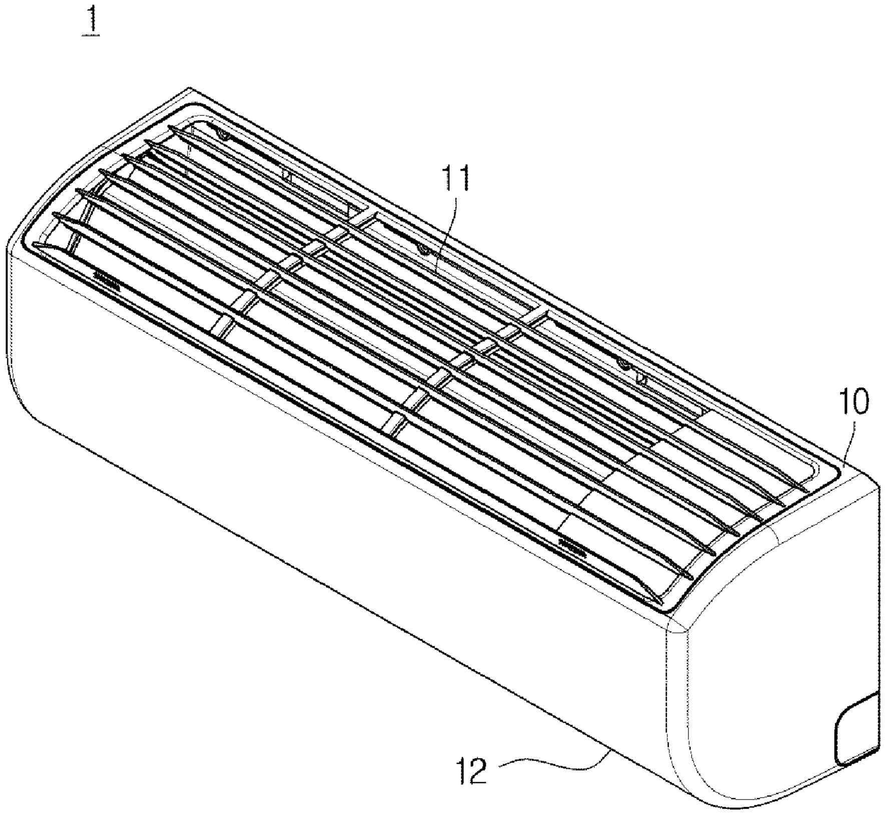


FIG. 2

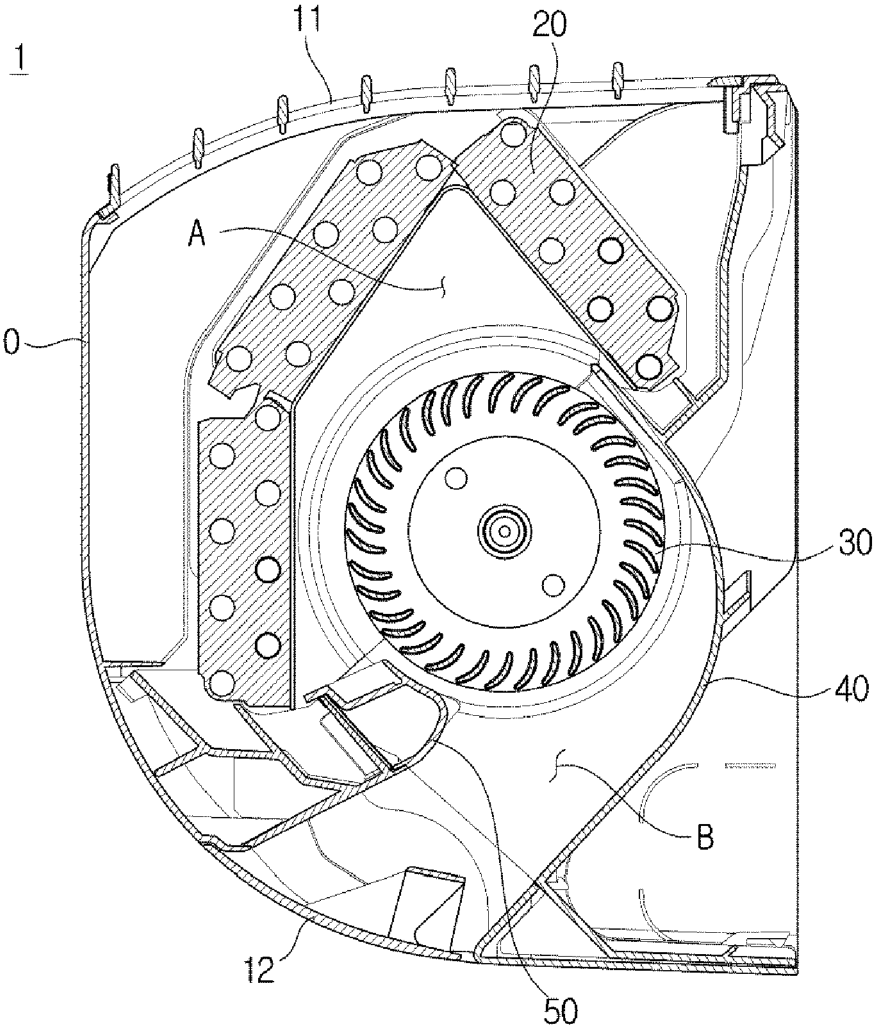


FIG. 3

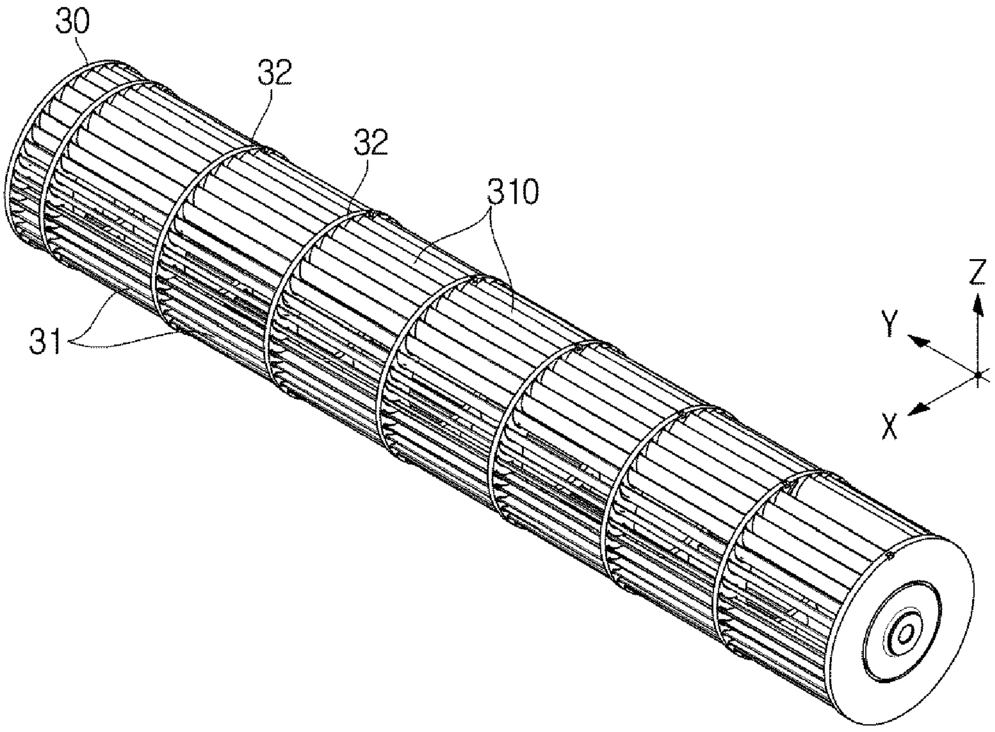


FIG. 4

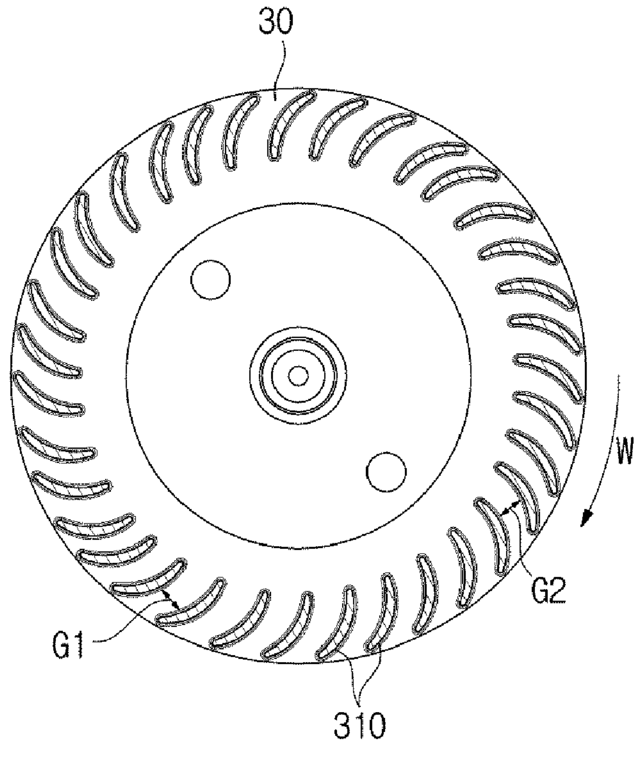


FIG. 5

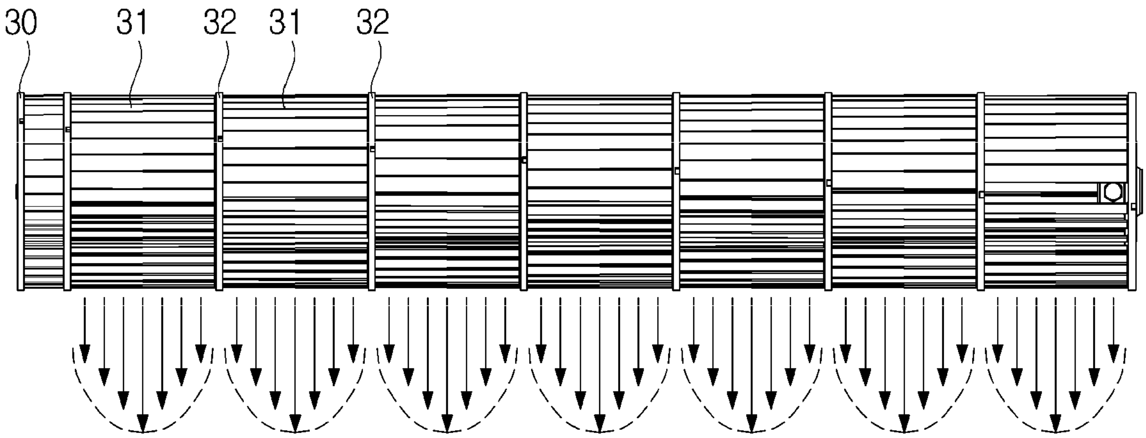


FIG. 6

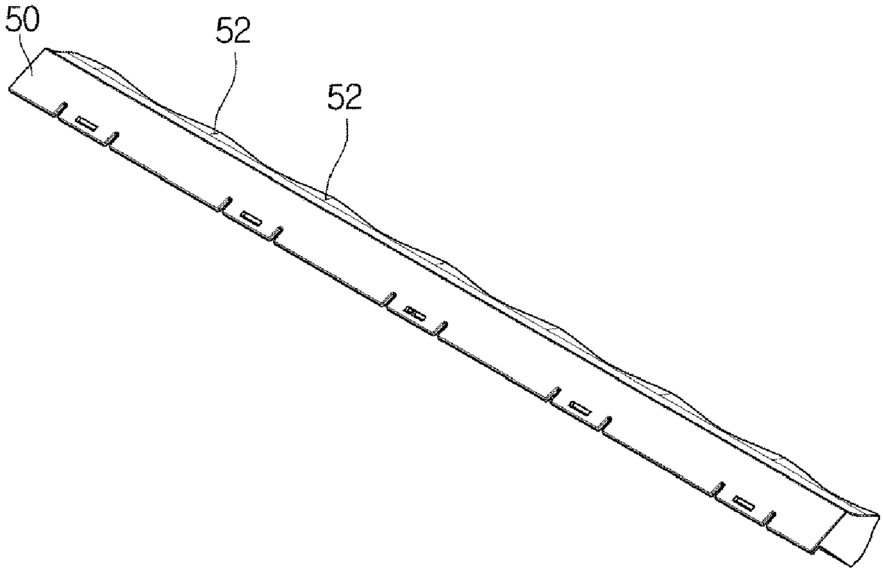


FIG. 7

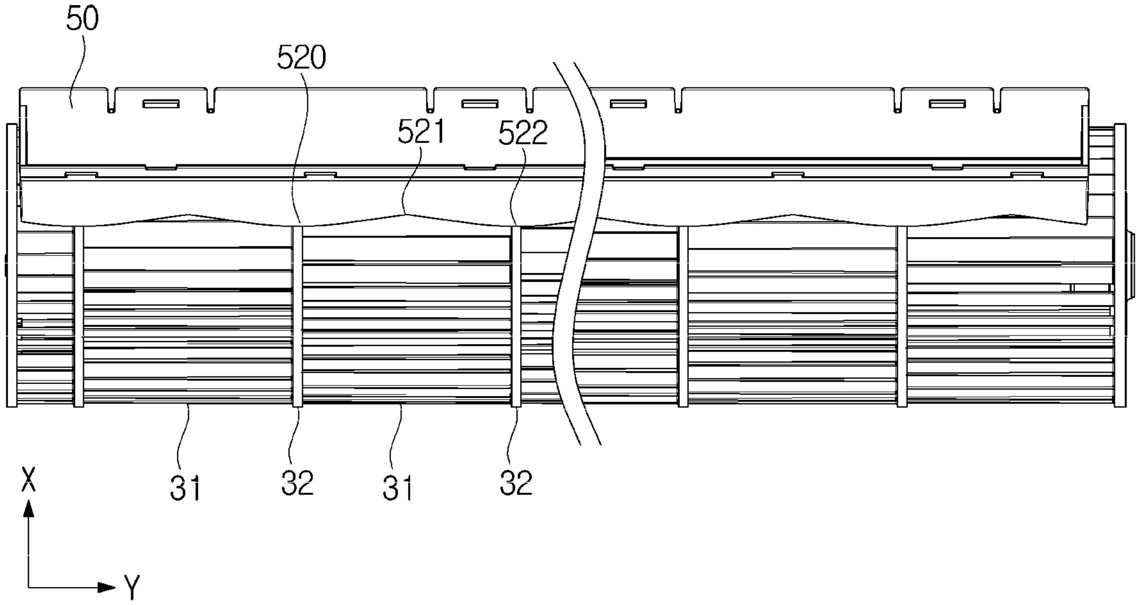


FIG. 8

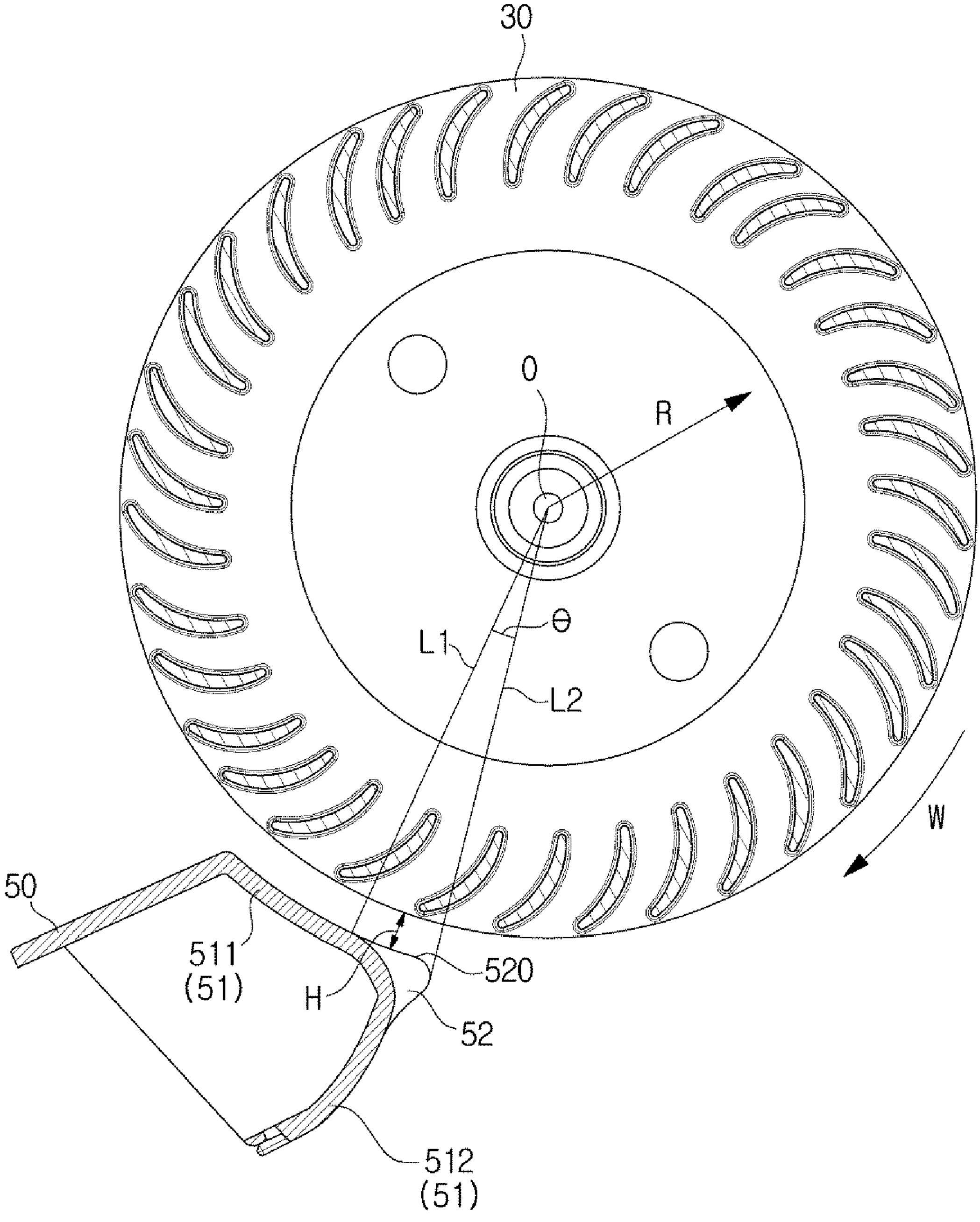


FIG. 9A

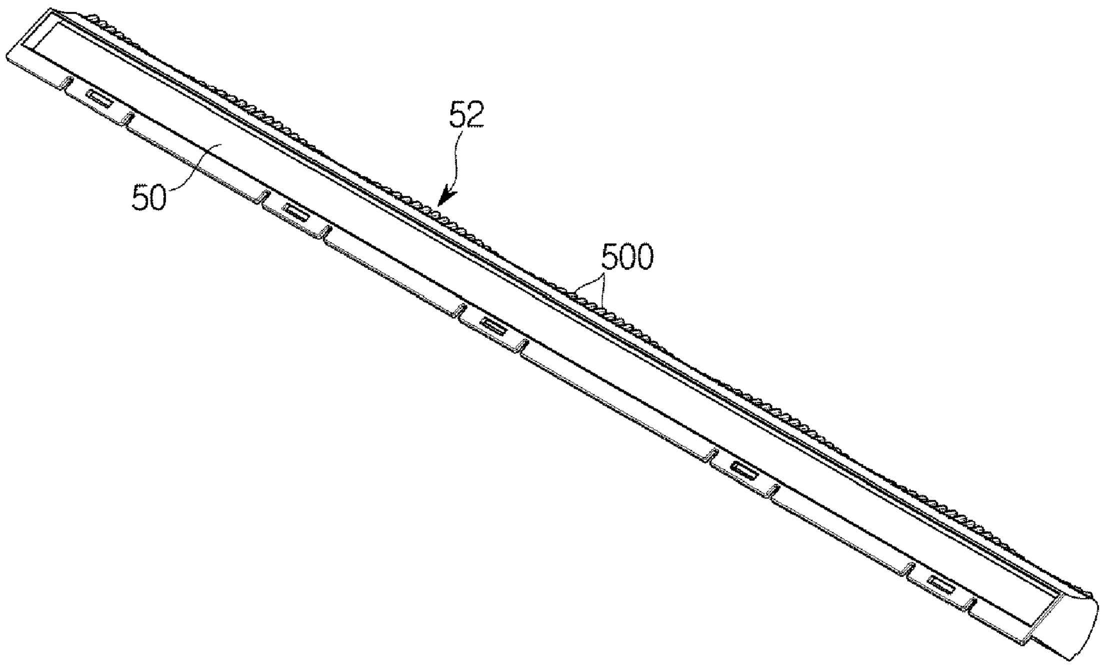
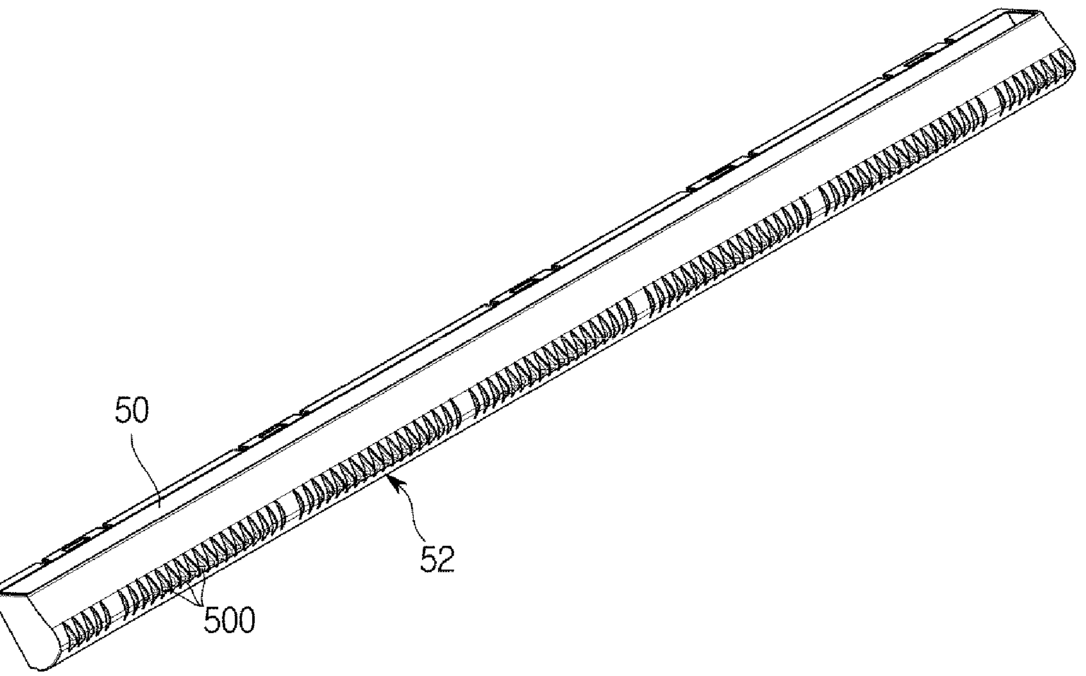


FIG. 9B



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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 6206

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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	20 March 2018	Decking, Oliver

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