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Air-processing apparatus

Abstract

An air-processing apparatus is provided. The air-processing apparatus may include a case having an outlet formed therein, a louver rotatably disposed in the case and configured to adjust a direction of air flowing through the outlet, and a louver actuator configured to adjust an orientation of the louver. The louver may include a louver rotational shaft and a plurality of vanes spaced apart from each other in a radial direction based on the louver rotational shaft. The louver actuator may be disposed so as to be in contact with a vane located at an outermost position among the plurality of vanes to change an orientation of the louver.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION(S)

(1) This application claims priority under 35 U.S.C. § 119 to Korean Application Nos. 10-2021-0065987 and 10-2021-0065990 filed in Korea on May 24, 2021, and 10-2021-0174217 filed in Korea on Dec. 7, 2021, whose entire disclosures are hereby incorporated by reference.

BACKGROUND

1. Field

(2) An air-processing apparatus, and more particularly, an air-processing apparatus including a louver configured to adjust a direction of air blown out through an outlet is disclosed herein.

2. Background

(3) An air-processing apparatus may include an air conditioner configured to adjust an indoor temperature and an air purifier that removes fine dust from indoor air. In the case of an air conditioner, a stand-type indoor unit, a wall-mounted indoor unit, or a ceiling-mounted indoor unit may be mounted in an indoor space in order to adjust the temperature of the indoor space. An air purifier is generally configured to be movable, and is disposed on a floor of an indoor space in order to purify contaminated air in the indoor space.

(4) Because an air conditioner and an air purifier are physically separated from each other and are located at different positions, a region in which the air conditioner discharges heat-exchanged air and a region in which the air purifier discharges purified air may differ from each other. In order to address this problem, a filter may be disposed in an inlet region of the air conditioner. However, when a high-efficiency particulate air (HEPA) filter for use in an air purifier is mounted in the air

conditioner, the HEPA filter acts as resistance to a flow of air to a heat exchanger. Therefore, it is difficult to use a HEPA filter in an air conditioner.
(5) Korean Patent Laid-Open Publication No. 10-2012-0034446, which is hereby incorporated by reference, discloses a structure in which a separate air conditioner is disposed in a lower space in a stand-type air conditioner. This structure enables individual air conditioning for a lower region and an upper region in an indoor space. However, it is difficult to perform air conditioning and air purification for overlapping regions.
(6) A ceiling-mounted air-processing apparatus or a wall-mounted air-processing apparatus has an outlet formed to extend lengthwise in a lateral or leftward-rightward direction. In addition, this type of air-processing apparatus includes a louver that adjusts a direction of air blown out from the outlet formed in the leftward-rightward direction and a louver actuator that changes an orientation of the louver.
(7) Korean Patent Laid-Open Publication No. 10-2018-0066546, which is hereby incorporated by reference, discloses an air-processing apparatus capable of adjusting the direction of air that is blown out by changing the orientation of a vane. However, a drive motor that changes the orientation of the vane is disposed on a left or right side of the vane, and thus, an outlet may not be formed in the portion in which the drive motor is disposed, which may cause a problem in which the area of the outlet is comparatively reduced.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) Embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements, and wherein:
(2) FIG. **1** is a perspective view of a first air-processing apparatus, a second air-processing apparatus, and a filter cleaner according to an embodiment disposed in an indoor space;
(3) FIG. **2** is a side view for explaining a filter cleaner disposed behind a first air-processing apparatus or a second air-processing apparatus according to an embodiment;
(4) FIG. **3** is a perspective view for explaining a guide rail disposed behind a first air-processing apparatus and a second air-processing apparatus according to an embodiment;
(5) FIG. **4** is a rear view of the guide rail of FIG. **3**;
(6) FIG. **5** is a perspective view of a first air-processing apparatus according to an embodiment;
(7) FIG. **6** is an exploded perspective view of the first air-processing apparatus of FIG. **5**;
(8) FIG. **7** is a bottom view of the first air-processing apparatus of FIG. **5**;
(9) FIG. **8** is a rear view of the first air-processing apparatus of FIG. **5**;
(10) FIG. **9** is a cross-sectional view, taken along line IX-IX′ in FIG. **7**;
(11) FIG. **10** is a cross-sectional view, taken along line X-X′ in FIG. **7**;
(12) FIG. **11** is a cross-sectional view, taken along line XI-XI′ in FIG. **7**;
(13) FIG. **12** is a perspective view showing a coupled state of a front cover and a louver according to an embodiment;
(14) FIG. **13** is a rear view of the front cover and louver of FIG. **12**;
(15) FIG. **14**A is a cross-sectional view, taken along line XIVA-XIVA′ in FIG. **13**;
(16) FIG. **14**B is a cross-sectional view, taken along line XIVB-XIVB′ in FIG. **13**;
(17) FIG. **15** is a perspective view of a louver according to an embodiment;
(18) FIG. **16** is a rear view of the louver of FIG. **15**;
(19) FIG. **17** is a cross-sectional view, taken along line XVII-XVII′ in FIG. **16**;
(20) FIG. **18**A is a cross-sectional view for explaining an orientation of a first louver in a first mode according to an embodiment;
(21) FIG. **18**B is a cross-sectional view for explaining the orientation of the first louver in a second

mode according to an embodiment;
(22) FIG. **18**C is a cross-sectional view for explaining the orientation of the first louver in a third mode according to an embodiment;
(23) FIG. **19** is a perspective view of a second air-processing apparatus according to an embodiment;
(24) FIG. **20** is an exploded perspective view of the second air-processing apparatus of FIG. **19**;
(25) FIG. **21** is a bottom view of the second air-processing apparatus of FIG. **19**;
(26) FIG. **22** is a cross-sectional view, taken along line XXII-XXII′ in FIG. **21**;
(27) FIG. **23** is an enlarged view of portion A in FIG. **22**;
(28) FIG. **24** is a cross-sectional view, taken along line XXIV-XXIV′ in FIG. **21**;
(29) FIG. **25**A is a perspective view of an inner cover according to an embodiment;
(30) FIG. **25**B is a perspective view of the inner cover when viewed from a direction different from that of FIG. **25**A;
(31) FIG. **26**A is a perspective view of a second upper housing according to an embodiment;
(32) FIG. **26**B is a side view of the second upper housing of FIG. **26**A;
(33) FIG. **27** is a perspective view of a second lower housing according to an embodiment;
(34) FIG. **28** is an exploded perspective view of a filter-mount and a filter device according to an embodiment;
(35) FIG. **29** is a bottom perspective view of a filter-mount according to an embodiment;
(36) FIG. **30** is an exploded perspective view of a filter device according to an embodiment;
(37) FIG. **31** is a cross-sectional view, taken along line XXXI-XXXI′ in FIG. **21**;
(38) FIG. **32** is a cross-sectional view, taken along line XXXII-XXXII′ in FIG. **21**;
(39) FIG. **33**A is a perspective view for explaining an arrangement of a second bottom cover, the filter-mount, and the filter device in a state in which the second bottom cover is located at a rear position;
(40) FIG. **33**B is a cross-sectional view of the arrangement of FIG. **33**A;
(41) FIG. **34**A is a perspective view for explaining the arrangement of the second bottom cover, the filter-mount, and the filter device in the state in which the second bottom cover is located at a front position;
(42) FIG. **34**B is a cross-sectional view of the arrangement of FIG. **34**A;
(43) FIG. **35**A is a perspective view for explaining the arrangement of the second bottom cover, the filter-mount, and the filter device in the state in which the second bottom cover is located at a front position and the filter-mount is moved downwards;
(44) FIG. **35**B is a cross-sectional view of the arrangement of FIG. **35**A; and
(45) FIG. **35**C is a cross-sectional view of the arrangement of FIG. **35**A when viewed from a direction different from that of FIG. **35**A.

DETAILED DESCRIPTION

(46) Advantages and features and methods for achieving them will be made clear from embodiments described below with reference to the accompanying drawings. The embodiments may, however, be embodied in many different forms, and should not be construed as being limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope to those skilled in the art. The embodiments are defined only by the scope of the claims. Throughout the specification, the same or like reference numerals represent the same or like components.
(47) The terms “U”, “D”, “Le”, “Ri”, “F”, and “R” shown in FIGS. **1** to **35**C indicate an upward direction, a downward direction, a leftward direction, a rightward direction, a forward direction, and a rearward direction, respectively. The aforementioned directions are used only for convenience of description, and are not intended to limit the scope of the disclosure. Thus, the aforementioned directions may be set differently according to some reference.
(48) Hereinafter, an air-conditioning system according to an embodiment will be described with

reference to the accompanying drawings.

(49) An air-conditioning system according to an embodiment may include a first air-processing apparatus **100**, which adjusts a temperature of air through heat exchange between the air and a refrigerant, and a second air-processing apparatus **200**, which is disposed on one side of the first air-processing apparatus in order to remove foreign substances from the air. The air-conditioning system according to an embodiment may include a plurality of air-processing apparatuses **100***a*, **100***b*, and **200**. The air-conditioning system according to an embodiment may include one or two or more first air-processing apparatuses **100***a* and **100***b* and one or two or more second air-processing apparatuses **200**.

(50) The air-conditioning system according to an embodiment may include a filter cleaner **300**, which moves along a surface in which inlets **102***a* and **202***a* of the plurality of air-processing apparatuses **100***a*, **100***b*, and **200** are formed in order to clean pre-filters **188** and **288** disposed in the inlets **102***a* and **202***a*.

(51) Referring to FIG. **1**, the air-conditioning system according to an embodiment may include one second air-processing apparatus **200** and two first air-processing apparatuses **100** disposed on both sides of the second air-processing apparatus **200**. However, this is merely illustrative, and a numbers and arrangement of first and second air-processing apparatuses **100** and **200** may be set differently.

(52) Referring to FIG. **2**, the air-conditioning system may include a guide rail **10**, which is disposed at the rear sides of the first air-processing apparatuses **100** and the second air-processing apparatus **200** in order to guide movement of the filter cleaner **300**. Support rails **116** and **244** that support movement of the filter cleaner **300** may be disposed at upper ends of rear surfaces of the first air-processing apparatuses **100** and the second air-processing apparatus **200**.

(53) The support rails may include first support rails **116** disposed at the first air-processing apparatuses **100** and second support rail **244** disposed at the second air-processing apparatus **200**. The first support rails **116** may be formed integrally with first rear covers **114** (refer to FIG. **8**) of the first air-processing apparatuses **100**, which will be described hereinafter. The second support rail **244** may be formed integrally with a second rear cover **242** (refer to FIG. **20**) of the second air-processing apparatus **200**, which will be described hereinafter.

(54) The guide rail **10** may be disposed on rear sides of the first rear covers **114** and the second rear cover **242**. The guide rail **10** may be disposed above the first inlets **102***a* and the second inlet **202***a*. The guide rail **10** may extend in a lateral or leftward-rightward direction on the rear sides of the first rear covers **114** and the second rear cover **242**. The guide rail **10** may be fixedly disposed below first rail-fixing protrusions **117** of the first rear covers **114** and a second rail-fixing protrusion **245** of the second rear cover **242**.

(55) The guide rail **10** may include a gear rail **20**, which has threads to be engaged with a moving gear (not shown) of the filter cleaner **300**, and a roller rail **22**, which is in contact with a guide roller (not shown) of the filter cleaner **300**.

(56) The roller rail **22** may be disposed behind the gear rail **20**. The roller rail **22** may be disposed at each of an upper side and a lower side of the guide rail **10**. The gear rail **20** may be disposed in front of the roller rail **22**. The gear rail **20** may be formed on a lower surface of the guide rail **10**. The gear rail **20** may have a shape of a rack gear. When viewed from the rear, the guide rail **10** may have a structure in which the gear rail **20** is shielded by the roller rail **22**.

(57) A rail groove **24** may be formed in a rear surface of the guide rail **10**. The rail groove **24** may be recessed in a forward direction and extend in the lateral direction. An object to be sensed **26** may be disposed in the rail groove **24**. A plurality of the object to be sensed **26** may be provided, and the plurality of objects to be sensed may be spaced apart from each other in the lateral direction. A sensor (not shown) may be disposed at the filter cleaner **300**, and when the sensor senses the object to be sensed **26**, a position of the filter cleaner **300** may be detected.

(58) The object to be sensed **26** may correspond to the sensor. For example, when the sensor is a

switch sensor, the object to be sensed **26** may have a shape of a protrusion that protrudes rearwards. Alternatively, when the sensor is a Hall sensor, the object to be sensed **26** may be implemented as a magnet.

(59) An end plate **28** configured to limit movement of the filter cleaner **300** in one direction may be disposed at a left end or a right end of the guide rail **10**. The end plate **28** may extend in a direction perpendicular to a direction in which the guide rail **10** extends. The end plate **28** may protrude rearwards from the rear cover **114**.

(60) The end plate **28** may be provided with a charging terminal **30**, with which a connection terminal **320** of the filter cleaner **300** is brought into contact. The charging terminal **30** protrudes from the end plate **28** in the direction in which the guide rail **10** extends. Accordingly, when the filter cleaner **300** reaches the end plate **28**, the connection terminal **320** of the filter cleaner **300** may be brought into contact with and connected to the charging terminal **30**.

(61) Hereinafter, a first air-processing apparatus according to an embodiment will be described with reference to FIGS. **5** to **17**C.

(62) The first air-processing apparatus **100** induces air to exchange heat with a refrigerant and discharges the heat-exchanged air to the outside. The first air-processing apparatus **100** may include first inlet **102***a* formed in one or a first side thereof in order to suction air thereinto and a first outlet **102***b* formed in another or a second side thereof perpendicular to the first inlet **102***a* in order to discharge air therefrom. Referring to FIG. **5**, the first inlet **102***a* may be formed so as to be perpendicular to a surface of a floor or ceiling. The first outlet **102***b* may be open downwards. The first outlet **102***b* may extend perpendicular to the first inlet **102***a*.

(63) Referring to FIG. **6**, the first air-processing apparatus **100** may include a first fan **182**, which causes air to flow, a first fan motor **184**, which rotates the first fan **182**, and a heat exchanger **186**, through which a refrigerant flows to exchange heat with air. The first air-processing apparatus **100** may further include a first case **102**, which forms an external appearance of the first air-processing apparatus **100**, and a first housing **132**, which is disposed inside of the first case **102** and which forms a flow path through which air flows. The first air-processing apparatus **100** may further include a first louver **150**, which is rotatably disposed in the first case **102** in order to adjust a direction of air that is discharged from the first outlet **102***b*, and a first louver actuator **174**, which changes an orientation of the first louver **150**. The first air-processing apparatus **100** may also include a first control box **190** that controls operation of the first fan motor **184** or operation of the first louver actuator **174**.

(64) Referring to FIG. **6**, the first case **102** may include a first upper cover **104**, which may be secured to a ceiling, a first lower cover **106**, which is disposed below the first upper cover **104**, a first rear cover **114**, in which is formed therein the first inlet **102***a* and to which first pre-filter **188** is mounted, a first front cover **118**, which is spaced forwards apart from the first rear cover **114**, and two first side covers **128**, which are disposed at both side ends of the first lower cover **106**. Referring to FIG. **6**, the first case **102** may further include a first bottom cover **130**, which is disposed below the first lower cover **106**.

(65) Referring to FIG. **6**, the first inlet **102***a* may be formed in the first rear cover **114**. The guide rail **10** may be mounted on an outer surface of the first rear cover **114**. The first inlet **102***a* may be formed in a lower portion of the first rear cover **114**. The first pre-filter **188** may be mounted in the first inlet **102***a* formed in the first rear cover **114**. The guide rail **10** and the first support rail **116** that guides movement of the filter cleaner **300** may be mounted on the first rear cover **114**.

(66) Referring to FIG. **2**, the guide rail **10** may be disposed above the first inlet **102***a*. The first support rail **116** may be disposed at an upper end of the first rear cover **114**. The guide rail **10** may be provided separately from the first rear cover **114**. The first support rail **116** may be formed integrally with the first rear cover **114**.

(67) Referring to FIG. **9**, the first support rail **116** may include a first top plate **116***a*, which protrudes rearwards from the upper end of the first rear cover **114**, and a first bent portion **116***b*,

which is bent and extends downwards from the rear end of the first top plate **116***a*. A top roller **326** (refer to FIG. **2**) of the filter cleaner **300** may be in contact with the first bent portion **116***b*.
(68) Referring to FIG. **9**, the first rear cover **114** may be disposed behind a first vertical plate **110** of the first lower cover **106**, which will be described hereinafter. The first rear cover **114** may be fixedly disposed behind the first vertical plate **110**.
(69) Referring to FIG. **6**, the first upper cover **104** may include a first fixing recess **104***a* formed in an upper surface thereof, into which a fixing member **12** that fixes the first case **102** to the ceiling may be inserted. Referring to FIG. **6**, a plurality of first fixing recesses **104***a* may be formed in the upper surface of the first upper cover **104**. The fixing member **12** may be inserted into and fixed to each of the plurality of first fixing recesses **104***a*. The fixing member **12** may have a substantial "[" shape when viewed from the side. The fixing member **12** may be connected to a mounting member **14** that is fixed to the ceiling, thereby fixing the first case **102** to the ceiling.
(70) The first upper cover **104** may include two side plates **105**, which are bent and extend downwards from both side ends thereof. Each of the two side plates **105** may be connected to a respective one of the two first side covers **128**.
(71) Referring to FIG. **6**, the first lower cover **106** may be disposed below the first housing **132**. The first louver actuator **174** may be disposed on the first lower cover **106**. The first lower cover **106** may include a first horizontal plate **108**, which is disposed above the first bottom cover **130**, first vertical plate **110**, which is disposed at a rear side of the first horizontal plate **108** so as to be perpendicular thereto and in which a first inner suction hole **110***a* may be formed, and two first side walls **112**, which are bent and extend upwards from both side ends of the first horizontal plate **108**.
(72) The first louver actuator **174** may be disposed on the first horizontal plate **108**. The first horizontal plate **108** may include a connection slit **108***a* formed therein to allow a vertical protrusion **131** of the first bottom cover **130** to be inserted thereinto.
(73) Referring to FIG. **6**, each of the two first side covers **128** may be connected at a lower portion thereof to the first lower cover **106**, and connected at an upper portion thereof to the first upper cover **104**. A first rotational support rod **168** that supports rotation of the first louver **150** may be disposed on each of the two first side covers **128**. The first rotational support rod **168** may be connected to each of both ends of the first louver **150**, thereby supporting rotation of the first louver **150**.
(74) Referring to FIG. **9**, the first front cover **118** may be disposed in front of the first housing **132**. Referring to FIG. **9**, a lower end of the first front cover **118** may be spaced a predetermined gap apart from a front end portion **106***a* of the first lower cover **106**. The first outlet **102***b* may be formed between the first front cover **118** and the first lower cover **106**. A first louver protrusion **120**, in which a first louver groove **122** configured to receive a louver rotational shaft **160** is formed, may be formed on the first front cover **118** in order to limit a range within which the first louver **150** may rotate.
(75) The first louver protrusion **120** may extend lengthwise in the lateral direction, in which the first front cover **118** is formed. Referring to FIG. **14**B, the first louver protrusion **120** has the first louver groove **122** formed therein to allow the louver rotational shaft **160** of the first louver **150** to be disposed therein. The first louver groove **122** may extend lengthwise in the lateral direction, in which the first louver protrusion **120** extends.
(76) Referring to FIG. **14**A, a first support-rod recess **124** in which a first auxiliary support rod **170** may be disposed is formed between a left or first end and a right or second end of the first louver protrusion **120**. The first auxiliary support rod **170** may be fixedly disposed on the first front cover **118**, and may support rotation of the first louver **150**. The first auxiliary support rod **170** may be disposed between two first rotational support rods **168**, which will be described hereinafter. The first auxiliary support rod **170** may be connected to the first louver **150** via a first auxiliary rotational shaft **172**.
(77) Referring to FIG. **14**B, the first louver protrusion **120** may include an upper protruding portion

120*a*, which forms a surface that is inclined from an upper end of the first louver groove **122** in a rearward-upward direction, and a lower protruding portion **120***b*, which forms a surface that is inclined from a lower end of the first louver groove **122** in a forward-downward direction.
(78) When the upper surface of the louver rotational shaft **160** of the first louver **150**, which will be described hereinafter, comes into contact with the upper protruding portion **120***a*, rotation of the first louver **150** in one direction is limited by the upper protruding portion **120***a*. When an axial vane **158** of the first louver **150**, which will be described hereinafter, comes into contact with the lower protruding portion **120***b*, rotation of the first louver **150** in the opposite direction is limited by the lower protruding portion **120***b*.
(79) Referring to FIG. **14**B, a first stepped portion or step **126**, which interferes with an end portion of a first upper housing **134** described hereinafter, may be formed in the first front cover **118**.
(80) Referring to FIG. **9**, the first housing **132** may be disposed inside of the first case **102**, and form therein a space through which air flows. The first fan **182** and the heat exchanger **186** may be disposed inside of the first housing **132**. Referring to FIG. **9**, the heat exchanger **186** may be disposed in a region adjacent to the first inlet **102***a*. The heat exchanger **186** may be disposed so as to be inclined toward the first fan **182** to thereby increase a heat-exchange area and minimize resistance to air flow.
(81) The first fan motor **184** that rotates the first fan **182** may be disposed inside of the first housing **132**. The first fan motor **184** may be disposed on a rotational shaft of the first fan **182** in order to rotate the first fan **182**. The first fan **182** may be implemented as, for example, a cross-flow fan, which is configured to suction air into one side thereof in a radial direction and to discharge air from another side thereof in the radial direction. Referring to FIG. **6**, a fan support bracket **146** may be disposed inside of the first housing **132** in order to support rotation of the first fan **182** or to support placement of the first fan motor **184**.
(82) Referring to FIG. **6**, the first housing **132** may include first upper housing **134**, which is disposed above the first fan **182**, and a first lower housing **138**, which is disposed below the first fan **182**. Referring to FIG. **9**, the first upper housing **134** and the first lower housing **138** may form discharge guides **136** and **144**, along which air flows from the first fan **182** to the first outlet **102***b*.
(83) The first upper housing **134** may be mounted to the first upper cover **104**. A lower end of the first upper housing **134** may be disposed at an upper side of the first stepped portion **126** of the first front cover **118**. Referring to FIG. **9**, the first upper housing **134** may include upper guide **136**, along which air flowing out of the first fan **182** moves to the first outlet **102***b*. The upper guide **136** induces air flowing along the first fan **182** to move downwards. The upper guide **136** induces air flowing out of the first fan **182** to move toward the first front cover **118**.
(84) The first lower housing **138** may be disposed above the first lower cover **106**. Referring to FIG. **9**, the first lower housing **138** may include a drain pan **140**, which is disposed below the heat exchanger **186** in order to collect therein condensation dropping from the heat exchanger **186**. The drain pan **140** may be disposed below the heat exchanger **186** in a region in which the heat exchanger **186** is disposed.
(85) Referring to FIG. **10**, the first lower housing **138** may include a drive device cover **142**, which is disposed in front of the drain pan **140** and which protrudes upwards from the first lower cover **106**. The drive device cover **142** forms a space thereunder in which the first louver actuator **174** may be disposed. The drive device cover **142** may protrude at an incline further upwards from a region in which the drain pan **140** is disposed to a region in which the first fan **182** is disposed. The drive device cover **142** may induce air passing through the heat exchanger **186** to flow to the region in which the first fan **182** is disposed.
(86) The drive device cover **142** may include lower guide **144** that induces air passing through the first fan **182** to flow to the first outlet **102***b*. The lower guide **144** may be spaced apart from the upper guide **136** so as to form a discharge flow path **132***a*. The lower guide **144** may include a first gear hole **142***a* formed in a portion thereof corresponding to a region in which the first louver gear

176 of the first louver actuator **174** is disposed. Referring to FIG. **9**, a portion of the first louver gear **176** may protrude outside of the first gear hole **142***a* and may be in contact with the first louver **150**.

(87) Referring to FIG. **6**, the first air-processing apparatus **100** may include first louver **150**, which is rotatably disposed in the first outlet **102***b* in order to adjust the direction of air blown out through the first outlet **102***b*, and first louver actuator **174** that adjusts the orientation of the first louver **150**. Referring to FIG. **17**, the first louver **150** may include a plurality of vanes **154**, **156**, and **158**, which are spaced apart from each other in the radial direction based on the rotational shaft. Referring to FIG. **17**, the first louver **150** may include louver rotational shaft **160**, which extends along a rotational center of the first louver **150**, outer vane **154**, which is spaced outwards apart from the louver rotational shaft **160** in the radial direction, a plurality of inner vanes **156**, which are spaced apart from each other in the radial direction between the louver rotational shaft **160** and the outer vane **154**, and a vane gear **166**, which is formed on an outer surface of the outer vane **154** in a circumferential direction.

(88) The plurality of vanes **154**, **156**, and **158** may include the outer vane **154** and the plurality of inner vanes **156**. Referring to FIG. **14**B, the louver rotational shaft **160** may be disposed so as to be in contact with the first front cover **118**. The louver rotational shaft **160** may be disposed in the first louver groove **122** in the first front cover **118**. When the louver rotational shaft **160** rotates, the orientation of the plurality of vanes **154**, **156**, and **158**, which are spaced apart from each other in the radial direction based on the louver rotational shaft **160**, may be changed.

(89) The louver rotational shaft **160** may include axial vane **158**, which extends from the louver rotational shaft **160** in a direction parallel to the inner vanes **156**. The axial vane **158** may extend in a direction parallel to lower portions of the inner vanes **156**.

(90) Referring to FIG. **17**, the outer vane **154** may be disposed farther from the louver rotational shaft **160** than the inner vanes **156**. The outer vane **154** may be longer than the inner vanes **156** in the circumferential direction. Referring to FIG. **16**, the outer vane **154** may be formed in the circumferential direction based on the louver rotational shaft **160**.

(91) Referring to FIG. **17**, the inner vanes **156** may be disposed between the louver rotational shaft **160** and the outer vane **154** so as to be spaced apart from each other. The inner vanes **156** may be shorter than the outer vane **154**. The inner vanes **156** may be longer than the axial vane **158**.

(92) Referring to FIG. **17**, the inner vanes **156** have different lengths, respectively. The lengths of the inner vanes **156** gradually increase in a direction approaching the louver rotational shaft **160**. The lengths of the inner vanes **156** gradually decrease in a direction approaching the outer vane **154**.

(93) Referring to FIG. **17**, the inner vanes **156** may include lower inner vane portions **156***a***1**, **156***b***1**, and **156***c***1**, which are inclined so as to be gradually closer to the louver rotational shaft **160** in the downward direction, and upper inner vane portions **156***a***2**, **156***b***2**, and **156***c***2**, which are bent and extend upwards from upper ends of the lower inner vane portions **156***a***1**, **156***b***1**, and **156***c***1**. The axial vane **158** extends in a direction parallel to the lower inner vane portions **156***a***1**, **156***b***1**, and **156***c***1**.

(94) The inner vanes **156** include first inner vane **156***a*, which is disposed closest to the louver rotational shaft **160**, a second inner vane **156***b*, which is disposed farther from the louver rotational shaft **160** than the first inner vane **156***a*, and a third inner vane **156***c*, which is disposed farther from the louver rotational shaft **160** than the second inner vane **156***b*.

(95) Referring to FIG. **12**, the first louver **150** may include end panels **162**, which are disposed at both ends of the vanes **154**, **156**, and **158** in a direction perpendicular to the vanes **154**, **156**, and **158**, and a support panel **164**, which is disposed between the end panels **162**. The vane gear **166** may be disposed on one side of the support panel **164**. The end panels **162**, which may be disposed at both ends of the vanes **154**, **156**, and **158**, may prevent the air flowing through the first louver **150** from being discharged in the lateral direction.

(96) The support panel **164**, which is disposed between the end panels **162**, may support the vanes **154**, **156**, and **158**. The vanes **154**, **156**, and **158** may extend lengthwise in a longitudinal direction, in which the louver rotational shaft **160** is formed. Accordingly, the support panel **164** may stably maintain the arrangement of the vanes **154**, **156**, and **158**.
(97) Referring to FIG. **14**A, the support panel **164** may be formed in a fan shape. The vane gear **166** may be disposed on an outer circumferential end of the support panel **164**. The vane gear **166** may form threads on the outer circumferential end of the support panel **164** in the circumferential direction.
(98) Referring to FIG. **14**A, the support panel **164** may be connected to the first auxiliary support rod **170**. The support panel **164** may form a space in which the first auxiliary support rod **170** is disposed in the portion in which the louver rotational shaft **160** is formed. The first auxiliary rotational shaft **172** may be disposed inside of the first auxiliary support rod **170**, and the first auxiliary support rod **170** may be connected to the louver rotational shaft **160** via the first auxiliary rotational shaft **172**.
(99) The vanes **154**, **156**, and **158** may protrude downwards further than the end panels **162** and the support panel **164**.
(100) The first louver actuator **174** may be spaced apart from the louver rotational shaft **160** of the first louver **150** in a centrifugal direction. The first louver actuator **174** may be spaced apart from the louver rotational shaft **160**, and be disposed so as to be in contact with an outer circumferential surface of the first louver **150**.
(101) Referring to FIG. **6**, the first louver actuator **174** may include a first louver gear **176**, which is in contact with the first louver **150** in order to rotate the first louver **150**, and a first louver motor **178** that rotates the first louver gear **176**. According to this embodiment, two first louver gears **176** are provided so as to be spaced apart from each other, and the first louver actuator **174** further includes a first gear rotational shaft **180** that interconnects the two first louver gears **176**. The two first louver gears **176**, which are connected to each other via the first gear rotational shaft **180**, may rotate in the same direction.
(102) Referring to FIGS. **18**A to **18**C, the first louver **150** may be switched to a first mode P**1** for forming an oblique air current in the forward direction, a second mode P**2** for forming a horizontal air current in the forward direction, and a third mode P**3** for forming a vertical air current toward the floor. Referring to FIG. **18**A, the first louver **150** may be disposed above the first bottom cover **130** in the first mode P**1**. In the first mode P**1**, the lower end of each of the vanes **154**, **156**, and **158** of the first louver **150** may be disposed above the first bottom cover **130** in the vertical direction.
(103) In the first mode P**1**, the lower end of the outer vane **154** may be oriented in a direction perpendicular to the floor. In the first mode P**1**, the lower end of each of the inner vanes **156***a*, **156***b*, and **156***c* may be inclined in the forward direction.
(104) Referring to FIG. **18**B, a portion of the first louver **150** may be disposed below the first bottom cover **130** in the second mode P**2**. In the second mode P**2**, the lower end of the outer vane **154** and the lower end of each of the inner vanes **156***a*, **156***b*, and **156***c* may be disposed below the first bottom cover **130** in the vertical direction.
(105) In the second mode P**2**, an inclination angle **82** formed by the lower inner vane portion **156***a***1**, **156***b***1**, **156***c***1** of each of the inner vanes **156***a*, **156***b*, and **156***c* and the floor may be set to 30 degrees or less. Accordingly, in the second mode P**2**, the air flowing through the first louver **150** may be discharged in a direction substantially parallel to the floor.
(106) Referring to FIG. **18**C, the first louver **150** may be disposed above the first bottom cover **130** in the third mode P**3**. In the third mode P**3**, the lower end of the outer vane **154** and the lower end of each of the inner vanes **156***a*, **156***b*, and **156***c* may be disposed above the first bottom cover **130** in the vertical direction.
(107) In the third mode P**3**, an inclination angle **83** formed by the lower inner vane portion **156***a***1**, **156***b***1**, **156***c***1** of each of the inner vanes **156***a*, **156***b*, and **156***c* and the floor may be set to a range

from 60 degrees to 90 degrees. Accordingly, in the third mode P**3**, the air flowing through the first louver **150** may be discharged in a direction substantially perpendicular to the floor.

(108) Hereinafter, a second air-processing apparatus according to an embodiment will be described with reference to FIGS. **19** to **35**C.

(109) The second air-processing apparatus **200** induces air to flow through a filter device **284** and discharges the air to the outside. The second air-processing apparatus **200** may include a second inlet **202***a* formed in one or a first side thereof in order to suction air thereinto and a second outlet **202***b* formed in another or a second side thereof perpendicular to the second inlet **202***a* in order to discharge air therefrom. Referring to FIG. **19**, the second inlet **202***a* may be formed so as to extend perpendicular to a surface of a floor or ceiling. The second outlet **202***b* may be formed so as to be open downwards. The second outlet **202***b* may extend perpendicular to the second inlet **202***a*.

(110) Referring to FIG. **20**, the second air-processing apparatus **200** may include a second fan **280**, which causes air to flow, and a second fan motor **280***a*, which rotates the second fan **280**. According to this embodiment, a plurality of second fans **280** may be provided, and a plurality of second fan motors **280***a* may be provided such that each of the second fan motors **280***a* is connected to a respective one of the plurality of second fans **280**.

(111) The second air-processing apparatus **200** may include a second case **202**, which forms an external appearance of the second air-processing apparatus **200**, and a second housing **268**, which is disposed inside of the second case **202** and which forms a flow path through which air flows. The second air-processing apparatus **200** may further include a second louver **290**, which is rotatably disposed in the second case **202** in order to adjust a direction of air that is discharged from the second outlet **202***b*, and a second louver actuator **294**, which changes an orientation of the second louver **290**.

(112) The second louver **290** and the second louver actuator **294** disposed in the second air-processing apparatus **200** may have the same structures and perform the same functions as the first louver **150** and the first louver actuator **174** of the first air-processing apparatus **100** described above with reference to FIGS. **12** to **17**. Therefore, the description of the first louver **150** and the first louver actuator **174** of the first air-processing apparatus **100** may apply to the second louver **290** and the second louver actuator **294** disposed in the second air-processing apparatus **200**.

(113) The second air-processing apparatus **200** may include a second control box **291** that controls operation of the second fan motor **280***a* or operation of the second louver actuator **294**.

(114) Referring to FIG. **20**, the second case **202** may include a second upper cover **204**, which may be secured to a ceiling, a second lower cover **206**, which is disposed below the second upper cover **204**, second rear cover **242**, which forms therein the second inlet **202***a* and to which the filter device **284** is mounted, a second front cover **246**, which is disposed so as to be spaced forwards apart from the second rear cover **242**, and two second side covers **256**, which are disposed at both side ends of the second lower cover **206**. The second case **202** may further include a second bottom cover **258**, which is disposed below the second lower cover **206** so as to be movable in the forward-rearward direction.

(115) Referring to FIG. **20**, the second inlet **202***a* may be formed in the second rear cover **242**. The guide rail **10** (refer to FIG. **3**) may be mounted on an outer surface of the second rear cover **242**. The second inlet **202***a*, in which the filter device **284** is mounted, may be formed in a lower portion of the second rear cover **242**. The guide rail **10** and the second support rail **244** that guides movement of the filter cleaner **300** may be mounted on the second rear cover **242**.

(116) The guide rail **10** may be disposed above the second inlet **202***a*. Referring to FIG. **24**, the second support rail **244** may be disposed at an upper end of the second rear cover **242**.

(117) The second support rail **244** may include a second top plate **244***a*, which protrudes rearwards from an upper end of the second rear cover **242**, and a second bent portion **244***b*, which is bent and extends downwards from a rear end of the second top plate **244***a*. The top roller **326** of the filter cleaner **300** may be in contact with the second bent portion **244***b*.

(118) The second rear cover **242** may be disposed behind a second vertical plate **214** of the second lower cover **206**, which will be described hereinafter. The second rear cover **242** may be fixedly disposed behind the second vertical plate **214**.
(119) A filter-mounting part or portion or filter mount **234** (refer to FIG. **31**) that moves the filter device **284** in the upward-downward direction may be disposed in the second inlet **202***a* in the second rear cover **242**. The filter-mounting portion **234** may be moved in the upward-downward direction by a filter-drive device **228**, which will be described hereinafter.
(120) Referring to FIG. **20**, the second upper cover **204** may include a second fixing recess **204***a* formed in an upper surface thereof, into which fixing member **12** that fixes the second case **202** to the ceiling may be inserted. The second fixing recess **204***a* formed in the second upper cover **204** may have a same shape as the first fixing recess **104***a* formed in the first upper cover **104**. Accordingly, the second upper cover **204** may be fixed to mounting member **14** mounted to the ceiling by the fixing member **12** disposed at an upper side of the first upper cover **104**.
(121) Referring to FIG. **20**, the second upper cover **204** may include two side plates **266***d*, which are bent and extend downwards from both side ends thereof. Each of the two side plates **266***d* may be connected to a respective one of the two second side covers **256**.
(122) Referring to FIG. **23**, the second lower cover **206** may be disposed below the second housing **268**. The second louver actuator **294** may be disposed on the second lower cover **206**. A cover-drive device **220** that moves the second bottom cover **258** in the forward-rearward direction may be disposed on the second lower cover **206**. The filter-drive device **228** that moves the filter device **284** and the filter-mount **234** in the upward-downward direction may be disposed on the second lower cover **206**.
(123) The second lower cover **206** may include a second horizontal plate **208**, which is disposed above the second bottom cover **258**, a second vertical plate **214**, which is disposed at a rear side of the second horizontal plate **208** so as to be perpendicular thereto and in which a second inner suction hole **214***a* is formed, and two second side walls **216**, which are bent and extend upwards from both side ends of the second horizontal plate **208**.
(124) Referring to FIG. **33**A, the second louver actuator **294** is disposed on the second horizontal plate **208**. The cover-drive device **220** is disposed above the second horizontal plate **208**. The second horizontal plate **208** has guide grooves **208***a* formed therein to allow cover guides **262** and **264** of the second bottom cover **258** to be inserted thereinto.
(125) Referring to FIGS. **31** and **33**A, the cover-drive device **220** may include a cover-drive gear **222**, which meshes with a guide gear **262***c* of the first cover guide **262**, which will be described hereinafter, so as to rotate together therewith, and a cover-drive motor **224** that rotates the cover-drive gear **222**.
(126) According to this embodiment, two cover-drive gears **222** may be provided so as to be spaced apart from each other in the lateral direction. The cover-drive device **220** may include a cover-drive shaft **226** that interconnects the two cover-drive gears **222** spaced apart from each other. Accordingly, the two cover-drive gears **222** connected to both ends of the cover-drive shaft **226** may rotate identically.
(127) Referring to FIG. **33**A, the second horizontal plate **208** may be provided with fixing guides **210**, which may be connected to the cover guides **262** and **264** of the second bottom cover **258** in order to prevent the second bottom cover **258** from moving in the upward-downward direction. The fixing guides **210** may protrude upwards from the second horizontal plate **208**, and extend in the forward-rearward direction.
(128) Referring to FIG. **33**A, the fixing guides **210** may be disposed so as to be in contact with the first cover guide **262** or the second cover guide **264**, which will be described hereinafter. The fixing guides **210** support movement of the second bottom cover **258** in the forward-rearward direction. The fixing guides **210** may also prevent the second bottom cover **258** from moving in the upward-downward direction.

(129) Referring to FIG. **23**, the fixing guides **210** may have fixing protrusions **212**, which protrude toward the cover guides **262** and **264**. The fixing protrusions **212** extend in the forward-rearward direction. The fixing protrusions **212** may be disposed so as to be in contact with a first guide protrusion **262***b* of the first cover guide **262** or a second guide protrusion **264***b* of the second cover guide **264**.
(130) The fixing protrusions **212** have a structure corresponding to the first guide protrusion **262***b* of the first cover guide **262** or the second guide protrusion **264***b* of the second cover guide **264**, thereby preventing the second bottom cover **258** from moving in the upward-downward direction.
(131) Referring to FIG. **20**, the second vertical plate **214** may have a second inner suction hole **214***a* formed therein. The second inner suction hole **214***a* may have a size corresponding to the second inlet **202***a*. The filter-drive device **228** may be disposed on the second vertical plate **214**.
(132) Each of the two second side covers **256** may be connected at a lower portion thereof to the second lower cover **206**, and be connected at an upper portion thereof to the second upper cover **204**. A second rotational support rod **292** that supports rotation of the second louver **290** may be disposed on each of the two second side covers **256**. The second rotational support rod **292**, which is connected to each of the second side covers **256**, may have a same shape as the first rotational support rod **168** connected to each of the first side covers **128**.
(133) The second front cover **246** may be disposed in front of the second housing **268**. The second front cover **246** may have a same shape as the first front cover **118**. Also, the second front cover **246** may be disposed in the same manner as the first front cover **118**. Therefore, a lower end of the second front cover **246** may be spaced a predetermined gap apart from a front end portion of the second lower cover **206**, thereby forming the second outlet **202***b*.
(134) In addition, a second louver protrusion **248**, in which a second louver groove **250** that receives a second louver rotational shaft **270***a* of the second louver **290** may be formed, may be formed on the second front cover **246** in order to limit a range within which the second louver **290** may rotate. A second support-rod recess **252**, in which a second auxiliary support rod **293** may be disposed, may be formed between a left or first lateral end and a right or second lateral end of the second louver protrusion **248**.
(135) Referring to FIG. **24**, a second stepped portion or step **254**, which interferes with an end portion of a second upper housing **270** described hereinafter, may be formed in the second front cover **246**.
(136) The second bottom cover **258** may be disposed at the second lower cover **206** so as to be movable in the forward-rearward direction. Referring to FIG. **33**B, when the second bottom cover **258** is disposed at a rear position adjacent to the second rear cover **242**, the second bottom cover **258** may cover a lower side of the filter device **284**. Referring to FIG. **34**B, when the second bottom cover **258** is disposed at a front position adjacent to the second front cover **246**, the second bottom cover **258** may block the second outlet **202***b*. Referring to FIG. **34**B, when the second bottom cover **258** is disposed at a front position adjacent to the second front cover **246**, the second bottom cover **258** may open the lower side of the filter device **284**.
(137) Referring to FIG. **20**, the second bottom cover **258** may include a bottom plate **260**, which may be disposed below the second lower cover **206**, and cover guides **262** and **264**, which protrude upwards from the bottom plate **260** and which move the bottom plate **260** in the forward-rearward direction. Referring to FIG. **23**, the cover guides **262** and **264** may include first cover guide **262**, which may be connected to the cover-drive device **220** to move the bottom plate **260**, and a second cover guide **264**, which prevents the bottom plate **260** from vibrating in the upward-downward direction.
(138) Referring to FIG. **23**, the first cover guide **262** may include a first guide wall **262***a*, which protrudes upwards from the bottom plate **260** and extends in the forward-rearward direction, a guide gear **262***c*, which is disposed on one or a first side of the first guide wall **262***a* and is screwed to the cover-drive device **220**, and a first guide protrusion **262***b*, which is disposed on the opposite

or a second side of the first guide wall **262***a* and guides movement of the second bottom cover **258** in the forward-rearward direction. A recess **262***b***1**, into which the fixing protrusion **212** may be inserted, may be formed in the first guide protrusion **262***b*.

(139) Referring to FIG. **23**, the second cover guide **264** may include a second guide wall **264***a*, which protrudes upwards from the bottom plate **260** and extends in the forward-rearward direction, and a second guide protrusion **264***b*, which is disposed on one side of the second guide wall **264***a* and guides movement of the second bottom cover **258** in the forward-rearward direction. A recess **264***b***1**, into which the fixing protrusion **212** may be inserted, may be formed in the second guide protrusion **264***b*.

(140) Referring to FIG. **20**, the second air-processing apparatus **200** may include an inner cover **266**, which may be disposed above the second lower cover **206** and cover upper sides of the second louver actuator **294** and the cover-drive device **220**. Referring to FIG. **24**, the inner cover **266** may guide a flow of air flowing inside of the second case **202**, and may prevent the air from flowing to the second louver actuator **294**. The inner cover **266** may be coupled to the second lower cover **206** to form a space in which the second louver actuator **294** and the cover-drive device **220** are disposed.

(141) Referring to FIGS. **25**A and **25**B, the inner cover **266** may include an upper plate **266***a*, which may be disposed above the second louver actuator **294**, a front plate **266***b*, which covers a front side of the second louver actuator **294**, a rear plate **266***c*, which covers a rear side of the second louver actuator **294**, and side plates **266***d*, which cover the lateral sides of the second louver actuator **294**.

(142) The rear plate **266***c* may prevent the air flowing through the filter device **284** from flowing to the space under the inner cover **266**. The upper plate **266***a* may guide the air flowing through the filter device **284** to the space in which the second fan **280** is disposed. The front plate **266***b* may guide the air flowing through the second fan **280** toward the second outlet **202***b*. The front plate **266***b* may have a second gear hole **266***b***1** formed in a region in which a second louver gear **294***a* of the second louver actuator **294** is disposed. A portion of the second louver gear **294***a* may protrude outside of the second gear hole **266***b***1** (refer to FIG. **25**A), and may be in contact with the second louver **290**.

(143) Referring to FIG. **25**B, the inner cover **266** may include a plurality of partition walls **266***e*, which vertically extend downwards from the upper plate **266***a*. The plurality of partition walls **266***e* may be spaced apart from each other in the lateral direction, and may increase a rigidity of the inner cover **266**.

(144) Referring to FIG. **24**, the second housing **268** may be disposed inside of the second case **202** to form a space in which air flows. A second fan **280** and a second fan motor **280***a* that rotates the second fan **280** may be disposed inside of the second housing **268**.

(145) The second fan **280** may be implemented as, for example, a centrifugal fan, which suctions air in a direction parallel to a rotational axis and discharges air in a centrifugal direction. Accordingly, referring to FIG. **24**, the second fan motor **280***a* may be disposed inside of the second fan **280** to rotate the second fan **280**.

(146) The second fan motor **280***a* may be fixed to second upper housing **270**, which will be described hereinafter. Referring to FIG. **24**, the second housing **268** may include a second upper housing **270**, which is disposed above the second fan **280**, and a second lower housing **274**, which is disposed below the second fan **280**.

(147) Referring to FIGS. **26**A and **26**B, the second upper housing **270** may be mounted to the second upper cover **204**. A lower end of the second upper housing **270** may be disposed on the second stepped portion **254** of the second front cover **246**. The second upper housing **270** may include a front guide **272** that guides the air flowing through the second fan **280** to the second outlet **202***b*. The front guide **272** may extend downwards from a front end of the second upper housing **270**.

(148) Referring to FIG. **24**, the front guide **272** causes the air flowing along the second fan **280** to flow downwards. The front guide **272** guides the air flowing through the second fan **280** to the second outlet **202***b*.
(149) The front guide **272** may be disposed so as to be smoothly connected to the second front cover **246**. Accordingly, the air flowing along the front guide **272** may flow to the second outlet **202***b* via the second front cover **246**.
(150) Referring to FIG. **24**, the second fan motor **280***a* may be mounted in the second upper housing **270**. Referring to FIG. **24**, the second lower housing **274** may be disposed above the inner cover **266**. Referring to FIG. **27**, the second lower housing **274** may include a plurality of fan housings **276** that forms spaces in which a plurality of second fans **280** may be disposed. Each of the fan housings **276** may be spaced apart from an outer circumferential surface of the second fan **280** in the radial direction. Each of the fan housings **276** may have an open front portion. Accordingly, the air flowing in the radial direction of the second fan **280** may be discharged to the open front portion of each of the fan housings **276**. A fan inlet **276***a*, through which air is introduced into the second fan **280**, may be formed below each of the fan housings **276**.
(151) The second lower housing **274** may be spaced upwards apart from the inner cover **266**. Accordingly, a suction flow path **268***a*, through which the air passing through the filter device **284** flows, may be formed between the second lower housing **274** and the inner cover **266**.
(152) The second lower housing **274** may be spaced rearwards apart from the front guide **272** of the second upper housing **270**. The second lower housing **274** may include a rear guide **278**, which may be spaced apart from the front guide **272** and extends downwards. The second lower housing **274** may be spaced upwards apart from the inner cover **266** by the rear guide **278**. The rear guide **278** forms a second discharge flow path **268***b* in the upward-downward direction together with the front guide **272**. The front guide **272** and the rear guide **278** may guide the air flowing from the second fan **180** to the second outlet **202***b*.
(153) The filter device **284** may be mounted to the filter-mount **234**. The filter-mount **234** may be movably disposed in the second case **202**. The filter device **284** and the filter-mount **234** may be coupled to each other by means of a first magnet **287** disposed in the filter device **284** and a second magnet **238** disposed in the filter-mount **234**. Accordingly, a position of the filter device **284** may be changed in the upward-downward direction according to movement of the filter-mount **234**. Also, a user may easily separate the filter device **284** from the filter-mount **234**.
(154) Referring to FIGS. **28** and **29**, the filter-mount **234** may include a mounting body **236**, to which the filter device **284** may be mounted, and a body gear **240** that adjusts a position of the mounting body **236**.
(155) Referring to FIGS. **28** and **29**, the mounting body **236** may include an upper body **236***a*, which is disposed above the filter device **284**, side bodies **236***b*, which extend downwards from both ends of the upper body **236***a*, a front body **236***c*, which extends downwards from the front end of the upper body **236***a*, and a rear body **236***d*, which extends downwards from the rear end of the upper body **236***a*. The side bodies **236***b* may extend downwards to be longer than the front body **236***c* or the rear body **236***d*. Two side bodies **236** may be provided at respective ends of the upper body **236***a*. A partition body **236***e* that isolates a plurality of filter devices **284** from each other may be disposed between the two side bodies **236***b*. A length that the front body **236***c* extends downwards from the upper body **236***a* may be longer than a length that the rear body **236***d* extends downwards from the upper body **236***a*. The front body **236***c*, the rear body **236***d*, and the side bodies **236***b* may guide mounting of the filter device **284** to the filter-mount **234**.
(156) A body gear **240** may be disposed outside of the side body **236***b*. The body gear **240** may be a rack gear in which threads protruding forwards extend in the upward-downward direction.
(157) A plurality of second magnets **238** may be disposed above the upper body **236***a*.
(158) Referring to FIG. **30**, the filter device **284** may include a filter case **286**, which supports a second pre-filter **288** disposed in one side thereof and has an open opposite side, and a HEPA filter

289, which is disposed so as to be inserted into or withdrawn out of the filter case **286** and functions to remove fine dust. The filter case **286** may have a size capable of accommodating the HEPA filter **289**. The second pre-filter **288** that primarily removes foreign substances from the air introduced into the second inlet **202***a* may be disposed in one side of the filter case **286**. The filter case **286** may have an opening **286***a* formed in a surface thereof opposite the second pre-filter **288**. The HEPA filter **289** may be inserted into or withdrawn out of the filter case **286** through the opening **286***a*.

(159) The first magnet **287** may be disposed on an upper wall of the filter case **286**. The first magnet **287** may be disposed at a position corresponding to the second magnet **238** when the filter device **284** is mounted to the filter-mount **234**.

(160) Referring to FIG. **33**A, the filter-drive device **228** may be disposed on the second lower cover **206**, and move the filter-mount **234** in the upward-downward direction. The filter-drive device **228** may be disposed on the second vertical plate **214**. The filter-drive device **228** may be disposed at each of both side ends of the second vertical plate **214**.

(161) Referring to FIGS. **32** and **33**A, the filter-drive device **228** may include a filter-drive gear **230**, which meshes with the body gear **240** and rotates together therewith, and a filter-drive motor **232**, which rotates the filter-drive gear **230**. The filter-drive gear **230** may be implemented as, for example, a spur gear. The filter-drive gear **230** and the filter-drive motor **232** may be fixedly disposed on the second vertical plate **214**.

(162) The second air-processing apparatus **200** may include second louver **250**, which is rotatably disposed in the second outlet **202***b* in order to adjust a direction of air that is discharged from the second outlet **202***b*, and a second louver actuator **294**, which adjusts an orientation of the second louver **290**.

(163) The second louver **290** and the second louver actuator **294** may have the same structures and perform the same functions as the first louver **150** and the first louver actuator **174** of the first air-processing apparatus **100** described above. Therefore, the description of the first louver **150** and the first louver actuator **174** of the first air-processing apparatus **100** may apply to the second louver **290** and the second louver actuator **294**.

(164) Hereinafter, movement of the second bottom cover **258**, the filter-mount **234**, and the filter device **284** will be described with reference to FIGS. **33**A to **35**C.

(165) Referring to FIGS. **33**A and **33**B, the second bottom cover **258** is disposed below the filter device **284**. Accordingly, a lower side of the second louver **270** may be opened, and thus, the orientation of the second louver **270** may be changed. The filter device **284** and the filter-mount **234** that moves the filter device **284** are disposed above the second bottom cover **258**.

(166) Referring to FIGS. **34**A and **34**B, the second bottom cover **258** may be moved forwards, and may be disposed below the second outlet **202***b*. The second bottom cover **258** may be moved forwards by the operation of the cover-drive device **220**.

(167) Referring to FIG. **34**B, when the second bottom cover **258** is moved forwards, a region below the filter device **284** is opened. Referring to FIG. **34**B, when the second bottom cover **258** is moved forwards, a lower side of the second outlet **202***b* is blocked. Accordingly, rotation of the second louver **270** is restricted.

(168) Referring to FIGS. **35**A to **35**C, in a state in which the second bottom cover **258** is moved forwards, the filter device **284** and the filter-mount **234** may be moved downwards. The filter-mount **234** may be moved downwards by the filter-drive device **228**.

(169) The coupled state of the filter-mount **234** and the filter device **284** may be maintained by the first magnet **287** and the second magnet **238**. Accordingly, when the filter-mount **234** is moved downwards, the filter device **284** is also moved downwards. When the filter device **284** is moved downwards by the filter-mount **234**, a user may easily separate the filter device **284** from the filter-mount **234**.

(170) As is apparent from the above description, the air-conditioning system according to

embodiments disclosed herein has one or more of the following advantages.
(171) First, as an air-processing apparatus for discharging heat-exchanged air and an air-processing apparatus for discharging purified air are arranged in series in the lateral direction, it is possible to simultaneously perform air purification and temperature control in an indoor space.
(172) Second, as the first air-processing apparatus and the second air-processing apparatus are arranged in the lateral direction and louvers disposed in outlets of the first and second air-processing apparatuses are individually operated, it is possible to individually adjust directions of air discharged therefrom in consideration of the temperature of air that is discharged, thereby promoting air circulation in an indoor space.
(173) Third, as the louver actuator that drives the louver is disposed outside in the radial direction of the rotational shaft of the louver, a size of the louver may increase in the lateral direction. Accordingly, it is possible to secure a size of the outlet in the lateral direction to a maximum extent. Accordingly, the amount of air discharged from the air-processing apparatus may be maximized, and thus, the air in the indoor space may be rapidly processed.
(174) Fourth, as the outer vane has an arc shape and is spaced apart from the louver rotational shaft, a range within which the outer vane may protrude outside of the outlet or may move inside of the outlet may increase, thereby increasing an angular range within which air is discharged.
(175) Fifth, the louver has a structure including a plurality of vanes and a support panel, and is connected to the louver actuator at the support panel. Accordingly, a rigidity of the louver may increase, and thus, the orientation of the louver may be stably changed.
(176) Sixth, the louver groove, which is formed in the case to receive therein the louver rotational shaft, includes an upper protruding portion and a lower protruding portion that limit rotation of the louver. Accordingly, the rotation of the louver may be stably limited.
(177) Embodiments disclosed herein provide an air-conditioning system capable of simultaneously supplying heat-exchanged air and purified air to an indoor space.
(178) Embodiments disclosed herein provide an air-conditioning system capable of rapidly circulating heat-exchanged air and purified air in an indoor space. Embodiments disclosed herein further provide an air-processing apparatus including a louver and a louver actuator capable of opening an outlet, which is formed in the air-processing device in a lateral direction, to a maximum extent. Embodiments disclosed herein furthermore provide an air-processing apparatus capable of increasing a range within which a direction of air is capable of being adjusted by a louver.
(179) A louver, which extends lengthwise in the lateral direction, may be relatively susceptible to distortion. Thus, embodiments disclosed herein provide an air-processing apparatus including a louver having a stable structure. Also, embodiments disclosed herein provide an air-processing apparatus capable of stably restricting movement of a louver.
(180) Advantages are not limited to the above-described advantages, and other advantages not mentioned herein may be readily understood by those skilled in the art from the following description.
(181) Embodiments disclosed herein provide an air-processing apparatus that may include a case having an outlet formed therein, a louver rotatably disposed in the case and configured to adjust a direction of air flowing through the outlet, and a louver actuator configured to adjust an orientation of the louver. The louver may include a louver rotational shaft and a plurality of vanes disposed so as to be spaced apart from each other in a radial direction based on the louver rotational shaft. The louver actuator may be disposed so as to be in contact with the vane located at an outermost position among the plurality of vanes to change the orientation of the louver. Accordingly, a size of the outlet may be secured in a lateral direction to a maximum extent.
(182) The louver rotational shaft may extend along a rotational center of the louver. The plurality of vanes may include an outer vane spaced outwards apart from the louver rotational shaft in a radial direction and a plurality of inner vanes disposed between the louver rotational shaft and the outer vane so as to be spaced apart from each other in the radial direction. The louver may be connected

at an outer circumferential surface of the outer vane to the louver actuator. The louver actuator may be disposed outside of the louver in the radial direction of the louver rotational shaft.
(183) A vane gear may be formed on the outer circumferential surface of the outer vane in a circumferential direction, and the louver actuator may be engaged with the vane gear to rotate the louver. The louver actuator may be disposed outside of the louver in the radial direction of the louver rotational shaft.
(184) The outer vane may have an arc shape that extends in the circumferential direction based on the louver rotational shaft. Accordingly, it is possible to change the orientation of the louver and to change the direction of air that is discharged.
(185) The plurality of inner vanes may be shorter than the outer vane. That is, the outer vane may be larger than the inner vanes in order to change the orientation of the louver and to adjust the direction of air.
(186) Each of the plurality of inner vanes may have a different length from the remaining ones of the plurality of inner vanes. The lengths of the plurality of inner vanes may gradually increase in a direction approaching the louver rotational shaft. That is, the lengths of the plurality of inner vanes may gradually decrease in a direction approaching the outer vane. Accordingly, it is possible to prevent a reduction in size of a flow path between the outer vane and the inner vanes. A distance between the outer vane and each of the plurality of inner vanes may gradually increase from above to below.
(187) Each of the plurality of inner vanes may include a lower inner vane portion formed to be inclined so as to be gradually closer to the louver rotational shaft in a downward direction and an upper inner vane portion formed to be bent and extend upwards from the upper end of the lower inner vane portion. This structure is determined in consideration of the direction in which the lower inner vane portion that guides air that is discharged is oriented according to a change in the orientation of the louver.
(188) The louver may include an axial vane that extends from the louver rotational shaft, and the axial vane may extend in a direction parallel to the lower inner vane portion. Accordingly, it is possible to effectively guide the direction of air that flows along the louver rotational shaft.
(189) The louver may include a pair of end panels disposed at both ends of the plurality of vanes in a direction perpendicular to the plurality of vanes and a support panel disposed between the pair of end panels and provided at one side thereof with a vane gear. The vane gear may be engaged with the louver actuator. Accordingly, the plurality of vanes may be stably disposed.
(190) The louver actuator may be spaced apart from the louver rotational shaft in a centrifugal direction, and may be disposed so as to be in contact with an outer circumferential surface of the louver. That is, the louver actuator that rotates the louver may not be disposed on the side surface of the louver, and thus, a size of the louver may increase to left and right surfaces of the outlet.
(191) The louver actuator may include a louver gear configured to be engaged with one side of the louver to rotate the louver and a louver motor configured to rotate the louver gear. The louver actuator may include a pair of louver gears arranged so as to be spaced apart from each other and engaged with one side of the louver to rotate the louver, a gear rotational shaft that interconnects the pair of louver gears, and a louver motor connected to the gear rotational shaft to rotate the gear rotational shaft. Accordingly, it is possible to easily rotate the louver, which extends lengthwise in the lateral direction.
(192) The case may include an upper cover, a lower cover disposed below the upper cover, a rear cover that forms an inlet and supports the filter device mounted thereto, and a front cover disposed so as to be spaced forwards apart from the rear cover. The louver may be rotatably disposed at a lower end of the front cover. Accordingly, it is possible to discharge air in the downward direction or the forward direction of the case.
(193) The front cover may include a louver protrusion having formed therein a louver groove in which the louver rotational shaft is disposed in order to limit a range within which the louver

rotates.
(194) The louver protrusion may include an upper protruding portion forming a surface that is inclined from the upper end of the louver groove in a rearward-upward direction and a lower protruding portion forming a surface that is inclined from the lower end of the louver groove in a forward-downward direction. Accordingly, it is possible to limit the rotation of the louver in both directions.
(195) Other advantages will be obvious from the description and the drawings.
(196) Advantages are not limited to the above-described advantages, and other advantages not mentioned herein may be clearly understood by those skilled in the art from the accompanying claims.
(197) Although embodiments have been described with reference to specific embodiments shown in the drawings, it will be apparent to those skilled in the art that the embodiments are not limited to those exemplary embodiments and may be embodied in many forms without departing from the scope, which is set forth in the following claims. These modifications should not be understood separately from the technical spirit or scope.
(198) It will be understood that when an element or layer is referred to as being “on” another element or layer, the element or layer can be directly on another element or layer or intervening elements or layers. In contrast, when an element is referred to as being “directly on” another element or layer, there are no intervening elements or layers present. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.
(199) It will be understood that, although the terms first, second, third, etc., may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.
(200) Spatially relative terms, such as “lower”, “upper” and the like, may be used herein for ease of description to describe the relationship of one element or feature to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation, in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “lower” relative to other elements or features would then be oriented “upper” relative to the other elements or features. Thus, the exemplary term “lower” can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.
(201) The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.
(202) Embodiments are described herein with reference to cross-section illustrations that are schematic illustrations of idealized embodiments (and intermediate structures). As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.
(203) Unless otherwise defined, all terms (including technical and scientific terms) used herein

have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

(204) Any reference in this specification to “one embodiment,” “an embodiment,” “example embodiment,” etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

(205) Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. An air-processing apparatus, comprising: a case having an outlet formed therein; a louver assembly rotatably disposed in the case, the louver assembly being configured to adjust a direction of air flowing through the outlet; and a louver actuator configured to adjust an orientation of the louver assembly, wherein the louver assembly comprises a louver rotational shaft and a plurality of vanes spaced apart from each other in a radial direction based on the louver rotational shaft, and wherein the louver rotational shaft extends along a rotational center of the louver assembly, wherein the plurality of vanes comprises: an outer vane spaced outwards apart from the louver rotational shaft in the radial direction; and a plurality of inner vanes disposed between the louver rotational shaft and the outer vane so as to be spaced apart from each other in the radial direction, wherein a vane gear is formed on the outer circumferential surface of the outer vane in a circumferential direction, and wherein the louver actuator is engaged with the vane gear to rotate the louver assembly.

2. The air-processing apparatus according to claim 1, wherein the louver assembly is connected at an outer circumferential surface of the outer vane to the louver actuator.

3. The air-processing apparatus according to claim 2, wherein the outer vane has an arc shape that extends in a circumferential direction based on the louver rotational shaft.

4. The air-processing apparatus according to claim 2, wherein the plurality of inner vanes is shorter than the outer vane.

5. The air-processing apparatus according to claim 2, wherein each of the plurality of inner vanes has a different length from remaining ones of the plurality of inner vanes.

6. The air-processing apparatus according to claim 2, wherein lengths of the plurality of inner vanes gradually increase in a direction approaching the louver rotational shaft.

7. The air-processing apparatus according to claim 2, wherein a distance between the outer vane and each of the plurality of inner vanes gradually increases in a downward direction.

8. The air-processing apparatus according to claim 2, wherein each of the plurality of inner vanes comprises: a lower inner vane portion inclined so as to be gradually closer to the louver rotational

shaft in a downward direction; and an upper inner vane portion bent and extending upwards from an upper end of the lower inner vane portion.

9. The air-processing apparatus according to claim 2, wherein the louver assembly comprises an axial vane that extends from the louver rotational shaft, and wherein the axial vane extends in a direction parallel to the lower inner vane portion.

10. The air-processing apparatus according to claim 1, wherein the louver assembly comprises: a pair of end panels disposed at both ends of the plurality of vanes in a direction perpendicular to the plurality of vanes; and a support panel disposed between the pair of end panels, the support panel being provided at one side thereof with a vane gear, and wherein the vane gear is engaged with the louver actuator.

11. The air-processing apparatus according to claim 1, wherein the louver actuator is spaced apart from the louver rotational shaft in a centrifugal direction, and is disposed so as to be in contact with an outer circumferential surface of the louver assembly.

12. The air-processing apparatus according to claim 1, wherein the louver actuator comprises: a louver gear configured to be engaged with one side of the louver assembly to rotate the louver assembly; and a louver motor configured to rotate the louver gear.

13. The air-processing apparatus according to claim 1, wherein the louver actuator comprises: a pair of louver gears spaced apart from each other, the pair of louver gears being engaged with one side of the louver assembly to rotate the louver assembly; a gear rotational shaft that interconnects the pair of louver gears; and a louver motor connected to the gear rotational shaft to rotate the gear rotational shaft.

14. The air-processing apparatus according to claim 1, wherein the case comprises: an upper cover; a lower cover disposed below the upper cover; a rear cover that forms an inlet, the rear cover supporting a filter device mounted thereto; and a front cover spaced forwards apart from the rear cover, and wherein the louver assembly is rotatably disposed at a lower end of the front cover.

15. The air-processing apparatus according to claim 14, wherein the front cover includes a louver protrusion having formed therein a louver groove in which the louver rotational shaft is disposed in order to limit a range within which the louver assembly rotates.

16. The air-processing apparatus according to claim 15, wherein the louver protrusion comprises: an upper protruding portion forming a surface that is inclined from an upper end of the louver groove in a rearward-upward direction; and a lower protruding portion forming a surface that is inclined from a lower end of the louver groove in a forward-downward direction.