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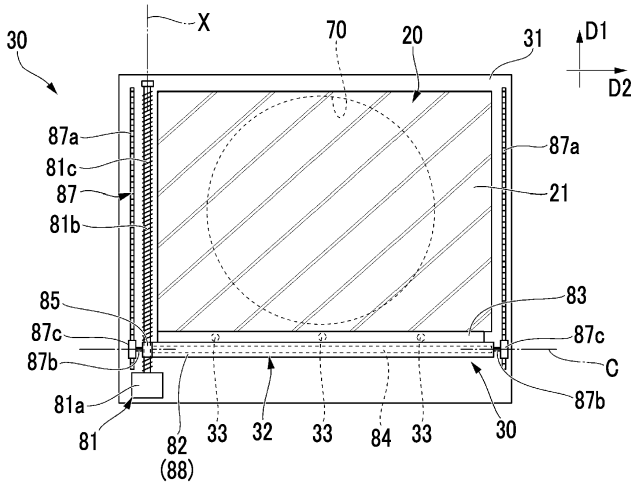
(54) **AIR CONDITIONING DEVICE**

(57) This air conditioner comprises an air conditioner body that has an inlet, a filter part that is provided to the inlet and collects dust contained in air, and a cleaning device that removes the dust which has attached to the filter part. The cleaning device has a cleaning unit that is capable of reciprocating movement in a first direction along an outer surface of the filter part, and a radiating part that is attached to the cleaning unit and that radiates ultraviolet light in the direction of the outer surface of the filter part.

FIG. 2



EP 4 498 004 A1

Description

Technical Field

[0001] The present disclosure relates to an air conditioner.

[0002] The present application claims priority to Japanese Patent Application No. 2022-083778, filed in Japan on May 23, 2022, the content of which is incorporated herein by reference.

Background Art

[0003] An air conditioner indoor unit of ceiling cassette type (hereinafter, simply referred to as an air conditioner) mainly includes an electric motor, a turbofan that is rotationally driven by the electric motor, a heat exchanger that surrounds the turbofan from an outer peripheral side, and a panel having a suction port and a discharge port. Indoor air taken in from the suction port is pressurized and sent by the turbofan to come into contact with the heat exchanger. The air that is warmed or cooled by exchanging heat with a refrigerant in the heat exchanger is blown into the indoor through the discharge port.

[0004] Here, in general, the suction port is provided with a filter unit for collecting dust contained in the indoor air. Various devices for automatically removing dust adhered to the filter unit have been practically used. As an example of this type of device, PTL 1 discloses a device including a mechanism for recovering the dust collected by a filter unit, a dust box in which the recovered dust is stored, and a light source that irradiates the inside of the dust box with ultraviolet rays.

Citation List

Patent Literature

[0005] [PTL 1] Japanese Unexamined Patent Application Publication No. 2009-236399

Summary of Invention

Technical Problem

[0006] However, in a case where the ultraviolet rays are irradiated only to the inside of the dust box as described above, sterilization and disinfection of the filter unit are insufficient. Therefore, there has been an increasing demand for an air conditioner including a mechanism capable of automatically sterilizing and disinfecting the filter unit.

[0007] The present disclosure has been made to solve the above problem, and an object of the present disclosure is to provide an air conditioner capable of efficiently sterilizing and disinfecting a filter unit.

Solution to Problem

[0008] In order to solve the above problem, an air conditioner according to the present disclosure includes an air conditioner indoor unit having a suction port, a filter unit provided in the suction port and collecting dust contained in air, and a cleaning device removing the dust adhered to the filter unit, in which the cleaning device has a cleaning unit capable of reciprocating in a first direction along an outer surface of the filter unit, and an irradiation unit attached to the cleaning unit and irradiating the outer surface of the filter unit with ultraviolet rays.

Advantageous Effects of Invention

[0009] According to the present disclosure, it is possible to provide an air conditioner capable of efficiently sterilizing and disinfecting a filter unit.

Brief Description of Drawings

[0010]

Fig. 1 is a vertical sectional view showing a configuration of an air conditioner according to an embodiment of the present disclosure.

Fig. 2 is a plan view showing a configuration of a filter unit and a cleaning device according to the embodiment of the present disclosure.

Fig. 3 is a cross-sectional view showing the cleaning device according to the embodiment of the present disclosure.

Fig. 4 is a cross-sectional view showing a first modification example of the cleaning device according to the embodiment of the present disclosure.

Fig. 5 is a cross-sectional view showing a second modification example of the cleaning device according to the embodiment of the present disclosure.

Description of Embodiments

(Configuration of air conditioner indoor unit of ceiling cassette type)

[0011] Hereinafter, an air conditioner indoor unit of ceiling cassette type 1 (air conditioner) according to an embodiment of the present disclosure will be described with reference to Figs. 1 to 3. As shown in Fig. 1, the air conditioner indoor unit of ceiling cassette type 1 includes an air conditioner indoor unit 10, a filter unit 20, and a cleaning device 30.

[0012] The air conditioner indoor unit 10 includes an air conditioner indoor unit case 11, a motor 12, a turbofan 13, a heat exchanger 14, a bell mouth 15, and a drain pan 16.

[0013] The air conditioner indoor unit case 11 is embedded in the ceiling 90 of the building. The air conditioner indoor unit case 11 has a rectangular shape when viewed from below, and is recessed upward to form a

space therein. Specifically, the air conditioner indoor unit case 11 has a panel 41 that is exposed on a ceiling surface 91 and a box-shaped cabinet 42 that is provided above the panel 41. The panel 41 includes a panel main body 43 that is a rectangular frame body, and a grill 44 provided at a lower center. The panel 41 forms a discharge port 45 around the grill 44.

[0014] The motor 12 is provided at a central portion of a bottom surface 46 facing downward in the cabinet 42. The motor 12 has a motor 51 that accommodates a coil, a magnet, and the like, and an output shaft 52 that protrudes vertically downward from the motor 51. The output shaft 52 is rotationally driven around an axis O extending in a vertical direction.

[0015] The turbofan 13 is attached to the output shaft 52. The turbofan 13 includes a main plate 61 that extends radially outside and has a disk shape around the axis O, a plurality of main blades 62 that are arranged at intervals in the circumferential direction, and a ring-shaped shroud 63 that covers the main blades 62 from below. As the output shaft 52 rotates, the turbofan 13 fixed to the output shaft 52 by the main plate 61 rotates, and air sucked from the grill 44 passes through a bell mouth 15 (to be described later) and is sent to the radially outside by the turbofan 13.

[0016] The annular heat exchanger 14 that surrounds the turbofan 13 is provided radially outside the turbofan 13. The heat exchanger 14 is a part of a refrigerant circuit having a refrigerating cycle.

[0017] The air sent to the heat exchanger 14 by the turbofan 13 is heat-exchanged with a refrigerant in a case of passing through the heat exchanger 14. Accordingly, the air that has flowed out to an outer peripheral side of the heat exchanger 14 is cooled or warmed. The air flows downward along a side surface of the cabinet 42 and is supplied to the indoor from the discharge port 45.

[0018] The drain pan 16 provided below the heat exchanger 14 is a plate-shaped member for receiving the condensed water generated on the surface of the heat exchanger 14. A plurality of opening portions for guiding the air that has passed through the heat exchanger 14 to the discharge port 45 are formed in the drain pan 16. A portion excluding the opening portions covers the heat exchanger 14 from below when viewed in a direction of the axis O.

[0019] The bell mouth 15 is disposed at a center of the drain pan 16. The bell mouth 15 is provided to guide the air introduced from the grill 44 and to send the air to the turbofan 13. The bell mouth 15 has a conical shape that gradually contracts from below to above. An end portion of the bell mouth 15 on one side (upper side) in the direction of the axis O is surrounded by the above-described shroud 63 from the outer peripheral side. An opening of the bell mouth 15 on the other side (lower side) in the direction of the axis O is a suction port 70 that communicates with the grill 44.

(Configuration of filter unit)

[0020] A filter unit 20 is provided between the grill 44 and the bell mouth 15. The filter unit 20 is provided to collect dust contained in the air guided into the air conditioner indoor unit 10 through the grill 44. As shown in Fig. 2, the filter unit 20 has a rectangular shape covering the suction port 70 from the lower side. The filter unit 20 is detachably attached to a frame unit 31 (to be described later) of the cleaning device 30 from below. The filter unit 20 is a fiber material formed of a resin or a metal and has a thin film shape. In addition, the filter unit 20 is formed of a material containing a photocatalyst. The photocatalyst is a substance that exhibits a photochemical reaction by being irradiated with light including ultraviolet rays or other visible light, and has an effect of killing adhered bacteria and viruses. The filter unit 20 is provided with a large number of holes, and the air flows through the filter unit 20. On the other hand, dust or foreign matter is captured by a surface (outer surface 21) of the filter unit 20 facing the lower side.

(Configuration of cleaning device)

[0021] The cleaning device 30 is provided to remove the dust adhered to the outer surface 21 of the filter unit 20. As shown in Fig. 2, the cleaning device 30 includes the frame unit 31, a cleaning unit 32, and an irradiation unit 33. The frame unit 31 has a rectangular shape covering the suction port 70 from below, and is provided to hold the cleaning unit 32 and the irradiation unit 33.

[0022] The cleaning unit 32 includes a drive mechanism 81, a brush mechanism 82, a pedestal unit 83, a brush unit 84, a brush mechanism moving nut 85, a brush rotation mechanism 87, and a dust box 88.

[0023] The drive mechanism 81 is a mechanism for reciprocating the brush mechanism 82 and the brush unit 84 along the outer surface 21 of the filter unit 20. In the following description, the reciprocating direction will be referred to as a "first direction D1", and a horizontal direction orthogonal to the first direction D1 will be referred to as a "second direction D2".

[0024] The drive mechanism 81 has a drive motor 81a and a drive rod 81b. The drive motor 81a has a rotary shaft extending in the first direction D1. The drive rod 81b is connected to the rotary shaft. The drive rod 81b has a rod shape extending in the first direction D1, and a spiral wire 81c extending to turn spirally around the first direction D1 is fixed to an outer peripheral surface of the drive rod 81b. That is, the drive rod 81b has the same shape as a male screw. The drive motor 81a is supplied with electric power to rotationally drive the drive rod 81b around a rotation axis X extending in the first direction D1.

[0025] The brush mechanism 82 is a frame body for holding the brush unit 84. The brush mechanism 82 extends in the second direction D2 along one side of the rectangular filter unit 20. The pedestal unit 83 is provided on one side of the brush mechanism 82 in the

first direction D1. The pedestal unit 83 is provided to support the irradiation unit 33 to be described later. The pedestal unit 83 protrudes from the brush mechanism 82 in the first direction D1.

[0026] Both ends of the brush unit 84 are supported by the brush mechanism 82 in a state of being rotatable around a central axis C extending in the second direction D2. The brush unit 84 has a columnar shape around the central axis C. The brush unit 84 has a large number of fiber materials extending from an outer peripheral surface of a shaft portion (not shown) in the radially outside of the central axis C. The filter unit 20 is disposed such that at least a part of an outer peripheral surface of the brush unit 84 comes into contact with the outer surface 21 of the filter unit 20 from below.

[0027] The brush mechanism moving nut 85 is attached to one end of the brush mechanism 82 in the second direction D2. The brush mechanism moving nut 85 is provided at a position overlapping the above-described drive rod 81b in the second direction D2. A female screw hole (not shown) into which the drive rod 81b is inserted is formed in the brush mechanism moving nut 85. That is, a female screw of the brush mechanism moving nut 85 is screwed with the spiral wire 81c of the drive rod 81b. When the drive rod 81b rotates, the drive rod 81b is guided by the screws, and the brush mechanism moving nut 85, the brush mechanism 82, and the brush unit 84 move in the first direction D1. By switching the rotation direction of the drive rod 81b forward and backward, movement directions of the brush mechanism moving nut 85, the brush mechanism 82, and the brush unit 84 are also reversed, and the movement directions of the brush mechanism moving nut 85, the brush mechanism 82, and the brush unit 84 are capable of reciprocating in the first direction D 1.

[0028] The brush rotation mechanism 87 is provided to rotate the brush unit 84 around the central axis C. The brush rotation mechanism 87 includes a pair of rack gears 87a provided at end edges of the frame unit 31 on both sides in the second direction D2 with the filter unit 20 interposed therebetween, a pair of shafts 87b provided in the brush mechanism 82, and pinion gears 87c. The rack gear 87a extends in the first direction D1. The rack gear 87a has a plurality of teeth arranged in the first direction D1. The pinion gear 87c is supported by the pair of shafts 87b extending from both end portions of the brush unit 84 in the second direction D2. The shaft 87b extends along the central axis C of the brush unit 84. The pinion gear 87c has a circular shape around the central axis C, and a plurality of teeth that mesh with the teeth of the rack gears 87a are formed on an outer peripheral surface of the pinion gear 87c.

[0029] When the brush mechanism 82 is moved in the first direction D1 by the drive mechanism 81, the pinion gear 87c rotates around the central axis C by meshing with the rack gear 87a. The brush unit 84 also rotates around the central axis C with the rotation of the pinion gear 87c. The brush unit 84 rotates while coming into contact with the outer surface 21 of the filter unit 20. In this manner, the dust adhered to the outer surface 21 is removed.

[0030] As shown in Fig. 3, the dust box 88 is attached below the brush mechanism 82. The dust box 88 is a container for storing the dust removed by the brush unit 84. The dust box 88 is detachably attached to the brush mechanism 82. That is, in a case where the dust box 88 is filled with the dust, a user detaches the dust box 88 to remove the dust, and then attaches the dust box 88 to the brush mechanism 82 again. The dust box 88 may be attached to the grill 44 instead of the brush mechanism 82. In this case, for example, by providing a mechanism for raising and lowering the grill 44 in the up-down direction, the dust can be removed from the dust box 88 when the grill 44 is lowered.

(Configuration of irradiation unit)

[0031] As shown in Figs. 2 and 3, a plurality of the irradiation units 33 are provided on the pedestal unit 83 of the brush mechanism 82. The irradiation unit 33 is, for example, a light emitting diode (LED) that emits deep ultraviolet rays. More specifically, the irradiation unit 33 is a UVC-LED. The deep ultraviolet rays referred to herein indicate ultraviolet rays having a short wavelength of about 50 to 200 nm. The irradiation unit 33 is attached to a surface of the pedestal unit 83 facing an outer surface 21 side of the filter unit 20. The plurality of (for example, three) irradiation units 33 are provided at intervals in the second direction D2. In addition, when viewed in the second direction D2, the irradiation unit 33 and the pedestal unit 83 are provided adjacent to an end edge on the side opposite to the side where the drive motor 81a of the brush mechanism 82 is located. In a case where the cost is emphasized, it is also possible to use a UVA-LED as the irradiation unit 33 instead of the UVC-LED.

[0032] The irradiation unit 33 is connected to a power source via a cable (not shown), and continuously or intermittently irradiates the outer surface 21 of the filter unit 20 with ultraviolet rays during the movement of the cleaning unit 32 in the first direction D1. In addition, although not shown in detail, the irradiation unit 33 has an LED chip as a light source and a diffusion lens that covers the LED chip. The ultraviolet rays emitted from the LED chip are scattered through the diffusion lens to be irradiated over a wider range of the outer surface 21 of the filter unit 20. That is, as described above, the entire region of the filter unit 20 in the second direction D2 is irradiated with the deep ultraviolet rays by the three irradiation units 33. Accordingly, the bacteria and viruses adhered to the filter unit 20 and the dust are killed (sterilized and disinfected).

(Actions and effects)

[0033] An operation of the above-described air conditioner indoor unit of ceiling cassette type 1 will be de-

scribed. When the air conditioner indoor unit 10 is operated, the indoor air is sucked into the suction port 70 of the bell mouth 15 through the grill 44. At this time, the dust contained in the air is collected by the filter unit 20 covering the suction port 70. Accordingly, the air blown from the discharge port 45 through an inside of the air conditioner indoor unit 10 is in a state of not containing the dust or is in a state of containing only an extremely small amount of the dust.

[0034] Here, in a case where the air conditioner indoor unit of ceiling cassette type 1 is operated for a long period of time, the dust is likely to accumulate in the filter unit 20, and the filter unit 20 is likely to be clogged. Therefore, the dust is removed by the cleaning device 30. An operation cycle of the cleaning device 30 may be determined by the user, or may be automatically determined by the control device.

[0035] When the cleaning device 30 is driven, the brush unit 84 moves in the first direction D1 while rotating, so that the dust on the outer surface 21 of the filter unit 20 is removed. The brush unit 84 reciprocates in the first direction D1 at least once. As the brush unit 84 moves in the first direction D1, the above-described irradiation unit 33 irradiates the outer surface 21 of the filter unit 20 with the deep ultraviolet rays. Accordingly, the bacteria and viruses adhered to the filter unit 20 are killed (the filter unit 20 is sterilized and disinfected). As a result, the air blown from the discharge port 45 through the inside of the air conditioner indoor unit 10 is in a clean state in which the bacteria and viruses are not contained. In this way, the filter unit 20 can be efficiently sterilized and disinfected in accordance with the driving of the cleaning device 30.

[0036] Further, according to the above configuration, the filter unit 20 is a photocatalyst filter. Since the filter unit 20 is the photocatalyst filter, the filter unit 20 can be autonomously sterilized and disinfected over time by being irradiated with the ultraviolet rays by the irradiation unit 33 in addition to the visible light emitted from indoor illumination or the like. That is, it is possible to achieve both the sterilization and disinfection of the filter unit 20 by the irradiation unit 33 and the self-cleaning action based on a photocatalyst effect of the filter unit 20. As a result, the filter unit 20 can be maintained in a cleaner state.

[0037] In addition, according to the above configuration, the plurality of irradiation units 33 are arranged at intervals in the second direction D2 orthogonal to the first direction D1, which is the reciprocating direction of the cleaning unit 32. Accordingly, the filter unit 20 can be sterilized and disinfected over a wider range in the first direction D1 and the second direction D2. In particular, the UVC-LED that emits the deep ultraviolet rays as described above is generally expensive. Therefore, the number of the UVC-LEDs required can be reduced by disposing only the plurality of (for example, three) irradiation units 33 at intervals in the second direction D2 in this way. As a result, it is possible to reduce the manufacturing cost and the maintenance cost of the device.

[0038] In addition, according to the above configuration, the UVC-LED that emits the deep ultraviolet rays having a short wavelength is used as the irradiation unit 33. By irradiating the filter unit 20 with the deep ultraviolet rays, it is possible to further effectively sterilize and disinfect the filter unit 20. In particular, it is known that the deep ultraviolet rays have an effect of fundamentally killing the bacteria and viruses by destroying genes of the bacteria and viruses. Therefore, the filter unit 20 can be maintained in an extremely clean state.

[0039] In addition, according to the above configuration, the irradiation unit 33 is provided adjacent to the first direction D1, which is the reciprocating direction of the cleaning unit 32. In this manner, as the cleaning unit 32 reciprocates, first, on an outbound path, the sterilization and disinfection of the dust adhered to the filter unit 20 are performed, and the dust is removed by the brush unit 84. That is, the dust stored in the dust box 88 is already in a state of being sterilized and disinfected. Further, on an inbound path, the filter unit 20 after the dust is removed can be directly sterilized and disinfected by the ultraviolet rays emitted by the irradiation unit 33, and at the same time, the photocatalyst effect can also be obtained. Accordingly, it is possible to reduce the possibility that the user comes into contact with the bacteria and viruses.

(Other embodiments)

[0040] Although the embodiment of the present disclosure has been described in detail above with reference to the drawings, the specific configuration of the present disclosure is not limited to the embodiment, and the present disclosure includes design changes or the like without departing from the scope of the present disclosure.

[0041] For example, in the above embodiment, an example has been described in which the irradiation unit 33 and the pedestal unit 83 are provided on the side opposite to a side where the drive motor 81a of the brush mechanism 82 is located. However, as a first modification example, as shown in Fig. 4, the irradiation unit 33 and the pedestal unit 83 may be provided on the side where the drive motor 81a of the brush mechanism 82 is located. Also with this configuration, the same actions and effects as described above can be obtained as the brush mechanism 82 reciprocates in the first direction D1. Which side of the brush mechanism 82 the irradiation unit 33 and the pedestal unit 83 are provided on may be appropriately selected as long as interference with the drive motor 81a does not occur.

[0042] Further, as a second modification example, as shown in Fig. 5, a configuration in which the pedestal unit 83 is not provided can be adopted. In this case, the irradiation unit 33 is directly fixed to an end surface of the brush mechanism 82 facing the first direction D1. Further, the irradiation unit 33 further includes a prism 100 for directing an irradiation direction of the irradiation unit 33 to the filter unit 20. With this configuration as well, the same actions and effects as described above can be

obtained. Further, since a protrusion length in the first direction D1 can be suppressed to be small, it is also possible to further increase a movable range of the brush mechanism 82 in the first direction D1.

[0043] In addition, in the above embodiment, an example has been described in which the filter unit 20 is the photocatalyst filter. However, in a case where the UVC-LED capable of irradiating the deep ultraviolet rays is used as the irradiation unit 33, a certain sterilization and disinfection effect can be obtained by the irradiation unit 33 alone. Therefore, the filter unit 20 does not necessarily need to be configured with the photocatalyst.

<Additional notes>

[0044] The air conditioner described in each embodiment is understood as follows, for example.

(1) An air conditioner according to a first aspect includes an air conditioner indoor unit 10 having a suction port 70, a filter unit 20 provided in the suction port 70 and collecting dust contained in air, and a cleaning device 30 removing the dust adhered to the filter unit 20, in which the cleaning device 30 has a cleaning unit 32 capable of reciprocating in a first direction D1 along an outer surface 21 of the filter unit 20, and an irradiation unit 33 attached to the cleaning unit 32 and irradiating the outer surface 21 of the filter unit 20 with ultraviolet rays.
According to the above configuration, the irradiation unit 33 attached to the cleaning unit 32 irradiates the filter unit 20 with the ultraviolet rays as the cleaning unit 32 reciprocates in the first direction D1. Accordingly, the entire region of the filter unit 20 can be sterilized and disinfected.
(2) The air conditioner according to a second aspect is the air conditioner of the first aspect, in which the filter unit 20 is a photocatalyst filter.
According to the above configuration, since the filter unit 20 is the photocatalyst filter, the filter unit 20 can be autonomously sterilized and disinfected over time by being irradiated with light emitted from indoor illumination or the like.
(3) The air conditioner according to a third aspect is the air conditioner of the first or second aspect, in which a plurality of the irradiation units 33 are arranged at intervals in a second direction D2 that is a horizontal direction orthogonal to the first direction D1.
According to the above configuration, the plurality of irradiation units 33 are arranged at intervals in the second direction D2 orthogonal to the first direction D1, which is the reciprocating direction of the cleaning unit 32. Accordingly, the filter unit 20 can be sterilized and disinfected over a wider range in the first direction D1 and the second direction D2.
(4) The air conditioner according to a fourth aspect is the air conditioner of the first or second aspect, in which the irradiation unit 33 is a light emitting diode that irradiates deep ultraviolet rays.
According to the above configuration, by irradiating the filter unit 20 with the deep ultraviolet rays having a short wavelength by the irradiation unit 33, it is possible to further effectively sterilize and disinfect the filter unit 20.
(5) The air conditioner according to a fifth aspect is the air conditioner of the first or second aspect, in which the irradiation unit 33 is provided adjacent to the cleaning unit 32 in the first direction D1.

[0045] According to the above configuration, the irradiation unit 33 is provided adjacent to the first direction D1, which is the reciprocating direction of the cleaning unit 32. In this manner, as the cleaning unit 32 reciprocates, on one of the outbound path or the inbound path, the sterilization and disinfection of the dust adhered to the filter unit 20 are performed. On the other of the outbound path or the inbound path, the filter unit 20 after the dust is removed can be directly sterilized and disinfected.

Industrial Applicability

[0046] According to the present disclosure, it is possible to provide an air conditioner capable of efficiently sterilizing and disinfecting a filter unit.

Reference Signs List

[0047]

1: air conditioner indoor unit of ceiling cassette type
10: air conditioner indoor unit
11: air conditioner indoor unit case
12: motor
13: turbofan
14: heat exchanger
15: bell mouth
16: drain pan
20: filter unit
21: outer surface
30: cleaning device
31: frame unit
32: cleaning unit
33: irradiation unit
41: panel
42: cabinet
43: panel main body
44: grill
45: discharge port
46: bottom surface
51: motor
52: output shaft
61: main plate
62: main blade
63: shroud
70: suction port

81: drive mechanism
81a: drive motor
81b: drive rod
81c: spiral wire
82: brush mechanism
83: pedestal unit
84: brush unit
85: brush mechanism moving nut
87: brush rotation mechanism
87a: rack gear
87b: shaft
87c: pinion gear
88: dust box
90: ceiling
91: ceiling surface
100: prism
C: central axis
D1: first direction
D2: second direction
O: axis
X: rotation axis

Claims

1. An air conditioner comprising:

an air conditioner indoor unit having a suction port;
a filter unit provided in the suction port and collecting dust contained in air; and
a cleaning device removing the dust adhered to the filter unit,
wherein the cleaning device has

a cleaning unit capable of reciprocating in a first direction along an outer surface of the filter unit, and
an irradiation unit attached to the cleaning unit and irradiating the outer surface of the filter unit with ultraviolet rays.

2. The air conditioner according to Claim 1, wherein the filter unit is a photocatalyst filter.

3. The air conditioner according to Claim 1 or 2, wherein a plurality of the irradiation units are arranged at intervals in a second direction that is a horizontal direction orthogonal to the first direction.

4. The air conditioner according to Claim 1 or 2, wherein the irradiation unit is a light emitting diode that irradiates deep ultraviolet rays.

5. The air conditioner according to Claim 1 or 2, wherein the irradiation unit is provided adjacent to the cleaning unit in the first direction.

FIG. 1

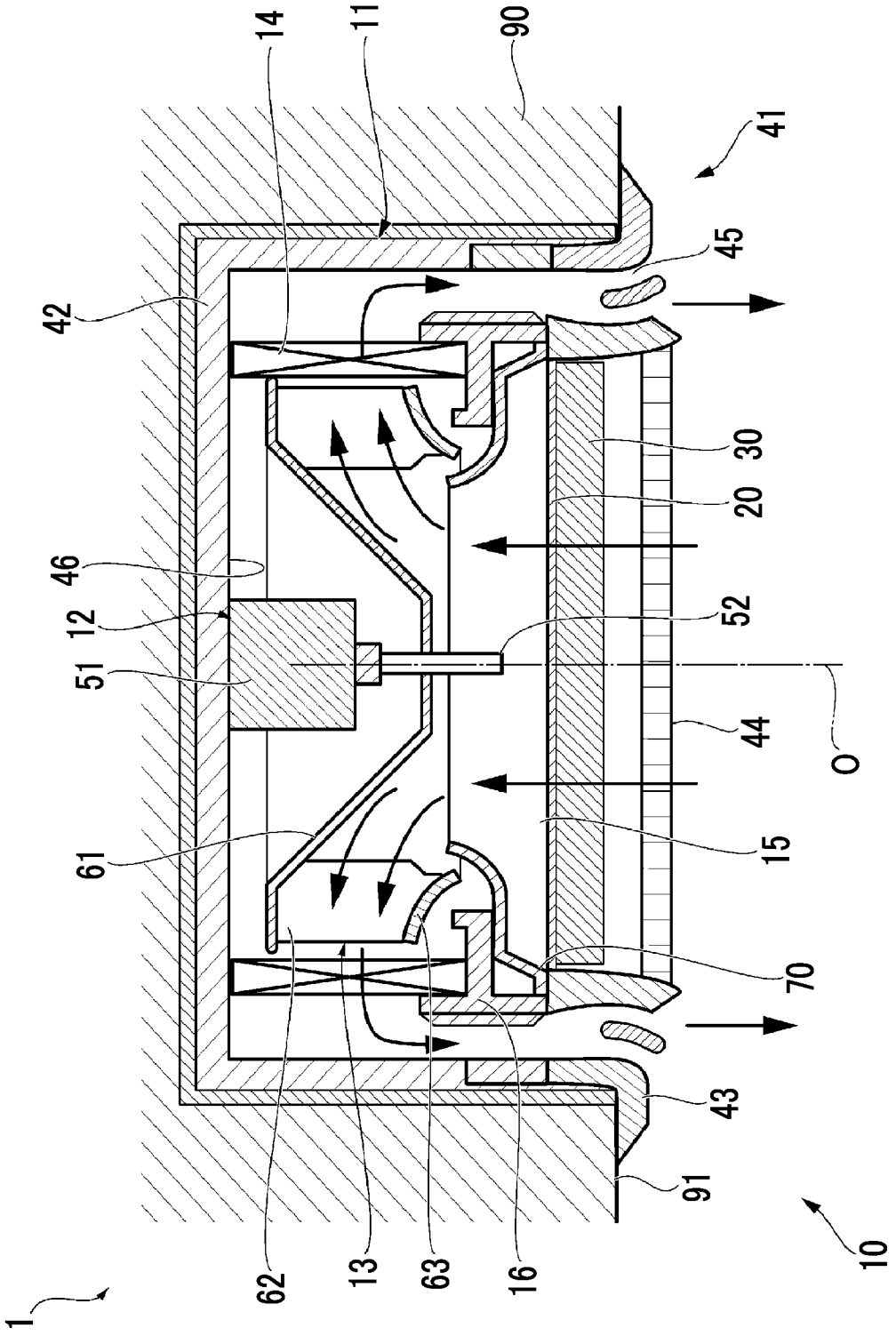
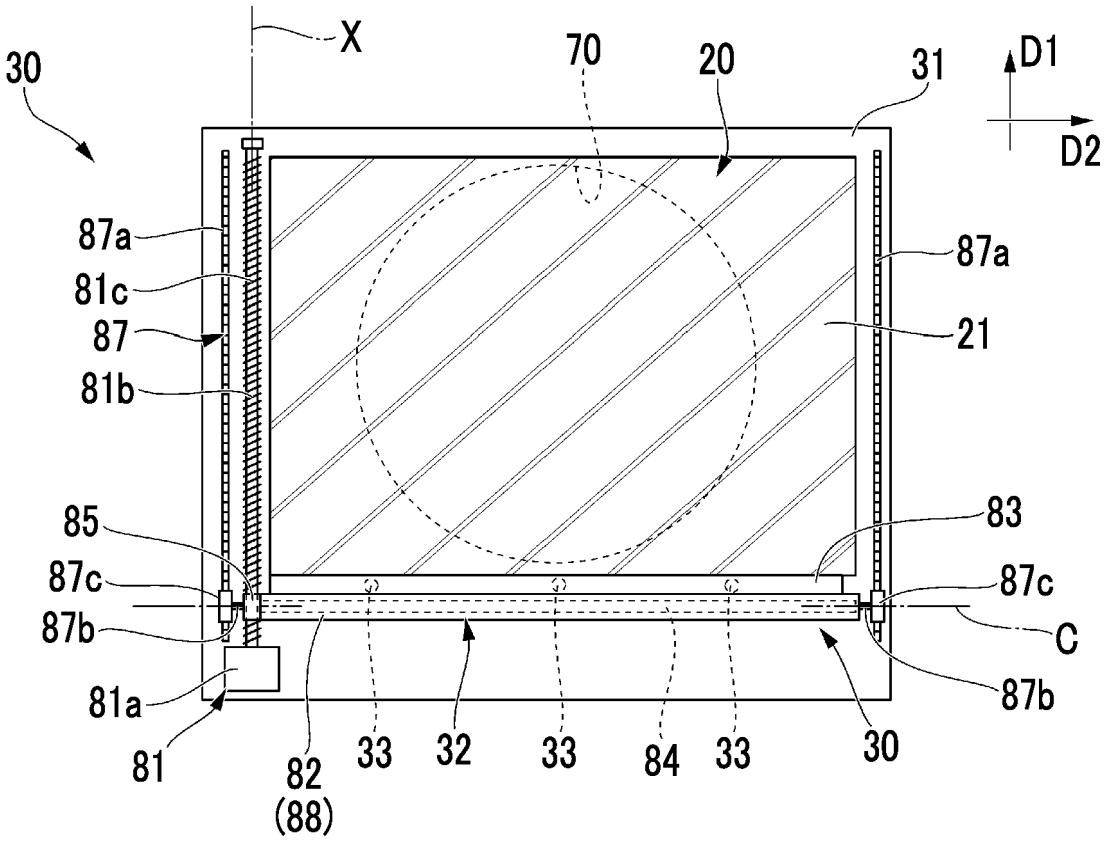


FIG. 2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(88)
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FIG. 3

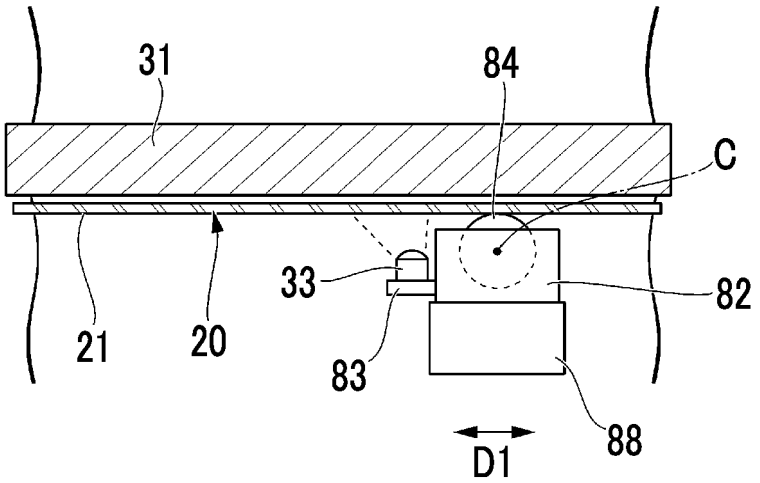
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FIG. 4

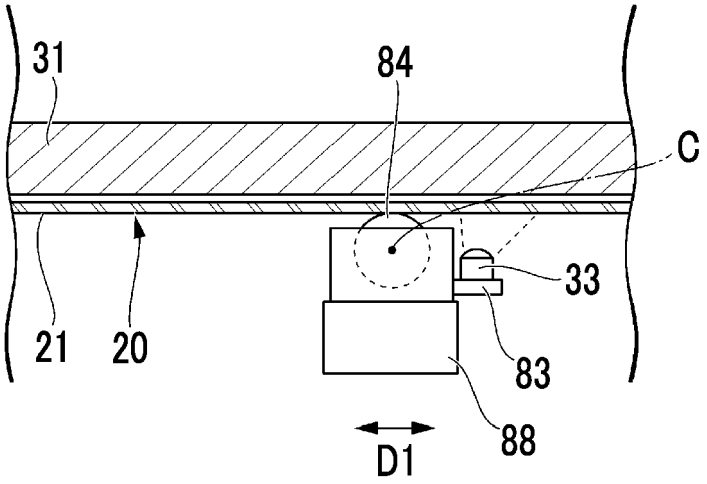
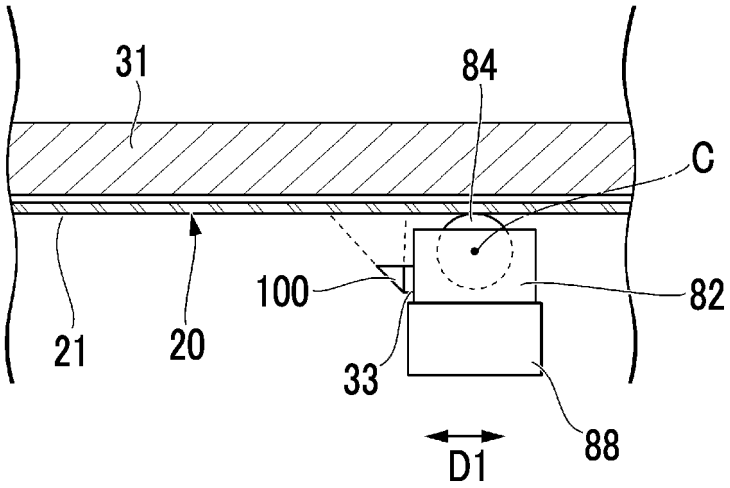


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/018598

A. CLASSIFICATION OF SUBJECT MATTER

F24F 1/0073(2019.01)i; ***F24F 1/0071***(2019.01)i; ***F24F 8/108***(2021.01)i; ***F24F 8/167***(2021.01)i; ***F24F 8/22***(2021.01)i; ***F24F 8/90***(2021.01)i; ***F24F 13/28***(2006.01)i
FI: F24F1/0073; F24F1/0071; F24F13/28; F24F8/108 110; F24F8/22; F24F8/167; F24F8/90 110

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F1/0073; F24F1/0071;

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2008-175407 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 31 July 2008 (2008-07-31) paragraphs [0014]-[0030], fig. 1-4	1-3, 5
Y		4
Y	JP 2021-186255 A (ASAHI KASEI CORP.) 13 December 2021 (2021-12-13) paragraph [0031], fig. 1	4

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 June 2023	**11 July 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/018598

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2008-175407 A	31 July 2008	(Family: none)	
JP 2021-186255 A	13 December 2021	CN 113730618 A	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2022083778 A **[0002]**
- JP 2009236399 A **[0005]**