



(11) **EP 3 795 911 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
24.03.2021 Bulletin 2021/12

(51) Int Cl.:
F24F 1/00 ^(2019.01) **F24F 11/49** ^(2018.01)

(21) Application number: **18913206.1**

(86) International application number:
PCT/JP2018/018519

(22) Date of filing: **14.05.2018**

(87) International publication number:
WO 2019/220494 (21.11.2019 Gazette 2019/47)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **HOSOKAWA, Kazuma**
Tokyo
1050022 (JP)
• **CAI, Jiaye**
Tokyo
1050022 (JP)

(71) Applicant: **Hitachi-Johnson Controls Air Conditioning, Inc.**
Tokyo 105-0022 (JP)

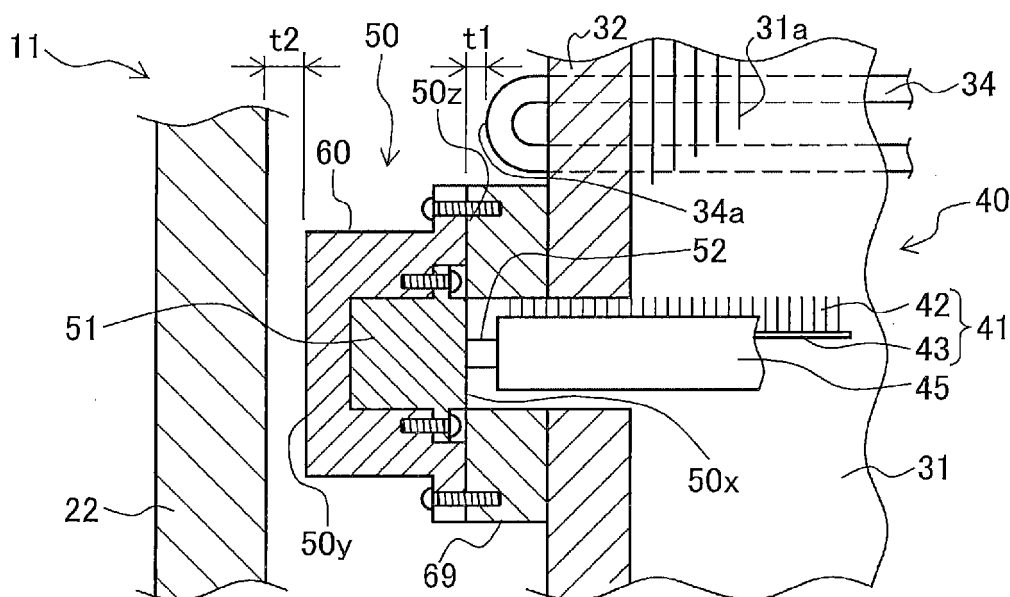
(74) Representative: **MERH-IP Matias Erny Reichl Hoffmann**
Patentanwälte PartG mbB
Paul-Heyse-Strasse 29
80336 München (DE)

(54) **AIR CONDITIONER**

(57) An air-conditioner (10) includes a heat exchanger (31), an air blower fan (38), a cleaner (a brush (41)) configured to clean the air blower fan, and a motor (51) arranged on the outside with respect to a side plate (32)

of the heat exchanger and configured to drive the cleaner. A main body of the motor is arranged on the outside with respect to an outer end portion (34a) of a curved portion provided at a hairpin pipe (34) of the heat exchanger.

[図5]



Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to an air-conditioner.

BACKGROUND ART

10 **[0002]** Generally, for an air-conditioner including an air blower fan, more dust adheres to the air blower fan as use time increases. Thus, the air volume of the air-conditioner might decrease, or power consumption of the air-conditioner might increase. Moreover, in some cases, fungi etc. are caused due to adherence of the dust in the air-conditioner, leading to insanitation. For these reasons, an air-conditioner including a fan cleaning device configured to remove dust adhering to an air blower fan to clean the air blower fan has been provided (see, e.g., Patent Document 1). The air-conditioner described in Patent Document 1 includes the fan cleaning device and a control device configured to control the fan cleaning device, and has a normal operation mode for blowing conditioned air into a room and a fan cleaning mode for rotating a fan at low speed and movably operating the fan cleaning device. The fan cleaning device includes a cleaner configured to contact the fan in the fan cleaning operation mode, and is configured to movably operate the cleaner to a position retreated from the fan in the normal operation mode.

15 **[0003]** The fan cleaning device rotatably drives the cleaner by a motor. It is efficient when the motor is arranged at a location close to a rotary shaft of the cleaner. For this reason, air-conditioners include one configured such that a motor of a fan cleaning device is attached to a location close to a rotary shaft of a cleaner at a side surface (specifically, an outer wall surface of a side plate forming the side surface of a heat exchanger) of the heat exchanger.

CITATION LIST

25

PATENT DOCUMENT

[0004] Patent Document 1: Japanese Patent No. 4046755

30 SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

35 **[0005]** However, as described below, in the typical air-conditioner, the motor of the fan cleaning device is arranged at such a location, and therefore, there is a probability that condensation water adheres to the motor and a motor failure rate increases.

[0006] For example, in the air-conditioner, the heat exchanger is cooled in air cooling operation. Thus, the outer wall surface of the side plate forming the side surface of the heat exchanger becomes cold. The motor of the typical air-conditioner is attached to the outer wall surface of the side plate. Thus, there is a probability that due to excessive cooling of the motor due to influence of cold air transmitted from the side plate, condensation water is caused and adheres to the motor. Consequently, there is a probability that the motor failure rate increases.

40 **[0007]** Moreover, e.g., a hairpin pipe projecting outward is arranged at the side plate of the heat exchanger. In the air-conditioner, refrigerant flows in the hairpin pipe in the air cooling operation, and therefore, condensation water adheres to the hairpin pipe. In the typical air-conditioner, the motor is arranged right below the hairpin pipe, and therefore, the condensation water might drop from the hairpin pipe onto the motor. Thus, there is a probability that the motor failure rate increases.

45 **[0008]** The present invention has been made for solving the above-described problems, and a main object of the present invention is to provide an air-conditioner configured to reduce adherence of condensation water to a motor of a fan cleaning device.

50

SOLUTIONS TO THE PROBLEMS

[0009] For accomplishing the above-described object, the present invention relates to an air-conditioner including a heat exchanger, an air blower fan, a cleaner configured to clean the air blower fan, and a motor arranged on the outside with respect to a side plate of the heat exchanger and configured to drive the cleaner. A main body of the motor is arranged on the outside with respect to an outer end portion of a curved portion provided at a hairpin pipe of the heat exchanger.

55 **[0010]** Other techniques will be described later.

EFFECTS OF THE INVENTION

[0011] According to the present invention, adherence of condensation water to the motor of a fan cleaning device can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a schematic view of an entire configuration of an air-conditioner according to a first embodiment.

Fig. 2 is a schematic view of a configuration of a heat exchanger and a peripheral configuration thereof in an indoor unit of the air-conditioner according to the first embodiment.

Fig. 3 is a schematic view of a configuration of a fan cleaning device according to the first embodiment and a peripheral configuration thereof.

Fig. 4 is an exploded view of a configuration of a motor assembly of the fan cleaning device according to the first embodiment.

Fig. 5 is a schematic view of a preferable arrangement location of the motor assembly of the first embodiment.

Fig. 6A is a schematic view (1) of a preferable arrangement relationship between a motor of the motor assembly and a drain pan in the first embodiment.

Fig. 6B is a schematic view (2) of the preferable arrangement relationship between the motor of the motor assembly and the drain pan in the first embodiment.

Fig. 6C is a schematic view (3) of the preferable arrangement relationship between the motor of the motor assembly and the drain pan in the first embodiment;

Fig. 7 is a schematic view of a configuration of a cleaner used in the first embodiment.

Fig. 8 is a schematic view of a configuration of another cleaner used in the first embodiment.

Fig. 9 is a perspective view (1) of a main portion of the configuration of another cleaner used in the first embodiment.

Fig. 10 is a perspective view (2) of the main portion of the configuration of another cleaner used in the first embodiment.

Fig. 11 is a schematic view of a configuration of a motor assembly according to a second embodiment.

Fig. 12 is an exploded view of the configuration of the motor assembly according to the second embodiment.

Fig. 13 is a schematic view of an internal structure of the motor assembly of the second embodiment.

Fig. 14 is a schematic view of an internal structure of a motor assembly of a first variation.

Fig. 15 is a schematic view of an internal structure of a motor assembly of a second variation.

Fig. 16 is a schematic view of an internal structure of a motor assembly of a third variation.

Fig. 17 is a schematic view of an internal structure of a motor assembly of a fourth variation.

DESCRIPTION OF THE EMBODIMENTS

[0013] Hereinafter, embodiments (hereinafter referred to as "present embodiments") of the present invention will be described in detail with reference to the drawings. Note that each figure is merely schematically illustrated to such an extent that the present invention can be fully understood. Thus, the present invention is not limited only to illustrated examples. Moreover, in each figure, the same reference numerals are used to represent common components or similar components, and overlapping description thereof will be omitted.

[0014] A first embodiment is intended to provide the following air-conditioner 10.

(1) As illustrated in Fig. 5, the air-conditioner 10 according to the first embodiment is configured such that a motor 51 is separated from a side plate 32 of a heat exchanger 31 to prevent generation of condensation water by excessive cooling of the motor 51 due to influence of cold air transmitted from the side plate 32 and adherence of the condensation water to the motor 51.

(2) As illustrated in Fig. 5, the air-conditioner 10 according to the first embodiment is configured such that the motor 51 is shifted outward (leftward in Fig. 5) from a location right below a hairpin pipe 34 to prevent condensation water dropping from the hairpin pipe 34 from dropping onto a main body of the motor 51.

(3) As illustrated in Fig. 3, the air-conditioner 10 according to the first embodiment is configured such that the main body of the motor 51 is covered with a motor cover 60 to prevent dropping of condensation water onto the main body of the motor 51 and condensation and adherence of condensation water to the main body of the motor 51.

Moreover, as illustrated in Fig. 3, the air-conditioner 10 according to the first embodiment is configured such that a protruding portion 32p covers above an inner end portion of the motor 51 to prevent dropping and adherence of condensation water onto the main body of the motor 51. Further, as illustrated in Figs. 6A to 6C, the air-conditioner 10 according to the first embodiment is configured so that condensation water adhering to and dropping from the

motor cover 60 can be reliably received by a drain pan 39.

<Entire Configuration of Air-Conditioner>

[0015] Hereinafter, an entire configuration of the air-conditioner 10 according to the first embodiment will be described with reference to Fig. 1. Fig. 1 is a schematic view of the entire configuration of the air-conditioner 10 according to the first embodiment.

[0016] As illustrated in Fig. 1, the air-conditioner 10 has an indoor unit 11 arranged inside a room, and an outdoor unit 12 arranged outside the room.

[0017] The indoor unit 11 sucks in indoor air, and causes the sucked indoor air to pass through the heat exchanger 31 (see Fig. 2) to obtain conditioned air subjected to any optional processing of heating, cooling, and dehumidification. Then, the indoor unit 11 blows the obtained conditioned air into the room to air-condition the inside of the room. The indoor unit 11 is connected to the outdoor unit 12 through a connection pipe 13 such that refrigerant circulates between the indoor unit 11 and the outdoor unit 12. The outdoor unit 12 exchanges heat with the circulating refrigerant.

[0018] The indoor unit 11 includes, in a housing 21 and a decorative frame 22 as an exterior member of the housing 21, structures such as an air blower fan 38 (see Fig. 2) and the heat exchanger 31 (see Fig. 2). The air blower fan 38 is a cross-flow fan configured to send air from an air suction port 24 side to an air blow port 25 side, and sends air heat-exchanged by the heat exchanger 31. The heat exchanger 31 is a unit configured to exchange heat with refrigerant.

[0019] In an example illustrated in Fig. 1, a front panel 23 is attached to an upper portion of a front surface of the decorative frame 22 (the exterior member). The front panel 23 is a member configured to cover a front surface of the indoor unit 11. Moreover, an upper-to-lower wind deflector 26 is attached to a lower portion of the front surface of the decorative frame 22.

[0020] The upper-to-lower wind deflector 26 is a member configured to define the direction of conditioned air blown from the air blow port 25 in an upper-to-lower direction. It is configured such that the upper-to-lower wind deflector 26 is pivotally supported on the drain pan 39 in the vicinity of a lower end thereof such that an upper portion of the upper-to-lower wind deflector 26 opens/closes in the upper-to-lower direction and is rotated by a not-shown drive unit. The indoor unit 11 opens the upper-to-lower wind deflector 26 to form the air blow port 25.

<Configuration of Heat Exchanger and Peripheral Configuration of Heat Exchanger>

[0021] Hereinafter, a configuration of the heat exchanger 31 and a peripheral configuration thereof in the indoor unit 11 of the air-conditioner 10 will be described with reference to Figs. 2 and 3. Fig. 2 is a schematic view of the configuration of the heat exchanger 31 and the peripheral configuration thereof. Fig. 3 is a schematic view of a configuration of a fan cleaning device 40 and a peripheral configuration thereof.

[0022] As illustrated in Fig. 2, structures such as the above-described air blower fan 38, the above-described heat exchanger 31, and the drain pan 39 configured to receive condensation water adhering to and dropping from the heat exchanger 31 in air cooling operation are arranged inside the indoor unit 11. The heat exchanger 31 includes multiple fins 31a for exchanging heat between refrigerant and indoor air, and the multiple hairpin pipes 34 arranged to penetrate the fins 31a and configured such that refrigerant flows in the hairpin pipes 34. As illustrated in Fig. 3, the heat exchanger 31 has, at each end portion thereof, the side plate 32 forming a side surface. The fins 31a, the hairpin pipes 34, etc. are cooled in the air cooling operation, and condensation water adheres to these components. The condensation water adhering to these components drops and received by the drain pan 39 (see Fig. 2).

[0023] Note that the side plate 32 includes the protruding portion 32p. The protruding portion 32p protrudes from an outer surface of the side plate 32 to cover at least above the inner end portion of the motor 51 such that condensation water having dropped from the hairpin pipe 34 does not drop onto a later-described motor assembly 50 (specifically, the main body of the motor 51). Note that the hairpin pipe 34 is in a curved shape folded back in the vicinity of the outside of the side plate 32. The hairpin pipes 34 are coupled to each other through a not-shown pipe.

[0024] When the indoor unit 11 is continuously used, dust etc. adhere to the air blower fan 38. Thus, as illustrated in Figs. 2 and 3, the indoor unit 11 has the fan cleaning device 40 configured to clean the air blower fan 38.

[0025] As illustrated in Fig. 3, the fan cleaning device 40 has a brush 41, a shaft 45, and the motor assembly 50.

[0026] The brush 41 is a member (a cleaner) configured to contact and clean the air blower fan 38 (see Fig. 2).

[0027] The shaft 45 is a member configured to hold the brush 41 (the cleaner).

[0028] The motor assembly 50 is a drive section configured to rotatably drive the shaft 45 in a direction about an axis.

[0029] The brush 41 is configured separately from the shaft 45, and is attachable to or detachable from the shaft 45.

Note that it will be described herein that the cleaner of the fan cleaning device 40 is the brush 41. Note that the cleaner of the fan cleaning device 40 may include not only the hairy brush 41 but also an elastic plate such as sponge or elastomer.

[0030] Each of the brush 41 and the shaft 45 is an elongated member. Hereinafter, the brush 41 and the shaft 45 will be collectively referred to as a "brush 41 etc." The brush 41 etc. are arranged between the fin 31a (see Fig. 2) of the

heat exchanger 31 and the air blower fan 38 to rotate about the axis. The brush 41 etc. are slightly longer than the length of the air blower fan 38 in a longitudinal direction thereof to cover the entire area of the air blower fan 38 in the longitudinal direction thereof. The brush 41 etc. are arranged such that both end portions thereof penetrate two side plates 32 arranged at both end portions of the heat exchanger 31.

[0031] Both end portions of the brush 41 etc. are rotatably held by the motor assembly 50 or a not-shown bearing member, for example.

[0032] The brush 41 has multiple fiber portions 42 and a brush base 43. The fiber portion 42 is a contact portion configured to contact the air blower fan 38. The brush base 43 is a base portion configured to hold each fiber portion 42.

[0033] The motor assembly 50 has the motor 51 configured to rotatably drive the brush 41 etc., and the motor cover 60 configured to cover the periphery of the motor 51. A rotary shaft 52 of the motor 51 is directly coupled to the shaft 45, or is indirectly coupled to the shaft 45 through, e.g., a not-shown gear or adaptor. Note that in an example illustrated in Fig. 3, no spacer 69 illustrated in Fig. 5 is used, but the motor assembly 50 may be attached to the side plate 32 of the heat exchanger 31 through the spacer 69 illustrated in Fig. 5.

[0034] Fig. 4 illustrates a configuration of the motor assembly 50 of the present embodiment. Fig. 4 is an exploded view of the motor assembly 50 of the present embodiment. Fig. 4 illustrates an example where the motor assembly 50 is disassembled into the motor 51, a heat insulating member 54, and the motor cover 60.

[0035] In the example illustrated in Fig. 4, the motor 51 has the rotary shaft 52, a lead line 53 drawn from the inside of the main body to the outside, and fixing portions 56 to be fastened to the motor cover 60 through screws 55. The heat insulating member 54 is in a tape shape, and is wound around the main body of the motor 51 to cover at least a peripheral surface of the main body of the motor 51 (see a white arrow A11).

[0036] The motor cover 60 has a housing portion 61 configured to house the main body of the motor 51, and fixing portions 66 to be fastened to, e.g., the side plate 32 of the heat exchanger 31 through screws 65. A groove 62 for housing the lead line 53 of the motor 51 is formed at a lower portion of an inner peripheral surface of the housing portion 61.

[0037] The motor 51 around which the heat insulating member 54 is wound is housed in the housing portion 61 of the motor cover 60 (see a white arrow A12). In this state, the lead line 53 of the motor 51 is drawn out of the motor cover 60 through the groove 62 of the motor cover 60.

[0038] When the motor 51 is housed in the housing portion 61 of the motor cover 60, the motor 51 and the motor cover 60 are fastened to each other with the screws 55 passing through the fixing portions 56 of the motor 51. Accordingly, the motor assembly 50 is assembled. The motor assembly 50 is arranged outside the side plate 32 (see Fig. 3) of the heat exchanger 31. Moreover, the motor cover 60 and an attachment target thereof are fastened to each other with the screws 65 passing through the fixing portions 66 of the motor cover 60.

<Preferable Arrangement Location of Motor Assembly>

[0039] Fig. 5 illustrates a preferable arrangement location of the motor assembly 50 of the present embodiment. Fig. 5 is a schematic view of the preferable arrangement location of the motor assembly 50 of the present embodiment.

[0040] For example, in the air-conditioner 10, the heat exchanger 31 is cooled in the air cooling operation. Thus, an outer wall surface of the side plate 32 of the heat exchanger 31 becomes cold. If the motor 51 is directly attached to the outer wall surface of the side plate 32, there is a probability that condensation water adheres to the main body of the motor 51 due to influence of cold air transmitted from the side plate 32. Thus, such a configuration is not preferable.

[0041] For this reason, as illustrated in Fig. 5, the air-conditioner 10 of the present embodiment is configured such that the motor 51 is arranged with an inner end portion 50x of the main body of the motor 51 being separated from the side plate 32. Specifically, the air-conditioner 10 is configured such that, e.g., the spacer 69 or a space is provided between the heat exchanger 31 and the motor assembly 50. Note that in an example illustrated in Fig. 5, the air-conditioner 10 is configured such that the motor assembly 50 is attached to the heat exchanger 31 through, e.g., the spacer 69 or the space to separate the inner end portion 50x of the main body of the motor 51 from the side plate 32.

[0042] Moreover, if the inner end portion 50x of the main body of the motor 51 is separated from the side plate 32, when such a separation distance is not enough, there is a probability that condensation water adhering to the hairpin pipe 34 drops onto the motor assembly 50.

[0043] In this case, dropping of condensation water onto the vicinity of a mating surface 50z between the motor assembly 50 and the spacer 69 in the air-conditioner 10 is not specifically preferable due to the following reasons. For example, the mating surface 50z is normally sealed. However, if a clearance is caused at the mating surface 50z, there is a probability that condensation water enters the mating surface 50z along such a clearance and reaches the main body of the motor 51. Thus, there is a probability that the condensation water adheres to the main body of the motor 51. For these reasons, dropping of condensation water onto the vicinity of the mating surface 50z is not preferable. Thus, the air-conditioner 10 is preferably configured such that a sufficient separation distance between the inner end portion 50x of the main body of the motor 51 and the side plate 32 is ensured.

[0044] Thus, as illustrated in Fig. 5, in the air-conditioner 10 of the present embodiment, the motor 51 (the motor

assembly 50) is arranged such that the inner end portion 50x of the main body of the motor 51 is positioned on the outside of an outer end portion 34a of a curved portion of the hairpin pipe 34 by, e.g., a distance t1. Thus, the air-conditioner 10 can reduce adherence of condensation water dropping from the hairpin pipe 34 to the main body of the motor 51. Note that the "outside" described herein means a side far from the side plate 32 of the heat exchanger 31.

[0045] Note that if an extremely-large separation distance between the inner end portion 50x of the main body of the motor 51 and the side plate 32 is provided in the air-conditioner 10, an outer end portion 50y of the motor assembly 50 contacts an inner wall surface of the decorative frame 22. Thus, upon drive of the motor 51, vibration of the motor 51 is propagated to the decorative frame 22, leading to the probability that noise is caused.

[0046] For this reason, as illustrated in Fig. 5, in the air-conditioner 10 of the present embodiment, the motor 51 (the motor assembly 50) is arranged such that the outer end portion 50y of the motor assembly 50 is positioned on the inside of the inner wall surface of the decorative frame 22 by, e.g., a distance t2. Thus, the air-conditioner 10 can reduce, upon drive of the motor 51, occurrence of noise due to propagation of vibration of the motor 51 to the decorative frame 22.

<Preferable Arrangement Relationship between Motor of Motor Assembly and Drain Pan>

[0047] Figs. 6A to 6C illustrate preferable arrangement relationships between the motor 51 of the motor assembly 50 and the drain pan 39 in the present embodiment. Figs. 6A to 6C are each schematic views of the preferable arrangement relationships between the motor 51 of the motor assembly 50 and the drain pan 39 in the present embodiment.

[0048] As illustrated in Figs. 6A and 6B, the drain pan 39 may be preferably arranged below the heat exchanger 31 (see Fig. 2) and the motor cover 60 to extend outward of an inner end portion (the inner end portion 50x of the motor 51) of the motor cover 60. That is, the drain pan 39 may be arranged below the heat exchanger 31 (see Fig. 2) and the motor cover 60, and an end portion of the drain pan 39 may be positioned on the outside of the inner end portion (the inner end portion 50x of the motor 51) of the motor cover 60. With this configuration, the air-conditioner 10 can reliably receive, by the drain pan 39, condensation water adhering to and dropping from the motor cover 60.

[0049] Moreover, as illustrated in Fig. 6B, a lower portion of the motor cover 60 may be preferably an inclined portion extending downwardly from an outer end portion side to an inner end portion side. With this configuration, the air-conditioner 10 is configured so that a lower surface of the lower portion of the motor cover 60 can function as a flow path R11 of condensation water adhering to the motor cover 60. As a result, the air-conditioner 10 can guide the condensation water adhering to the motor cover 60 to the drain pan 39, and can efficiently and reliably receive the condensation water by the drain pan 39.

[0050] Alternatively, as illustrated in Fig. 6C, the entirety of the motor cover 60 may be arranged on the inside of an outer end portion of the drain pan 39. With this configuration, the air-conditioner 10 can reliably receive, by the drain pan 39, condensation water adhering to and dropping from the motor cover 60.

<Configuration of Cleaner>

[0051] Fig. 7 illustrates a configuration of the brush 41 (the cleaner) used in the present embodiment. Fig. 7 is a schematic view of the configuration of the brush 41 (the cleaner).

[0052] As illustrated in Fig. 7, the brush 41 has such a structure that a hair implantation region 43a where the fiber portions 42 are implanted is formed across the entire area of the brush base 43.

[0053] The brush 41 is inserted into a housing portion 45a (see Fig. 9) provided at the shaft 45, and is attached to the shaft 45. Moreover, the brush 41 can be detached from the shaft 45 by pulling from the housing portion 45a (see Fig. 9).

[0054] The shaft 45 is arranged inside the indoor unit 11 such that both end portions thereof penetrate two side plates 32 arranged at both end portions of the heat exchanger 31. Note that Fig. 7 illustrates only the side plate 32 arranged on a left side. Both end portions of the shaft 45 are rotatably held by, e.g., the motor 51 (the motor assembly 50) or the not-shown bearing member.

[0055] In an example illustrated in Fig. 7, a case where the not-shown bearing member arranged on a right side of the shaft 45 is detached and the brush 41 is inserted into the housing portion 45a (see Fig. 9) from the right side to the left side of the shaft 45 is illustrated by way of example. However, the brush 41 can be inserted into the housing portion 45a (see Fig. 9) from the left side to the right side of the shaft 45 by detachment of the motor 51 (the motor assembly 50) arranged on the left side of the shaft 45.

[0056] For the brush 41, a strength for holding stiffness is set such that the brush 41 is easily inserted into the housing portion 45a (see Fig. 9) of the shaft 45. With this configuration, the brush 41 can be easily replaced by pulling from or insertion into the side of the shaft 45. Note that the brush base 43 (the base portion) of the brush 41 (the cleaner) may have elasticity so that the brush base 43 can be curved. With this configuration, the fan cleaning device 40 is configured such that the brush 41 can be attached (inserted) to or detached (drawn) from the shaft 45 with the brush base 43 of the brush 41 being curved. That is, for the fan cleaning device 40, a replacement process can be performed with the brush base 43 being curved. Such a fan cleaning device 40 is configured so that the process of replacing the brush 41

in a narrow space (e.g., the process of replacing the brush 41 in the air-conditioner 10 placed in the vicinity of an end of the room) can be facilitated.

<Configuration of Another Cleaner>

[0057] The brush 41 illustrated in Fig. 7 is configured such that the hair implantation region 43a is formed across the entire area of the brush base 43. Thus, the fiber portions 42 in the vicinity of the end portion contact the side plate 32 of the heat exchanger 31. Use of the brush 41 illustrated in Fig. 7 in the fan cleaning device 40 applies a load onto the brush 41 or easily contaminates the brush 41 when the brush 41 is, upon cleaning of the air blower fan 38, rotated to cause the brush 41 to contact the air blower fan 38.

[0058] For this reason, the fan cleaning device 40 may use, for example, a brush 41A illustrated in Figs. 8 to 10 instead of the brush 41. Figs. 8 to 10 illustrate a configuration of the brush 41A as another cleaner used in the present embodiment. Fig. 8 is a schematic view of the configuration of the brush 41A. Figs. 9 and 10 are each perspective views of a main portion of the configuration of the brush 41A.

[0059] As illustrated in Figs. 8 and 10, the brush 41A has, in the brush base 43, the hair implantation region 43a where the fiber portions 42 are implanted, and a hair non-implantation region 43b where no fiber portions 42 are implanted. The hair implantation region 43a is formed at other portions than one or both end portions of the brush base 43. The hair non-implantation region 43b is formed at one or both end portions of the brush base 43. The hair non-implantation region 43b is provided to extend from the outside to the inside of the side plate 32.

[0060] As illustrated in Fig. 9, the brush 41A is inserted into the housing portion 45a provided at the shaft 45, and is attached to the shaft 45. Moreover, the brush 41A can be detached from the shaft 45 by pulling from the housing portion 45a.

[0061] As illustrated in Figs. 8 and 10, the brush 41 has, at the end portion of the brush base 43, a handle portion 43c for gripping the brush base 43 with a human hand.

[0062] The handle portion 43c is a portion more closer to the end portion of the brush base 43 in the hair non-implantation region 43b formed at the end portion of the brush base 43. As illustrated in Figs. 8 and 10, the handle portion 43c protrudes outward of the end portion of the shaft 45 in a state in which the brush 41A is attached to the shaft 45.

[0063] In the fan cleaning device 40, the brush 41A can be easily detached from the shaft 45 by gripping of the handle portion 43c with the human hand. In this state, an operator operates the handle portion 43c to manually change the direction of the brush 41A, so that the brush 41A can be replaced at a position not contacting the air blower fan 38 and the heat exchanger 31. Note that the brush base 43 of the brush 41A may have elasticity to curve as in the brush base 43 of the brush 41 illustrated in Fig. 7.

[0064] The fan cleaning device 40 is configured such that when the brush 41A is rotated upon cleaning of the air blower fan 38, the fiber portions 42 do not contact the side plate 32 of the heat exchanger 31 at one or both end portions of the brush 41A. Thus, when the brush 41A is rotated, the fan cleaning device 40 can reduce a load on the brush 41A. Moreover, the fan cleaning device 40 can reduce contamination of the brush 41A.

[0065] Further, the fan cleaning device 40 is configured such that the handle portion 43c is provided at the brush base 43, and therefore, the brush 41 can be easily pulled out from a space at the side of the heat exchanger 31.

<Main Features of Air-Conditioner>

[0066] (1) As illustrated in Fig. 5, in the air-conditioner 10 of the present embodiment, the main body of the motor 51 for brush drive is arranged on the outside (the left side in Fig. 5) with respect to the outer end portion 34a of the curved portion provided at the hairpin pipe 34 of the heat exchanger 31.

[0067] In such an air-conditioner 10, a space can be ensured between the outer end portion 34a of the curved portion provided at the hairpin pipe 34 of the heat exchanger 31 and the motor 51. With this configuration, the air-conditioner 10 can reduce generation of condensation water and adherence of the condensation water to the motor 51 due to excessive cooling of the motor 51 due to the influence of cold air transmitted from the side plate 32 of the heat exchanger 31.

[0068] Moreover, in the air-conditioner 10, the motor 51 is arranged on the outside with respect to the outer end portion 34a of the curved portion of the hairpin pipe 34, and therefore, dropping of condensation water adhering to and dropping from the hairpin pipe 34 onto the motor 51 can be reduced.

(2) As illustrated in Fig. 5, the main body of the motor 51 may be preferably arranged such that the inner end portion 50x is separated from the side plate 32 and the outer end portion is separated from the exterior member of the housing. With this configuration, the air-conditioner 10 can reduce, upon drive of the motor 51, occurrence of noise due to propagation of vibration of the motor 51 to the decorative frame 22. Note that in the example illustrated in Fig. 3, the motor 51 may be also arranged such that the inner end portion 50x of the motor 51 is separated from the side plate 32 and the outer end portion is separated from the exterior member of the housing.

(3) As illustrated in Figs. 6A and 6B, the drain pan 39 is arranged below the heat exchanger 31 and the motor cover 60 to extend outward of the inner end portion of the motor cover 60. That is, the drain pan 39 is arranged below the heat exchanger 31 and the motor cover 60, and the end portion of the drain pan 39 is positioned on the outside with respect to the inner end portion of the motor cover 60. With this configuration, the air-conditioner 10 can reliably receive, by the drain pan 39, condensation water adhering to and dropping from the motor cover 60.

(4) As illustrated in Fig. 6B, the lower portion of the motor cover 60 may be preferably the inclined portion extending downward from the outer end portion side to the inner end portion side. With this configuration, in the air-conditioner 10, the lower surface of the lower portion of the motor cover 60 can function as the flow path R11 of condensation water adhering to the motor cover 60. As a result, the air-conditioner 10 can guide the condensation water adhering to the motor cover 60 to the drain pan 39, and can efficiently and reliably receive the condensation water by the drain pan 39.

(5) As illustrated in Fig. 6C, the entirety of the motor cover 60 may be preferably arranged on the inside with respect to the outer end portion of the drain pan 39. With this configuration, the air-conditioner 10 can reliably receive, by the drain pan 39, condensation water adhering to and dropping from the motor cover 60.

(6) As illustrated in Fig. 3, the air-conditioner 10 may preferably include the protruding portion 32p protruding from the outer surface of the side plate 32 to cover above the inner end portion of the motor 51. The protruding portion 32p functions as a dew guard section configured to reduce adherence of condensation water to the motor 51. With this configuration, the air-conditioner 10 can also reduce dropping of condensation water adhering to and dropping from the hairpin pipe 34 onto the motor 51.

(7) As illustrated in Fig. 4, the groove 62 for housing the lead line 53 of the motor 51 may be preferably formed at the lower portion of the motor cover 60. The lead line 53 passes through the groove 62 at the motor cover 60 such that housing in the housing portion 61 is allowed without a load on the lead line 53. Moreover, in the motor cover 60, the lead line 53 is drawn out through the groove 62 provided at the lower portion of the inner peripheral surface of the housing portion 61, so that the lead line 53 can be arranged to pass below the rotary shaft 52. With this configuration, the motor cover 60 allows arrangement of the lead line 53 in a direction in which less condensation water drops even if condensation water drops, for example, in the direction of the lead line 53. Such a motor cover 60 can reduce adherence of the condensation water to the lead line 53, and therefore, can reduce a motor failure rate.

(8) As illustrated in Fig. 4, the main body of the motor 51 may be preferably covered with the heat insulating member 54. With this configuration, the air-conditioner 10 can reduce generation of condensation water and adherence of the condensation water to the motor 51 due to excessive cooling of the motor 51.

(9) As illustrated in Figs. 8 to 10, the brush 41A (the cleaner) may be preferably configured such that the hair non-implantation region 43b where no fiber portions 42 are implanted is provided at one or both end portions of the brush base 43 (the base portion). Such a hair non-implantation region 43b may be provided to extend from the outside to the inside of the side plate 32. With this configuration, the air-conditioner 10 can prevent, when the brush 41A is rotated upon cleaning of the air blower fan 38, the fiber portions 42 from contacting the side plate 32 of the heat exchanger 31 at one or both end portions of the brush 41A. Thus, the air-conditioner 10 can reduce a load on the brush 41A when the brush 41A is rotated. Moreover, the air-conditioner 10 can reduce contamination of the brush 41A.

(10) As illustrated in Figs. 8 to 10, the end portion of the brush base 43 of the brush 41A may preferably protrude from the end portion of the shaft 45 as the handle portion 43c to the outside. With this configuration, the air-conditioner 10 allows the operator to grip the handle portion 43c upon replacement of the brush 41A, and therefore, the brush 41 can be easily pulled out from the space at the side of the heat exchanger 31.

[0069] As described above, according to the air-conditioner 10 of the first embodiment, adherence of condensation water to the main body of the motor 51 of the fan cleaning device 40 can be reduced.

[Second Embodiment]

[0070] In the motor assembly 50 (see Figs. 3 and 4) of the first embodiment, the motor cover 60 includes a single member.

[0071] On the other hand, a second embodiment provides a motor assembly 50A (see Figs. 11 to 13) configured such that a motor cover 60 includes multiple (e.g., two) members.

[0072] Hereinafter, a configuration of the motor assembly 50A according to the second embodiment will be described with reference to Figs. 11 to 12. Fig. 11 is a schematic view of the configuration of the motor assembly 50A. Fig. 12 is an exploded view of the configuration of the motor assembly 50A. Fig. 13 is a schematic sectional view of an internal structure of the motor assembly 50A.

[0073] As illustrated in Fig. 11, the motor assembly 50A of the second embodiment is, as compared to the motor assembly 50 (see Fig. 3) of the first embodiment, different in that the motor cover 60 includes two members of a first motor cover 71 and a second motor cover 72. In this embodiment, it will be described that the first motor cover 71 is a

member on a side (the outside) far from a side plate 32 of a heat exchanger 31 and the second motor cover 72 is a member on a side (the inside) closer to the side plate 32 of the heat exchanger 31. Note that in an example illustrated in Fig. 11, no spacer 69 illustrated in Fig. 5 is used, but the motor assembly 50A may be attached to the side plate 32 of the heat exchanger 31 through the spacer 69 illustrated in Fig. 5.

[0074] As illustrated in Fig. 12, the first motor cover 71 has a housing portion 61 for housing an outer portion of a main body of a motor 51, and fixing portions 66 to be fastened to, e.g., the side plate 32 of the heat exchanger 31 with screws 65. A groove 62 for housing a lead line 53 of the motor 51 is formed at a lower portion of an inner peripheral surface of the housing portion 61. The groove 62 is formed not to penetrate an inner wall surface (a left wall surface in Fig. 12) of the housing portion 61.

[0075] On the other hand, the second motor cover 72 has a housing portion 61a for housing an inner portion of the main body of the motor 51, and fixing portions 66a to be fastened to the first motor cover 71 with screws 55. As in the housing portion 61 of the first motor cover 71, a groove 62a for housing the lead line 53 of the motor 51 is formed at a lower portion of an inner peripheral surface of the housing portion 61a. the groove 62a is formed to penetrate an inner wall surface (a right wall surface in Fig. 12) of the housing portion 61a.

[0076] A structure is employed, in which the groove 62 of the first motor cover 71 and the groove 62a of the second motor cover 72 communicate with each other. The lead line 53 of the motor 51 is drawn out of the motor cover 60 through the groove 62 of the first motor cover 71 and the groove 62a of the second motor cover 72.

[0077] The motor assembly 50A is assembled as follows. First, a tape-shaped heat insulating member 54 is wound around the outer periphery of the main body of the motor 51 (see a white arrow A21). Next, the motor 51 around which the heat insulating member 54 is wound is housed in the housing portion 61 of the first motor cover 71 (see a white arrow A22). In this state, the lead line 53 of the motor 51 is drawn out of the first motor cover 71 through the groove 62 of the first motor cover 71. Next, the motor 51 is housed in the housing portion 61a of the second motor cover 72 (see a white arrow A23). In this state, the lead line 53 of the motor 51 is drawn out of the second motor cover 72 through the groove 62a of the second motor cover 72. In this manner, the motor assembly 50A is assembled.

[0078] Fig. 13 schematically illustrates a sectional structure of the motor assembly 50A as viewed from the side. Note that in Fig. 13, the lead line 53 of the motor 51 is not shown. As illustrated in Fig. 13, the motor assembly 50A seals the entire circumference of the motor 51 by the first motor cover 71 and the second motor cover 72, and in this state, is attached to the side plate 32. Such a motor assembly 50A can efficiently reduce adherence of condensation water to the motor 51.

[0079] As described above, according to the second embodiment, adherence of condensation water to the main body of the motor 51 of a fan cleaning device 40 can be efficiently reduced as in the first embodiment.

[0080] Note that the present invention is not limited to the above-described embodiments, and various changes and modifications can be made without departing from the gist of the present invention.

[0081] For example, the above-described embodiments have been described in detail for the sake of clear description of the gist of the present invention. Thus, the present invention is not limited to those including all components described above. Moreover, in the present invention, other components may be added to a certain component, and some components may be changed to other components. Further, in the present invention, some components may be omitted.

[0082] In addition, the motor assembly 50A (see Figs. 11 to 13) of the second embodiment described above may be, for example, modified as in first to fourth variations illustrated in Figs. 14 to 17.

<First Variation>

[0083] Fig. 14 is a schematic view of an internal structure of a motor assembly 50B of the first variation. As illustrated in Fig. 14, the motor assembly 50B according to the first variation is different on the following points as compared to the motor assembly 50A (see Figs. 11 to 13) of the second embodiment.

- (1) The first motor cover 71 has fixing portions 101 to be fastened to the second motor cover 72 with screws 111.
- (2) The second motor cover 72 has fixing portions 102 to be fastened to the side plate 32 with screws 112.

[0084] As in the motor assembly 50A (see Figs. 11 to 13) of the second embodiment, such a motor assembly 50B according to the first variation can efficiently reduce adherence of condensation water to the main body of the motor 51 of the fan cleaning device 40. Note that the motor 51 is housed in the first motor cover 71 and the second motor cover 72.

<Second Variation>

[0085] Fig. 15 is a schematic view of an internal structure of a motor assembly 50C of the second variation. As illustrated in Fig. 15, the motor assembly 50C of the second variation is different on the following points as compared to the motor assembly 50B (see Fig. 14) of the first variation.

EP 3 795 911 A1

(1) The motor cover 60 includes only the first motor cover 71.

(2) The side plate 32 includes a contact portion 32Z protruding in a screw boss shape from the outer surface of the side plate 32 to contact the inner end portion of the motor cover 60.

[0086] As compared to the motor assembly 50B (see Fig. 14) of the first variation, such a motor assembly 50C of the second variation can reduce the number of components by the second motor cover 72. Note that the motor cover 60 and the contact portion 32Z (a screw boss) may preferably have such a structure that the motor cover 60 and the contact portion 32Z covers at least above the entirety of the main body of the motor 51. With this configuration, the motor assembly 50C according to the second variation can efficiently reduce adherence of condensation water to the main body of the motor 51 of the fan cleaning device 40.

<Third Variation>

[0087] Fig. 16 is a schematic view of an internal structure of a motor assembly 50D of the third variation. As illustrated in Fig. 16, the motor assembly 50D of the third variation is different on the following points as compared to the motor assembly 50B (see Fig. 14) of the first variation.

(1) The first motor cover 71 has a fixing portion 104 to be fastened to the side plate 32 with a screw 111, and the fixing portion 104 is provided to protrude in a direction in which the fixing portion 104 does not overlap with the fixing portions 102 of the second motor cover 72.

(2) The motor 51 has fixing portions 103 to be fastened to the second motor cover 72 with screws 113.

(3) The first motor cover 71 has cover portions 67 covering above the fixing portions 102 of the second motor cover 72.

[0088] Such a motor assembly 50D of the third variation allows the cover portions 67 to function as a dew guard section configured to reduce adherence of condensation water to the motor 51. Thus, the motor assembly 50D of the third variation can efficiently reduce adherence of condensation water to the main body of the motor 51 of the fan cleaning device 40. Moreover, the cover portions 67 function as a positioning section configured to contact the side plate 32 to determine the position of the motor assembly 50D. With this configuration, the motor assembly 50D can be stably arranged at a desired position.

<Fourth Variation>

[0089] Fig. 17 is a schematic view of an internal structure of a motor assembly 50E of the fourth variation. As illustrated in Fig. 17, the motor assembly 50E of the fourth variation is different on the following points as compared to the motor assembly 50D (see Fig. 16) of the third variation.

(1) The first motor cover 71 has no cover portions 67 (see Fig. 16).

(2) Instead, a mating surface between the first motor cover 71 and the second motor cover 72 has such a lap structure 68 that surfaces engage with each other.

[0090] Such a motor assembly 50E of the fourth variation can cause the lap structure 68 to function as a dew guard section configured to reduce adherence of condensation water to the motor 51. Thus, the motor assembly 50E of the fourth variation can efficiently reduce adherence of condensation water to the main body of the motor 51 of the fan cleaning device 40.

LIST OF REFERENCE NUMERALS

[0091]

10	Air-conditioner
11	Indoor unit
12	Outdoor unit
13	Connection pipe
21	Housing
22	Decorative frame (exterior member)
23	Front panel
24	Air suction port
25	Air blow port

26	Upper-to-lower wind deflector
31	Heat exchanger
31a	Fin
32	Side plate
5 32p	Protruding portion
32Z	Contact portion (screw boss)
34	Hairpin pipe
34a	Outer end portion of curved portion
38	Air blower fan
10 39	Drain pan
40	Fan cleaning device
41	Brush (cleaner)
42	Fiber portion
43	Brush base (base portion)
15 43a	Hair implantation region
43b	Hair non-implantation region
43c	Handle portion
43z	Rail portion
45	Shaft
20 45a	Housing portion
50, 50A	Motor assembly
50x	Inner end portion
50y	Outer end portion
50z	Mating surface
25 51	Motor (drive section)
52	Rotary shaft
53	Lead line
54	Heat insulating member
55,65,111,112,113	Screw
30 56, 66, 101, 102, 103	Fixing portion
60	Motor cover
61, 61a	Housing portion
62, 62a	Groove (for drawing lead line)
67	Cover portion (positioning section)
35 68	Lap structure
69	Spacer
71	First motor cover
72	Second motor cover

40

Claims

1. An air-conditioner comprising:

- 45 a heat exchanger;
an air blower fan;
a cleaner configured to clean the air blower fan; and
a motor arranged on an outside with respect to a side plate of the heat exchanger and configured to drive the cleaner,
50 wherein a main body of the motor is arranged on the outside with respect to an outer end portion of a curved portion provided at a hairpin pipe of the heat exchanger.

2. An air-conditioner comprising:

- 55 a heat exchanger;
an air blower fan;
a cleaner configured to clean the air blower fan;
a motor arranged on an outside with respect to a side plate of the heat exchanger and configured to drive the

cleaner,
a motor cover configured to cover a main body of the motor; and
a drain pan configured to receive condensation water dropping from the heat exchanger,
wherein the drain pan is arranged below the heat exchanger and the motor cover, and an end portion of the
drain pan is positioned on an outside with respect to an inner end portion of the motor cover.

3. The air-conditioner according to claim 1 or 2, wherein
the motor is arranged such that an inner end portion thereof is separated from the side plate and an outer end portion
thereof is separated from an exterior member of a housing.

4. The air-conditioner according to claim 1 or 2, further comprising:
a protruding portion protruding from an outer surface of the side plate to cover above an inner end portion of the motor.

5. The air-conditioner according to claim 1 or 2, wherein
the cleaner includes a base portion in which a fiber portion is implanted, and
a region where no fiber portion is implanted is provided at an end portion of the base portion.

6. The air-conditioner according to claim 5, wherein
the region where no fiber portion is implanted is provided to extend from an outside to an inside of the side plate.

7. The air-conditioner according to claim 2, wherein
a lower portion of the motor cover is an inclined portion extending downward from an outer end portion side to an
inner end portion side.

8. The air-conditioner according to claim 2, wherein
an entirety of the motor cover is arranged on an inside with respect to an outer end portion of the drain pan.

9. The air-conditioner according to claim 2, wherein
a groove for housing a lead line of the motor is formed at a lower portion of an inner peripheral surface of the motor
cover.

10. The air-conditioner according to claim 2, further comprising:
a heat insulating member configured to cover a peripheral surface of the main body of the motor.

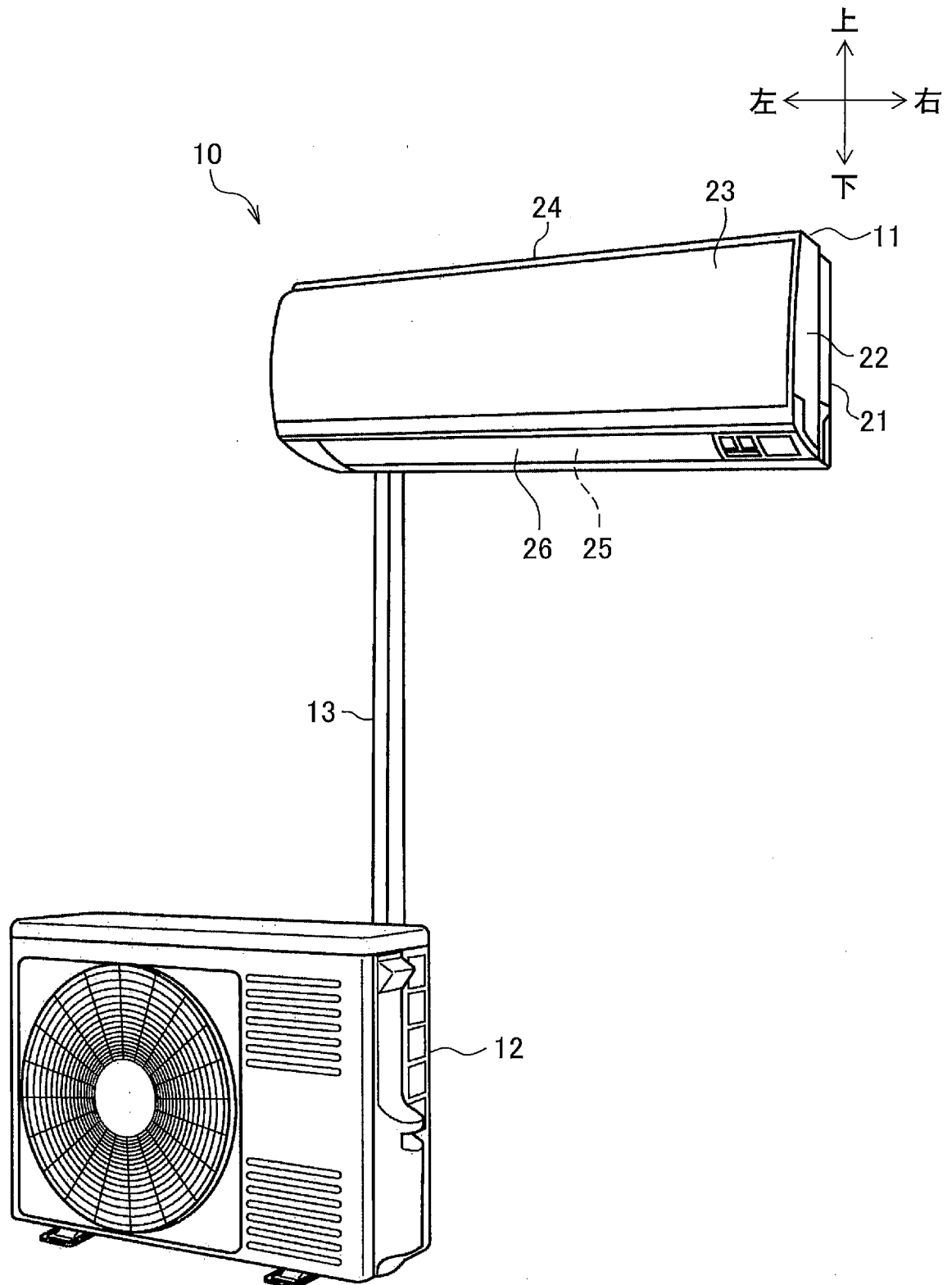
11. The air-conditioner according to claim 2, wherein
the side plate includes a contact portion formed to protrude from an outer surface of the side plate to contact the
inner end portion of the motor cover, and
the motor cover and the contact portion have such a structure that the motor cover and the contact portion cover at
least above an entirety of the main body of the motor.

12. The air-conditioner according to claim 2, further comprising:
a cover portion formed at the motor cover to cover above an inner end portion of the motor.

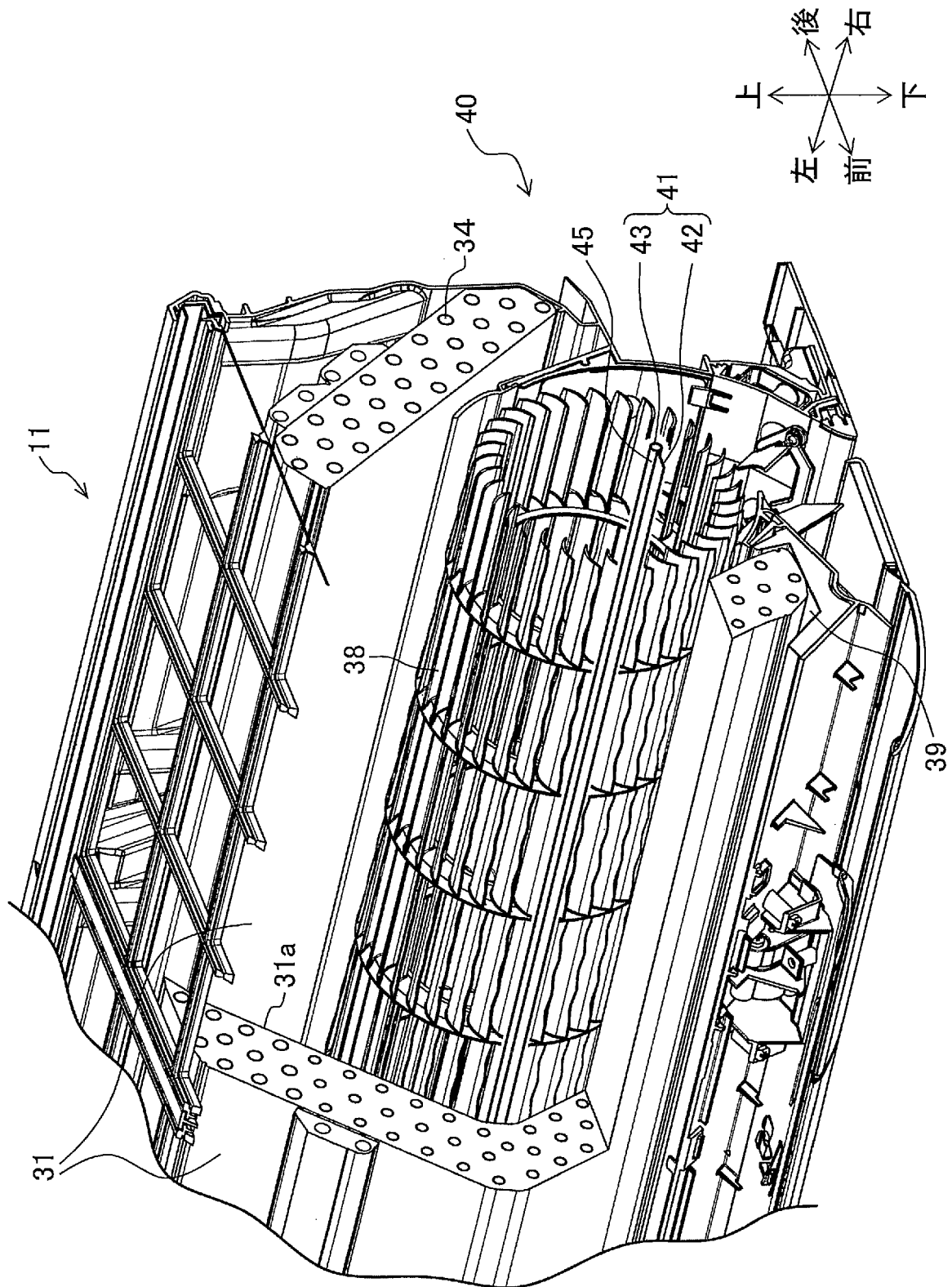
13. The air-conditioner according to claim 12, wherein
the cover portion functions as a positioning section configured to contact the side plate to determine a position of
the motor.

14. The air-conditioner according to claim 2, wherein
the motor cover includes multiple cover members, and
a mating surface between the cover members has a lap structure.

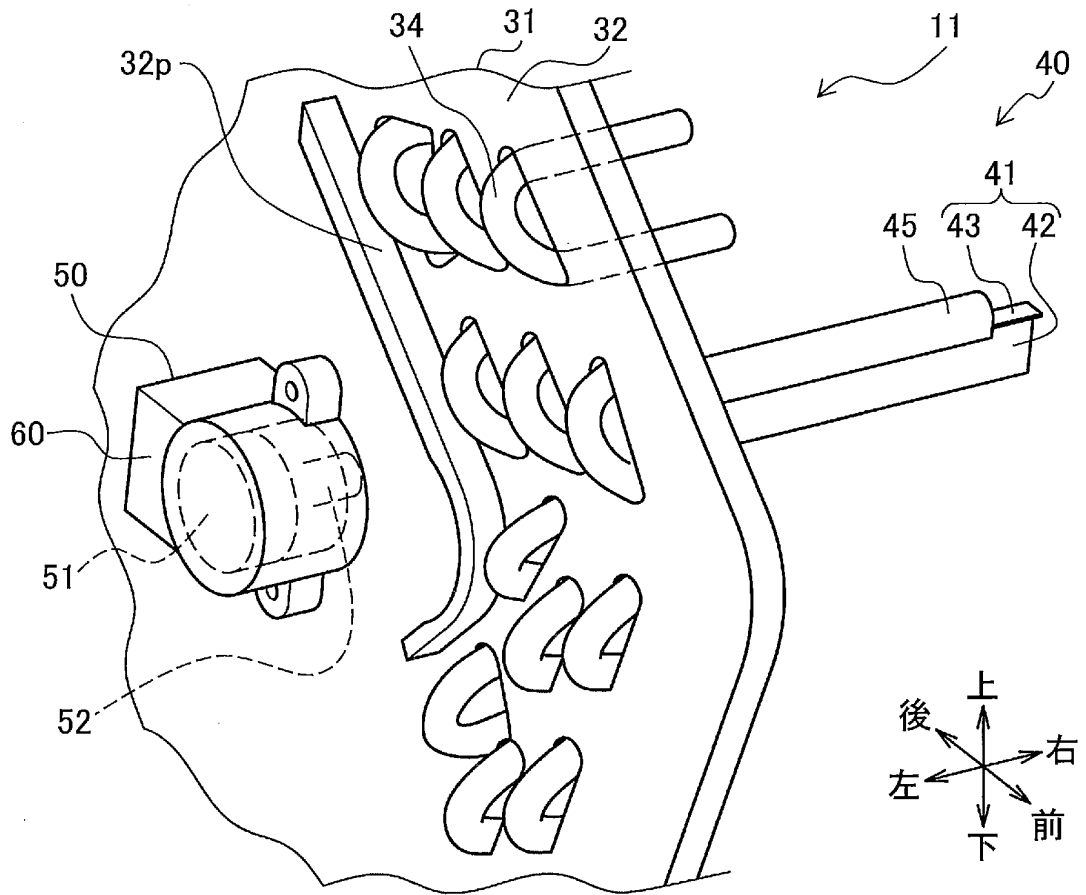
[図1]



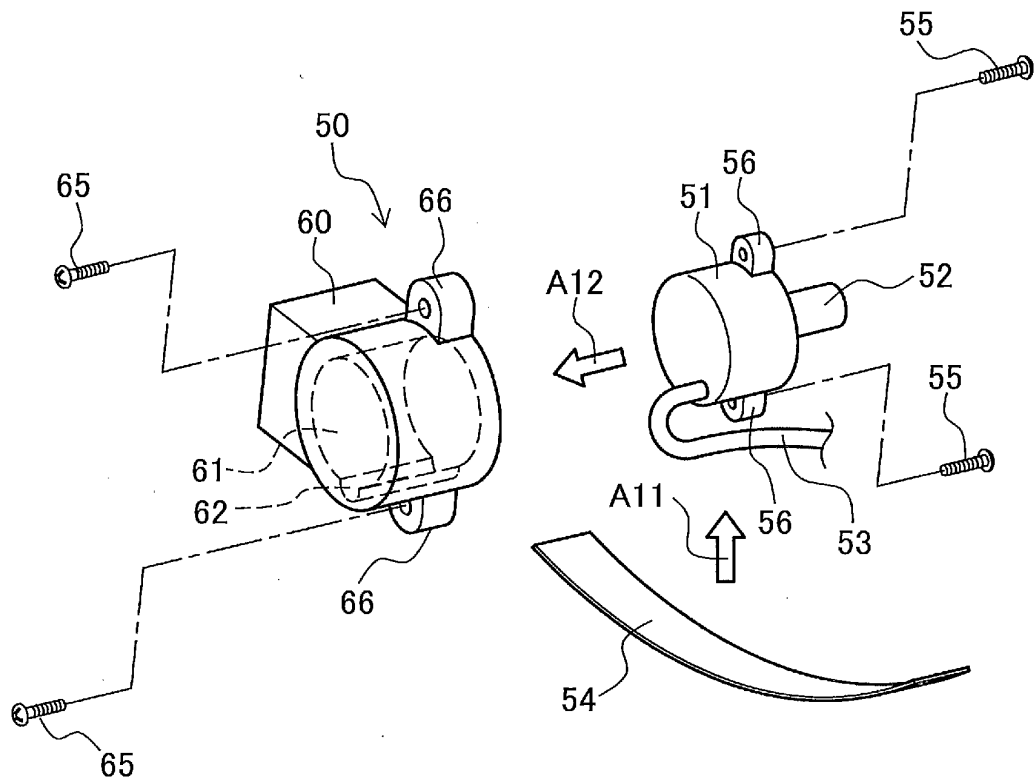
[図2]



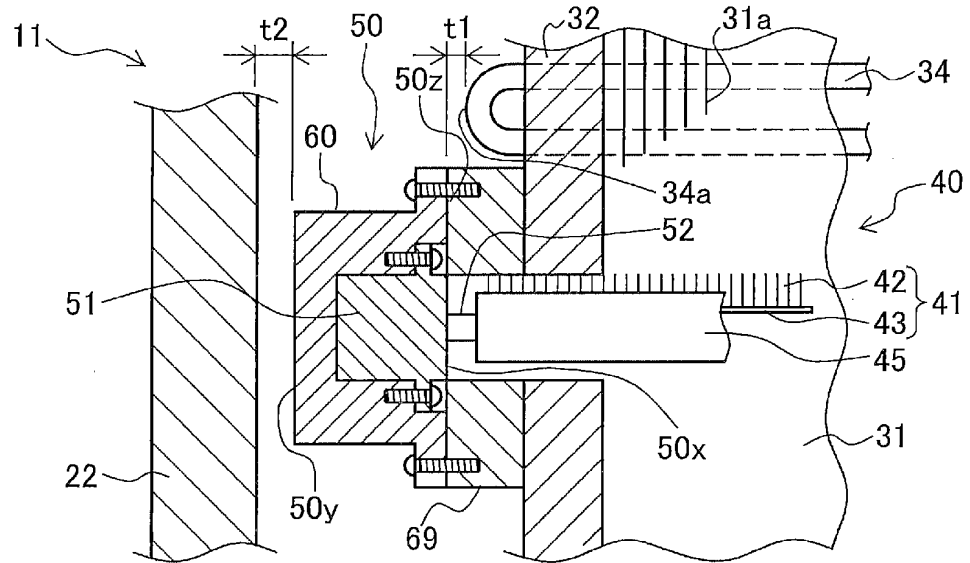
【図3】



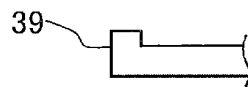
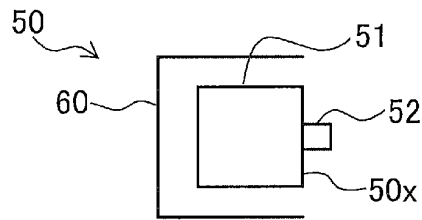
【図4】



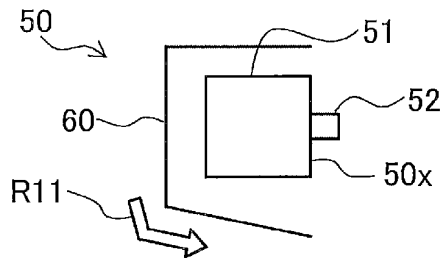
[図5]



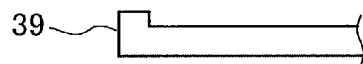
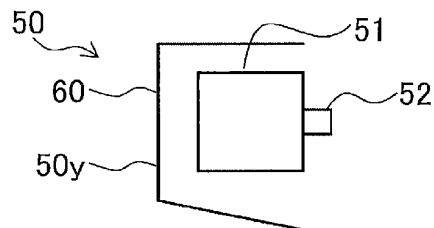
[図6A]



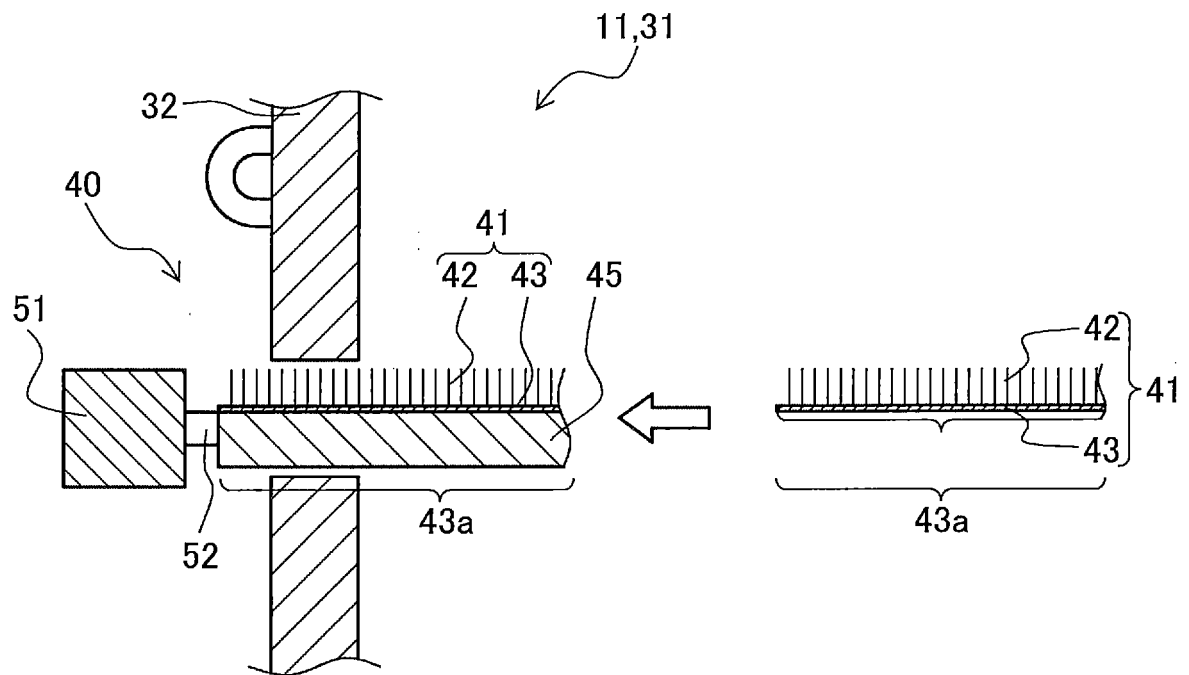
[図6B]



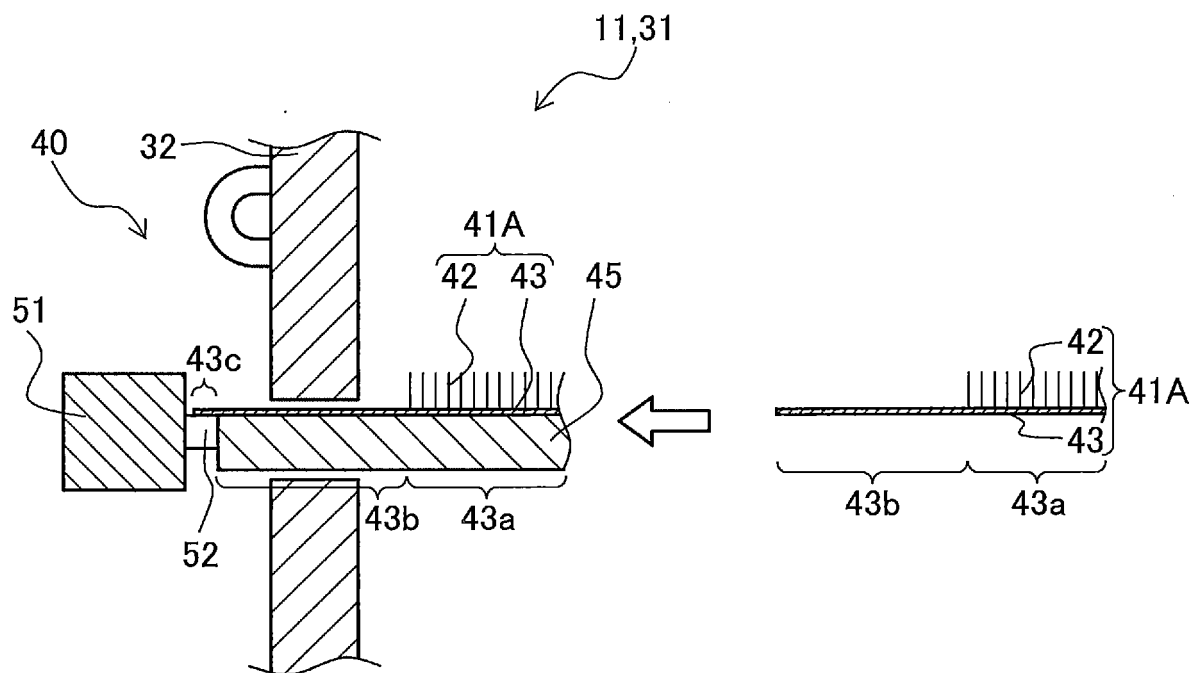
[図6C]



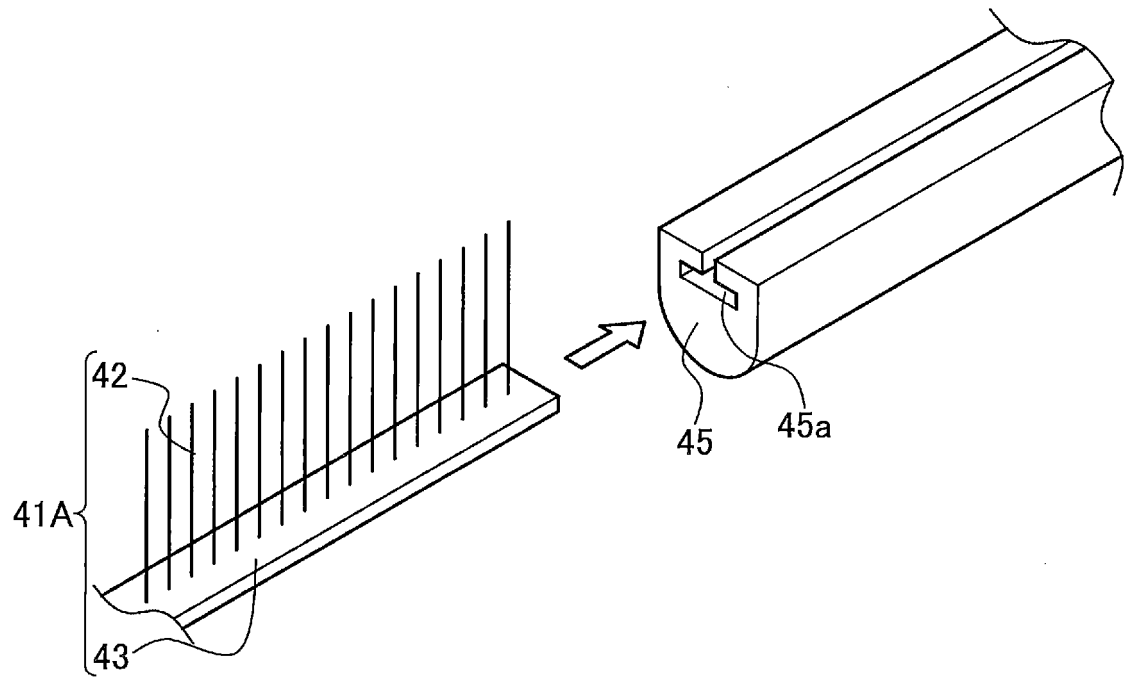
[図7]



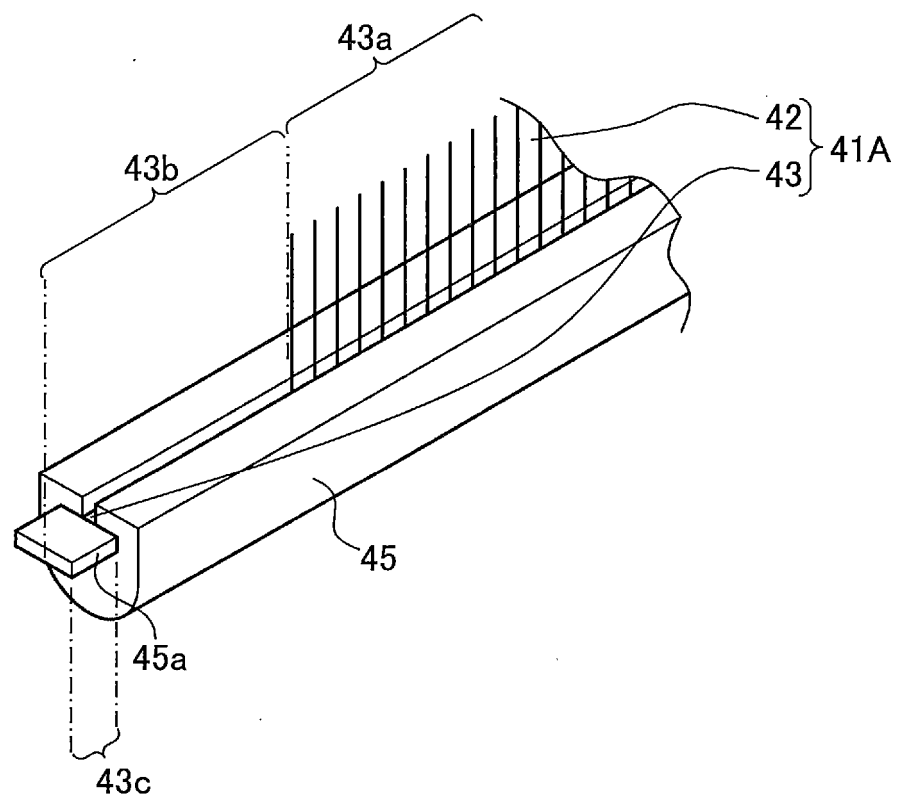
[図8]



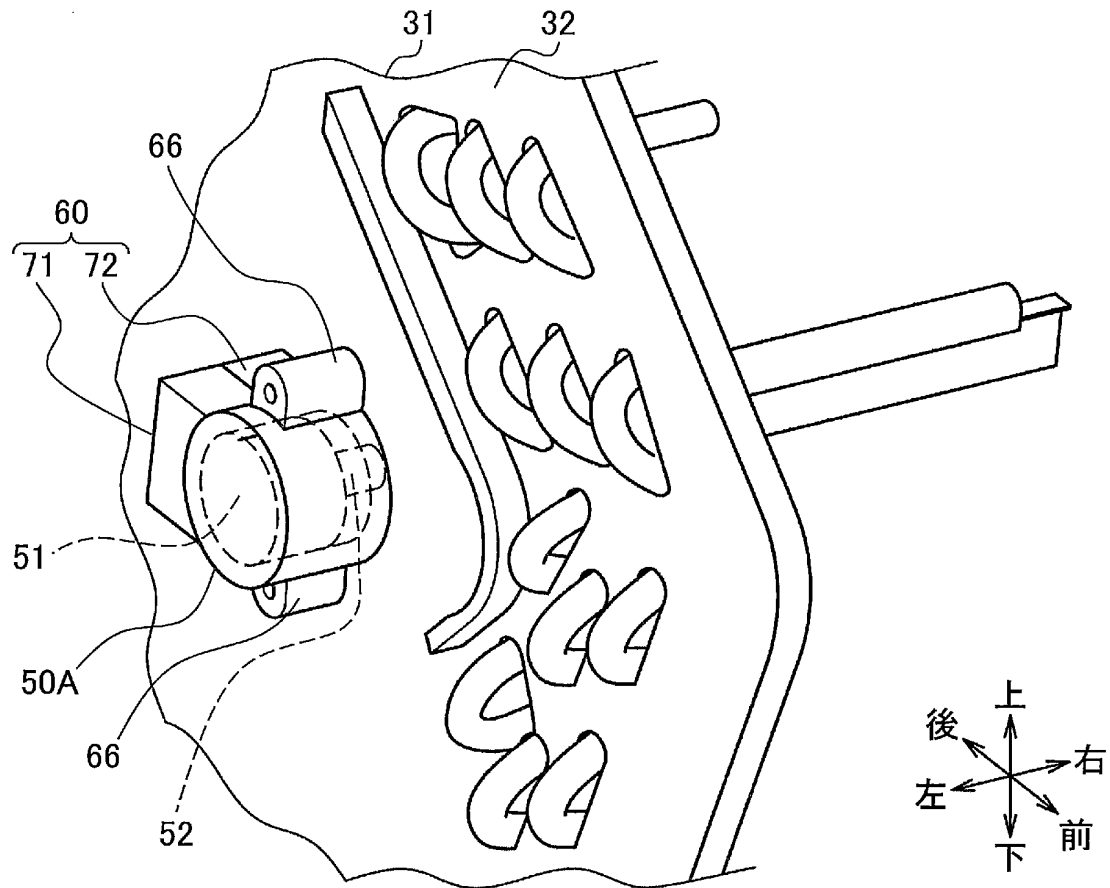
[図9]



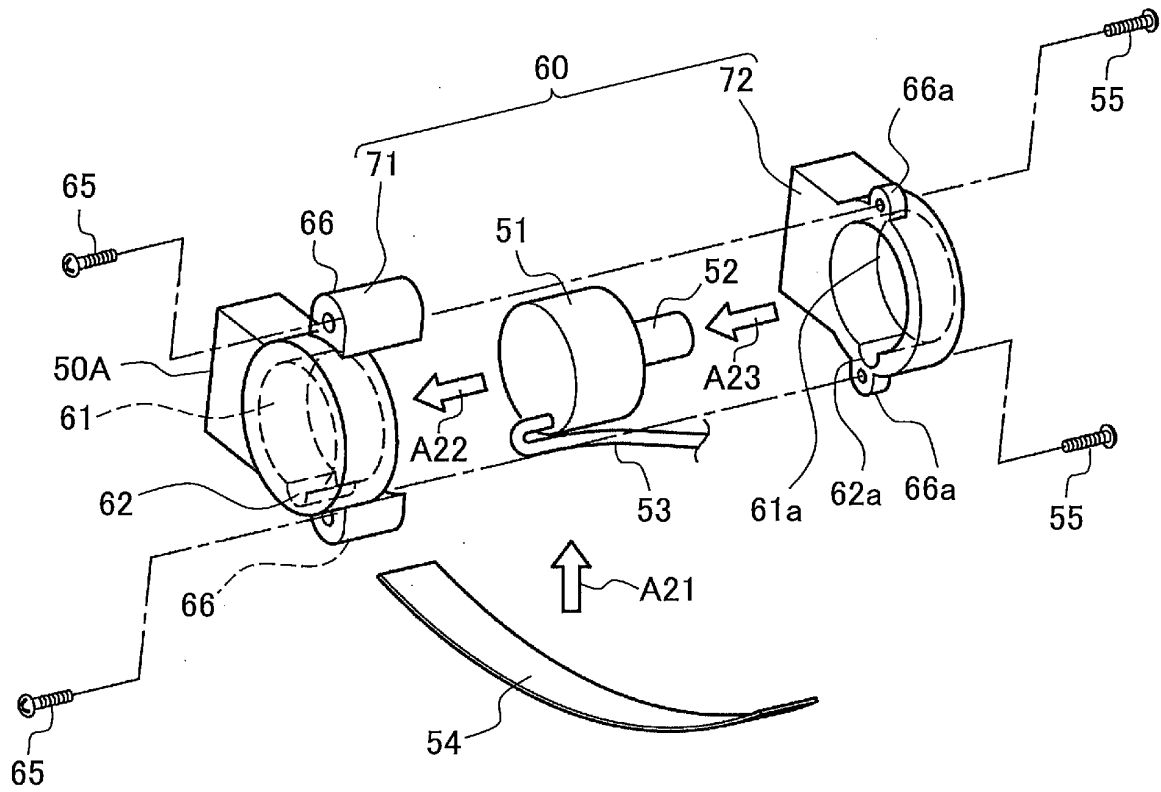
[図10]



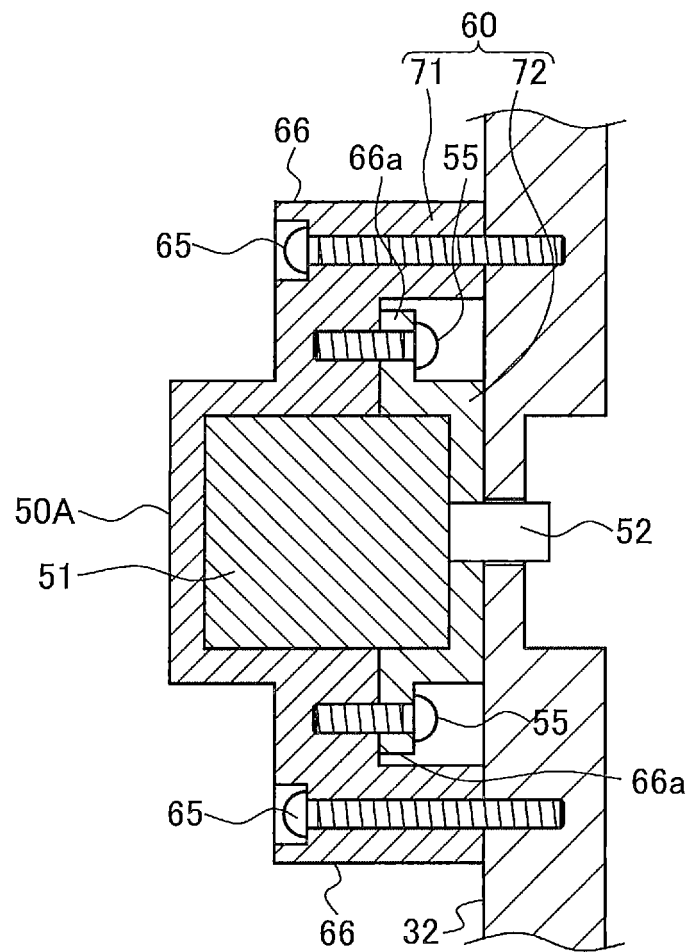
[図11]



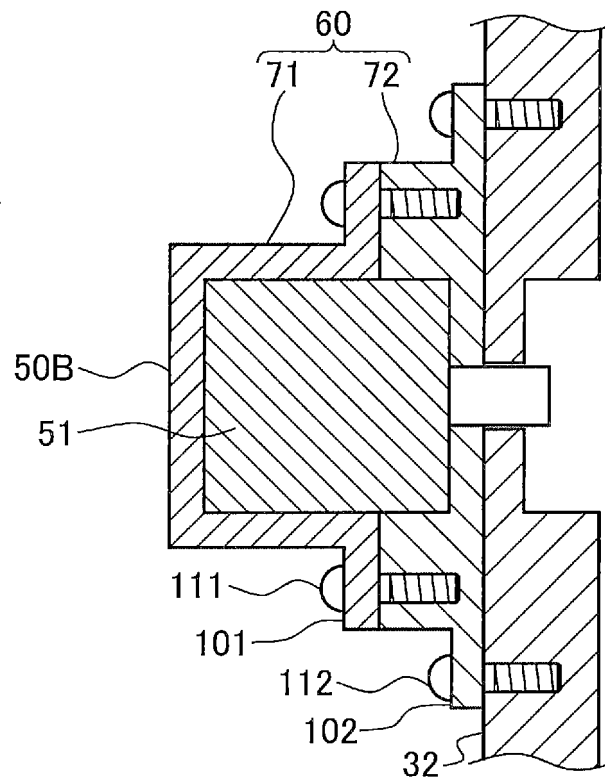
[図12]



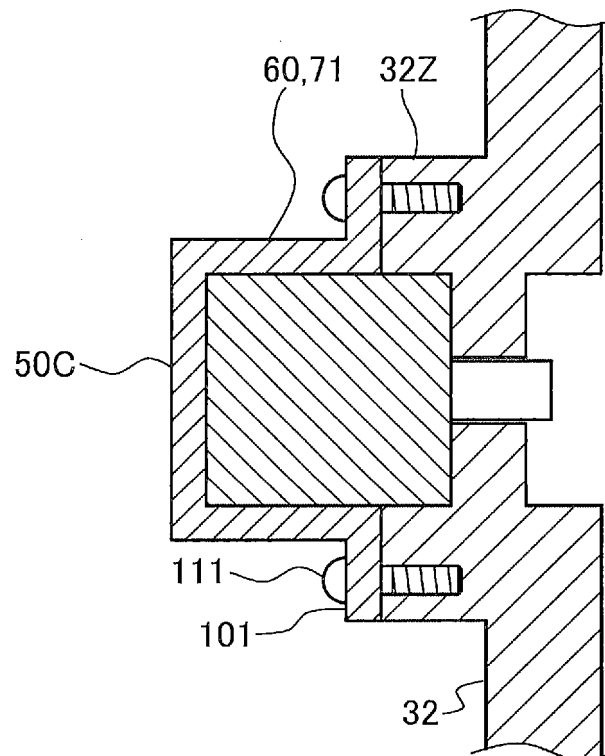
[図13]



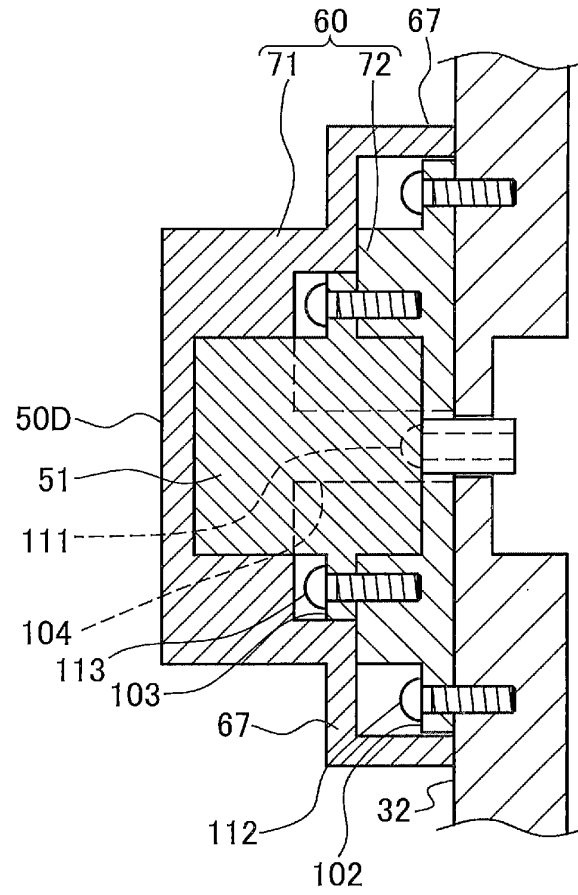
[図14]



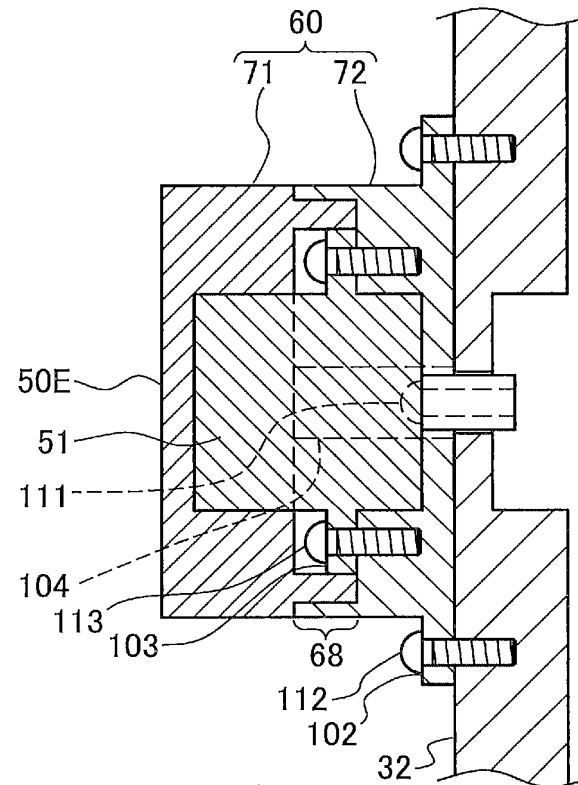
[図15]



[圖16]



[圖17]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/018519

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F24F1/00 (2011.01) i, F24F11/49 (2018.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl. F24F1/00, F24F11/49

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 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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 A	JP 2008-051430 A (TOSHIBA CARRIER CORP.) 06 March 2008, paragraphs [0015]-[0050], fig. 1-12 (Family: none)	1, 3, 5 2, 4, 6-14
A	JP 2008-045758 A (TOSHIBA CARRIER CORP.) 28 February 2008, paragraphs [0008]-[0042], fig. 1-9 (Family: none)	2, 4, 6-14
A	JP 2002-071157 A (TOSHIBA CARRIER CORP.) 08 March 2002, paragraphs [0013]-[0035], fig. 1-9 (Family: none)	2, 4, 6-14



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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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
20.07.2018Date of mailing of the international search report
31.07.2018Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/018519

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009/028766 A2 (LG ELECTRONICS INC.) 05 March 2009, paragraphs [0026]-[0117], fig. 1-10 & EP 2181292 A2 & KR 10-2009-0022098 A & CN 101772677 A	2, 4, 6-14

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 4046755 B [0004]