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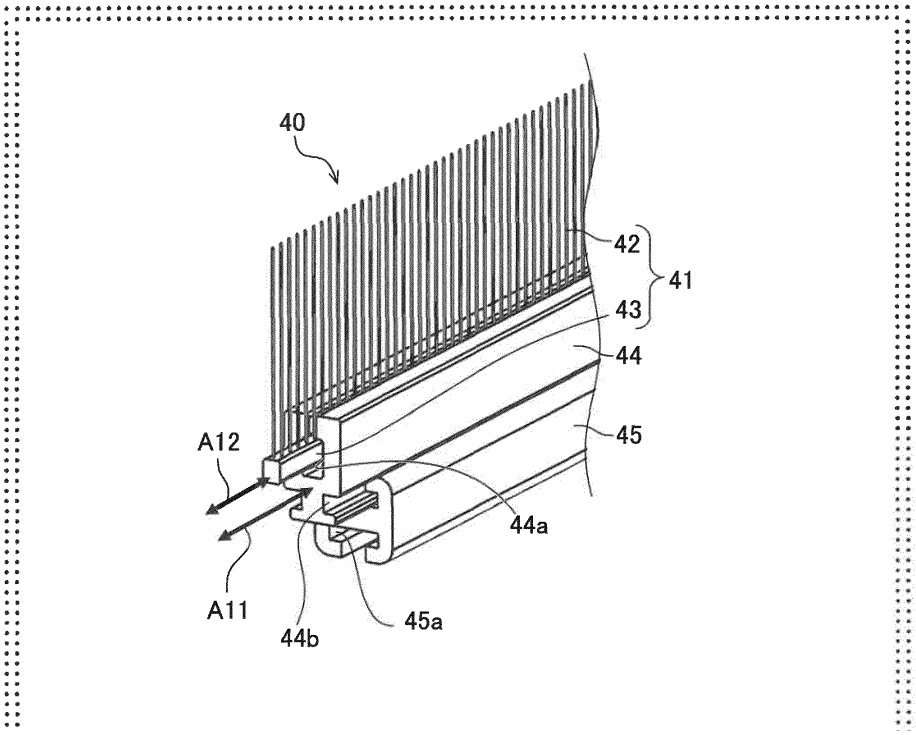
(54) **AIR CONDITIONER**

(57) An air-conditioner (10) includes a heat exchanger (31), an air blowing fan (38), and a fan cleaning device (40) configured to clean the air blowing fan. The fan cleaning device includes a shaft (45), a motor (34) configured to rotatably drive the shaft in a direction about an axis, and a cleaner (a brush (41)) attached to the shaft. The cleaner and the shaft are separated bodies.

FIG. 3



EP 3 822 491 A1

Description

TECHNICAL FIELD

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

BACKGROUND ART

[0002] Generally, in an air-conditioner including an air blowing fan, more grit and dust adhere to the air blowing fan as operating time increases. Thus, in the air-conditioner, an air volume is decreased and power consumption is increased in some cases. Moreover, in the air-conditioner, fungi etc. might be caused due to grit and dust adherence, leading to insanitation. For these reasons, an air-conditioner has been provided, which includes a fan cleaning device configured to remove grit and dust adhering to an air blowing fan to clean the air blowing fan (see, e.g., Patent Document 1). The air-conditioner described in Patent Document 1 includes a 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 operation mode for rotating a fan at low speed and operating the fan cleaning device. The fan cleaning device includes a cleaner configured to contact the fan in the fan cleaning operation mode, and in the normal operation mode, is movable to a position at which the cleaner is retracted from the fan.

CITATION LIST

PATENT DOCUMENT

[0003] Patent Document 1: Japanese Patent No. 4046755

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] Patent Document 1 states that the grit and dust adhering to the air blowing fan are removed by the cleaner of the fan cleaning device, but fails to describe replacement of the cleaner. The fan cleaning device includes the cleaner configured to contact the air blowing fan, such as a brush. As cumulative cleaning time increases, the cleaner is deteriorated or consumed. Thus, there is a probability that a cleaning effect is lowered. For this reason, it has been demanded for the air-conditioner that replacement of the cleaner of the fan cleaning device be facilitated.

[0005] 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 so that a cleaner can be easily replaced.

SOLUTIONS TO THE PROBLEMS

[0006] For accomplishing the above-described object, the present invention relates to an air-conditioner including a heat exchanger, an air blowing fan, and a fan cleaning device configured to clean the air blowing fan. The fan cleaning device includes a shaft, a motor configured to rotatably drive the shaft in a direction about an axis, and a cleaner attached to the shaft. The cleaner and the shaft are separated bodies.

[0007] Other techniques will be described later.

EFFECTS OF THE INVENTION

[0008] According to the present invention, the cleaner of the fan cleaning device can be easily replaced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

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 the vicinity of an air blowing fan in an indoor device of the air-conditioner according to the first embodiment.
Fig. 3 is a perspective view (1) of a configuration of a cleaner of a fan cleaning device used in the first embodiment.
Fig. 4 is a perspective view (2) of the configuration of the cleaner of the fan cleaning device used in the first

embodiment.
Fig. 5 is a view of a relationship between fiber portions of the cleaner of the fan cleaning device and fins of a heat exchanger.
Fig. 6 is a view of comparison between the cleaner of the fan cleaning device and a cleaner of a filter cleaning device.
Fig. 7 is a perspective view of an example of attachment of the cleaner to a shaft in the fan cleaning device used in the first embodiment.
Fig. 8 is a view (1) for describing an attachment tool suitable for attachment of the cleaner.
Fig. 9 is a view (2) for describing the attachment tool suitable for attachment of the cleaner.
Fig. 10 is a front view (1) of a configuration of a cleaner of a fan cleaning device used in a second embodiment.
Fig. 11 is a front view (2) of the configuration of the cleaner of the fan cleaning device used in the second embodiment.
Fig. 12 is a front view of the configuration of the cleaner of the fan cleaning device used in the second embodiment at both end portions.
Fig. 13 is a perspective view of a configuration of a cleaner of a fan cleaning device according to a first variation.
Fig. 14 is a perspective view of configurations of a holder and a shaft of a fan cleaning device according to a second variation.

DESCRIPTION OF EMBODIMENTS

[0010] 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 merely schematically illustrates the present invention 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.

[First Embodiment]

[0011] A first embodiment is intended to provide an air-conditioner 10 whose usage cost is reduced due to the availability of replacement of only a cleaner. Moreover, the first embodiment is also intended to provide the air-conditioner 10 configured so that in a case where a cleaner etc. with special additional functions are developed in the future, replacement with such a cleaner etc. can be facilitated.

<Entire Configuration of Air-Conditioner>

[0012] 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.

[0013] As illustrated in Fig. 1, the air-conditioner 10 has an indoor device 11 arranged inside a room, and an outdoor device 12 arranged outside the room.

[0014] The indoor device 11 is configured to suck indoor air to obtain, from the sucked indoor air, conditioned air subjected to any optional processing of heating, cooling, and dehumidification through a heat exchanger 31 (see Fig. 2), thereby blowing the obtained conditioned air into the room to air-condition the inside of the room. The indoor device 11 is connected to the outdoor device 12 through a connection pipe 13 such that refrigerant circulates between the indoor device 11 and the outdoor device 12. The outdoor device 12 is configured to perform heat exchange with the circulating refrigerant.

[0015] The indoor device 11 includes, with a housing 21 and a decorative frame 22 as an exterior member of the housing 21, structures such as an air blowing fan 38 (see Fig. 2) and the heat exchanger 31 (see Fig. 2). The air blowing 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 is configured to send air heat-exchanged by the heat exchanger 31. The heat exchanger 31 is a unit configured to perform heat exchange with refrigerant.

[0016] 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 device 11. Moreover, an upper-to-lower wind deflector 26 is attached to a lower portion of the front surface of the decorative frame 22.

[0017] The upper-to-lower wind deflector 26 is a member configured to define the direction of conditioned air discharged from the air blow port 25 in an upper-to-lower direction. The upper-to-lower wind deflector 26 is, in the vicinity of a lower end, pivotally supported by the decorative frame 22 (or the housing 21) to open/close an upper portion in the upper-to-lower direction, and is configured rotatably by a not-shown actuator. The indoor device 11 opens the upper-to-lower wind deflector 26 to form the air blow port 25.

<Configuration of Vicinity of Air Blowing Fan>

[0018] Hereinafter, a configuration of the vicinity of the air blowing fan 38 in the indoor device 11 of the air-conditioner 10 will be described with reference to Fig. 2. Fig. 2 is a schematic view of the configuration of the vicinity of the air blowing fan 38.

[0019] As illustrated in Fig. 2, the structures such as the air blowing fan 38 and the heat exchanger 31 are arranged inside the indoor device 11. When the indoor device 11 is continuously used, grit and dust etc. adhere to the air blowing fan 38. For this reason, the indoor device 11 has a fan cleaning device 40 configured to clean the air blowing fan 38.

<Configuration of Fan Cleaning Device>

[0020] Hereinafter, a configuration of a brush 41 (the cleaner) of the fan cleaning device 40 will be described with reference to Figs. 3 and 4. Figs. 3 and 4 are each perspective views of the configuration of the brush 41. Fig. 3 illustrates a structure in which the brush 41 is slidable. Fig. 4 illustrates a structure in which the brush 41 is bendable.

[0021] As illustrated in Fig. 3, the fan cleaning device 40 has, in the present embodiment, the brush 41, a holder 44, a shaft 45, and a motor 34 (see Fig. 2). One of a brush base 43 of the brush 41 and the holder 44 has a groove-shaped housing portion configured to slidably house the other of the brush base 43 and the holder 44 in a longitudinal direction of the air blowing fan 38. In description herein, the holder 44 has a groove-shaped housing portion 44a. Moreover, one of the holder 44 and the shaft 45 has a groove-shaped housing portion configured to slidably house the other of the holder 44 and the shaft 45 in the longitudinal direction of the air blowing fan 38. In description herein, the shaft 45 has a groove-shaped housing portion 45a.

[0022] The brush 41 is a member (the cleaner) configured to contact and clean the air blowing fan 38.

[0023] The holder 44 is a member configured to hold the brush 41.

[0024] The shaft 45 is a member configured to hold the brush 41 (the cleaner) together with the holder 44.

[0025] The motor 34 is a drive section configured to rotatably drive the shaft 45 in a direction about an axis.

[0026] Note that the brush 41 and the shaft 45 are separated bodies. The brush 41 is attached to the shaft 45 to move in the longitudinal direction of the air blowing fan 38 by a predetermined distance. The brush 41 is directly attached to the shaft 45, or is attached to the shaft 45 through other members (in this case, the later-described holder 44). In description herein, the brush 41 is attached to the shaft 45 through the holder 44 as other members. The brush 41 is attached to the holder 44 so that moderate elasticity allowing bending can be ensured and stiffness suitable for attachment to the shaft 45 can be obtained. Thus, for the brush 41, attachment to the shaft 45 can be facilitated. Note that the fan cleaning device 40 can be configured such that the holder 44 is omitted. In the case of this configuration, the brush 41 is directly attached to or detached from the shaft 45. Note that the "elasticity" means such a property that an object deforms due to external force application to the object and returns to an original shape when such force is removed. Moreover, the "stiffness" means such a property that an object resists deformation when such deformation is about to occur due to external force application.

[0027] Each of the brush 41, the holder 44, and the shaft 45 is an elongated member. Hereinafter, the brush 41, the holder 44, and the shaft 45 will be collectively referred to as "the brush 41 etc." The brush 41 etc. are arranged rotatably about the axes between a fin 32 of the heat exchanger 31 and the air blowing fan 38. For covering the entire area of the air blowing fan 38 in the longitudinal direction thereof, the brush 41 etc. are slightly longer than the longitudinal length of the air blowing fan 38. The brush 41 etc. are arranged such that both end portions thereof penetrate two side plates 33 (see Fig. 12) arranged at both end portions of the heat exchanger 31.

[0028] Both end portions of the brush 41 etc. are sealed with sealing members. The sealing members include, for example, the motor 34 (or a member such as a gear to be driven by the motor 34 or an adaptor 35 coupled to the gear) and an attachment member 36 (see Fig. 12) configured to rotatably hold end portions of the brush 41 etc.

[0029] The brush 41 has multiple fiber portions 42 and the brush base 43. The fiber portions 42 are contact portions configured to contact the air blowing fan 38. The brush base 43 is a base portion configured to hold each fiber portion 42.

[0030] As illustrated in Fig. 3, the brush base 43 (the base portion) is, in the present embodiment, in a rectangular shape as viewed laterally, and the multiple fiber portions 42 (the contact portions) are implanted into an upper surface of the brush base 43. The brush base 43 is housed in the housing portion 44a formed at the holder 44.

[0031] In an illustrated example, the holder 44 is in such a shape that an inverted T-shaped portion is joined to a lower side of a rectangular portion as viewed laterally. The holder 44 has the groove-shaped housing portion 44a and a rail portion 44b.

[0032] The housing portion 44a is a portion in which the brush base 43 is slidably housed in the longitudinal direction (see an arrow A12) of the air blowing fan 38. The housing portion 44a is formed to penetrate the inside of the rectangular portion of the holder 44 in the longitudinal direction of the air blowing fan 38. The housing portion 44a is in a rectangular shape as viewed laterally, and on an upper side thereof, opens slightly larger than the thickness of the fiber portions 42 so that the fiber portions 42 can move in the longitudinal direction of the air blowing fan 38.

[0033] The rail portion 44b is a portion housed in the housing portion 45a formed at the shaft 45. The rail portion 44b is in an inverted T-shape as viewed laterally. The rail portion 44b is formed across the entire area of the holder 44 in a longitudinal direction thereof.

[0034] The shaft 45 is in a rounded rectangular shape as viewed laterally. The shaft 45 has the groove-shaped housing portion 45a. In the illustrated example, the shaft 45 has two housing portions 45a.

[0035] The housing portion 45a is a portion in which the rail portion 44b is slidably housed in the longitudinal direction (see an arrow A11) of the air blowing fan 38. The housing portion 45a is formed to penetrate the inside of the shaft 45 in the longitudinal direction of the air blowing fan 38. The housing portion 45a is formed with a slightly-larger size than that of the rail portion 44b in a shape similar to that of the rail portion 44b as viewed laterally so that the rail portion 44b can be inserted and slid in the housing portion 45a.

[0036] In such a configuration, the holder 44 can be easily attached to the shaft 45 in such a manner that the rail portion 44b is inserted and slid in the housing portion 45a. Moreover, the holder 44 can be taken out of the shaft 45 in such a manner that the rail portion 44b is pulled out of the housing portion 45a. Further, the brush 41 can be easily attached to the holder 44 in such a manner that the brush base 43 is inserted and slid in the housing portion 44a. In addition, the brush 41 can be taken out of the holder 44 in such a manner that the brush base 43 is pulled out of the housing portion 44a.

[0037] The brush base 43 and the holder 44 are, for example, made of resin. The shaft 45 is, for example, made of metal or resin.

[0038] The brush base 43 of the brush 41 and the holder 44 exhibit the elasticity. Thus, as illustrated in Fig. 4, the brush 41 and the holder 44 can be attached to or detached from the shaft 45 in a bent state (see an arrow Alia).

[0039] Elastic force of the brush base 43 may be preferably greater than that of the shaft 45. That is, the stiffness of the brush base 43 may be preferably smaller than that of the shaft 45. Moreover, the elastic force of the brush base 43 may be greater than that of the holder 44. That is, the stiffness of the brush base 43 may be preferably smaller than that of the holder 44. With this configuration, the fan cleaning device 40 can ensure, for the brush 41 and the holder 44, moderate elasticity allowing bending while the stiffness suitable for attachment (insertion) of the brush 41 and the holder 44 to the shaft 45 can be obtained. Thus, for the fan cleaning device 40, attachment of the brush 41 and the holder 44 to the shaft 45 can be facilitated. Note that the "elastic force" means force generated based on the elasticity when an elastic body deforms due to external force.

[0040] Note that the holder 44 may preferably have the stiffness to such an extent that no deformation occurs due to friction force generated between the shaft 45 and the holder 44 upon attachment to the shaft 45.

[0041] As illustrated in Fig. 5, the pitch P42 of the fiber portion 42 of the brush 41 is smaller than the pitch P32 of the fin 32 provided at the heat exchanger 31. Fig. 5 is a view of a relationship between the fiber portions 42 of the brush 41 (the cleaner) of the fan cleaning device 40 and the fins 32 of the heat exchanger 31.

[0042] In the fan cleaning device 40, the pitch P42 of the fiber portion 42 of the brush 41 (the cleaner) is smaller than the pitch P32 of the fin 32, and therefore, the fan cleaning device 40 can contact the air blowing fan 38 in a closely-spaced state to efficiently clean the air blowing fan 38.

[0043] Note that the brush 41 has the relatively-long fiber portions 42 so that the fiber portions 42 can contact and clean the air blowing fan 38 even in a case where the fiber portions 42 deflect. The length of the fiber portion 42 is longer than that of a fiber portion 62 of a brush 61 of a filter cleaning device 60 described later (see Fig. 6), for example.

[0044] Fig. 6 is a view of comparison between the brush 41 of the fan cleaning device 40 and the brush 61 of the filter cleaning device 60. The filter cleaning device 60 is, for example, a device configured to clean a filter (not shown) provided at the periphery of the heat exchanger 31. As in the fan cleaning device 40, the filter cleaning device 60 is configured to clean the filter (not shown) by means of the brush 61 (see Fig. 6).

[0045] As illustrated in Fig. 6, the brush 61 has, as in the brush 41, the multiple fiber portions 62 and a brush base 63. The fiber portions 62 are contact portions configured to contact the not-shown filter. The brush base 63 is a base portion configured to hold each fiber portion 62. As in the brush 41, the brush 61 is configured such that the multiple fiber portions 62 are implanted into the brush base 63. As illustrated in comparison in Fig. 6, the length t42 of the fiber portion 42 of the brush 41 is longer than the length t62 of the fiber portion 62 of the brush 61. The length t42 of the fiber portion 42 is, for example, about 10 to 30 mm. Note that the length of a portion of the brush 41 held by the holder 44 is about several mm.

[0046] The fan cleaning device 40 is configured such that the length t42 of the fiber portion 42 of the brush 41 (the cleaner) is longer than the length t62 of the fiber portion 62 of the brush 61. Thus, even in a case where the fiber portions 42 deflect, the fiber portions 42 can contact and clean the air blowing fan 38.

[0047] As illustrated in Fig. 7, the shaft 45 has such a structure that multiple (in an illustrated example, two) brushes 41 can be attached to the shaft 45. Fig. 7 is a perspective view of an example of attachment of the brushes 41 (the cleaners) to the shaft 45. The fan cleaning device 40 alternately uses the multiple brushes 41 by rotation of the shaft 45 so that cumulative cleaning time for the air blowing fan 38 can be extended. That is, the fan cleaning device 40 can continuously clean the air blowing fan 38 without the need for replacement of the brush 41 for a long period of time.

<Attachment Example of Cleaner>

[0048] The indoor device 11 of the air-conditioner 10 is placed at a relatively-high location in the room. Thus, in the case of performing, e.g., the process of replacing the brush 41 (the cleaner), the replacement process needs to be performed with a worker raising one's hands to the high location. Thus, it is difficult to perform the process of replacing the brush 41, and a burden is on the worker.

[0049] For this reason, in the case of performing the process of replacing the brush 41 (the cleaner), an attachment tool 59 illustrated in Figs. 8 and 9 may be used, for example. Figs. 8 and 9 are views for describing the attachment tool 59 suitable for attachment of the brush 41 (the cleaner). Fig. 8 illustrates a use example of the attachment tool 59. Fig. 9 illustrates a configuration of the attachment tool 59.

[0050] Fig. 8 illustrates an example where a left portion of the decorative frame 22 is removed from the housing 21 and the brush 41 and the holder 44 (hereinafter merely referred to as the "brush 41") are attached to the shaft 45. The shaft 45 is arranged inside the indoor device 11.

[0051] For the fan cleaning device 40, the brush 41 can be, for example, attached to the shaft 45 in such a manner that the attachment tool 59 is attached to the shaft 45 and the brush 41 is inserted into the attachment tool 59, as illustrated in Fig. 8.

[0052] The attachment tool 59 is a tube for attaching the brush 41 to the shaft 45. The attachment tool 59 has a shorter length than that of the brush 41, and has a bendable structure.

[0053] As illustrated in Fig. 9, a through-hole OP44 penetrating from one end surface attachment tool 59a to the other end surface attachment tool 59b is formed inside the attachment tool 59. A groove-shaped fitting portion OP45 to be fitted to an end portion of the shaft 45 is formed at one end surface attachment tool 59a of the attachment tool 59.

[0054] The attachment tool 59 is attached to the indoor device 11 in such a manner that the fitting portion OP45 of the end surface attachment tool 59a is fitted to the end portion of the shaft 45.

[0055] The brush 41 is inserted into the through-hole OP44 from the other end surface attachment tool 59b, and slides toward a far side (a rightward direction in the drawing) of the indoor device 11 in the longitudinal direction of the air blowing fan 38. Accordingly, the brush 41 penetrates from the other end surface attachment tool 59b to one end surface attachment tool 59a. When a tip end portion of the brush 41 passes through one end surface attachment tool 59a, the rail portion 44b of the holder 44 is inserted into the housing portion 45a of the shaft 45. In this state, the brush 41 further slides toward the far side (the rightward direction in the drawing) of the indoor device 11 in the longitudinal direction of the air blowing fan 38, and therefore, is attached to the shaft 45. Thereafter, the removed left portion of the decorative frame 22 is attached to the housing 21. In this manner, the process of attaching the brush 41 is completed.

<Main Characteristics of Air-Conditioner>

[0056]

(1) For the fan cleaning device 40 of the air-conditioner 10, the brush 41 (the cleaner) can be easily attached or detached by mere sliding. Thus, for the fan cleaning device 40, the brush 41 can be easily replaced. Moreover, in a case where the cleaner etc. with the special additional functions are developed in the future, replacement with such a cleaner etc. can be facilitated for the fan cleaning device 40.
Note that the cleaner of the fan cleaning device 40 is not limited to the brush 41, and may include an elastic member made of sponge or rubber, for example.

(2) The brush 41 etc. are set to such strength that the elasticity is held for easily inserting the brush 41 etc. into the housing portion 45a of the shaft 45. With this configuration, the brush 41 etc. can be easily replaced by pulling or insertion from the side of the shaft 45.

(3) For the fan cleaning device 40, the brush base 43 (the base portion) of the brush 41 (the cleaner) and the holder 44 can be attached (inserted) to or detached (pulled) from the shaft 45 in the bent state. That is, for the fan cleaning device 40, the replacement process can be performed with the brush base 43 and the holder 44 being bent. For the fan cleaning device 40 described above, the process of replacing the brush 41 etc. in a narrow space (e.g., the process of replacing the brush 41 etc. in the air-conditioner 10 placed in the vicinity of a room end) can be facilitated.
Note that the brush base 43 (the base portion) may be preferably more easily bendable than the shaft 45. Moreover, the brush base 43 (the base portion) may be preferably more easily bendable than the holder 44. Further, the holder 44 may preferably have the stiffness to such an extent that no deformation occurs due to the friction force generated between the shaft 45 and the holder 44 upon attachment to the shaft 45.

(4) As illustrated in Fig. 12, both end portions of the brush 41 etc. are sealed with the sealing members such as the motor 34, the adaptor 35, and the attachment member 36. These sealing members can be detached as necessary. For the fan cleaning device 40, the brush 41 and the holder 44 can be replaced by detachment of these sealing members. Note that in the case of utilizing the motor 34 as the sealing member, the number of components can be

reduced by such utilization.

[0057] As described above, according to the air-conditioner 10 of the first embodiment, the brush 41 of the fan cleaning device 40 can be easily attached or detached by mere sliding, and therefore, can be easily replaced.

[Second Embodiment]

[0058] The brush 41 (see Figs. 3 and 5) of the fan cleaning device 40 according to the first embodiment is configured such that the fiber portions 42 are implanted across the entire area of the upper surface of the brush base 43. With this fan cleaning device 40, the brush 41 contacts the air blowing fan 38 upon cleaning of the air blowing fan 38, and therefore, a load is on the brush 41 or the brush 41 is easily contaminated upon rotation of the brush 41 etc.

[0059] For these reasons, a second embodiment provides a fan cleaning device 40A configured such that upon rotation of a brush 41 etc., a load on the brush 41 is reduced and the brush 41 resists contamination.

[0060] Hereinafter, a configuration of a brush 41A (a cleaner) of the fan cleaning device 40A according to the second embodiment will be described with reference to Figs. 10 to 12. Figs. 10 and 11 are each front views of the configuration of the brush 41A of the fan cleaning device 40A. Fig. 12 is a front view of the configuration of the brush 41A of the fan cleaning device 40A at both end portions.

[0061] Fig. 10 illustrates a state in which the later-described brush 41A is pulled out of a holder 44 and the holder 44 is pulled out of a shaft 45. Fig. 11 illustrates a state in which the later-described brush 41A is housed in the holder 44 and the holder 44 is housed in the shaft 45.

[0062] As illustrated in Figs. 10 and 11, the fan cleaning device 40A according to the present embodiment is, as compared to the fan cleaning device 40 (see Figs. 3 and 5) of the first embodiment, different in that the fan cleaning device 40A includes the brush 41A instead of the brush 41.

[0063] The brush 41A has a brush base 43 including an implantation region 43a where fiber portions 42 are implanted and a non-implantation region 43b where no fiber portions 42 are implanted. The implantation region 43a is formed at other portions than one or both end portions of the brush base 43. The non-implantation region 43b is formed at one or both end portions of the brush base 43.

[0064] As illustrated in Fig. 11, the fan cleaning device 40A according to the present embodiment has a handle portion 43c at the brush base 43 so that the brush base 43 can be easily grasped with a human hand.

[0065] The handle portion 43c is a portion at a further end in the non-implantation region 43b formed at the end portion of the brush base 43. As illustrated in Fig. 11, in a state in which the brush 41A etc. are attached to the shaft 45, the handle portion 43c protrudes outward from the end portion of the holder 44.

[0066] For the fan cleaning device 40A, the handle portion 43c is grasped with the human hand so that the brush 41A can be easily taken out of the holder 44. In this state, a worker operates the handle portion 43c to manually change the directions of the brush 41A etc., and in this manner, can replace the brush 41A etc. at a position not contacting an air blowing fan 38 and a heat exchanger 31.

[0067] As illustrated in Fig. 12, the brush 41A etc. are arranged inside an indoor device 11 such that both end portions of the brush 41A etc. penetrate two side plates 33 arranged at both end portions of the heat exchanger 31. One end portion of the brush 41A etc. is sealed with a motor 34 (or a member such as a gear to be driven by the motor 34 or an adaptor 35 coupled to the gear). Moreover, the other end portion of the brush 41A etc. is sealed with, e.g., an attachment member 36. The motor 34 (or the member such as the gear to be driven by the motor 34 or the adaptor 35 coupled to the gear) and the attachment member 36 rotatably hold the brush 41A etc.

[0068] Note that in an illustrated example, it is configured such that the motor 34 is arranged outside the side plate 33 and a rotary shaft 34a of the motor 34 is coupled to the brush 41A etc. through the member such as the gear or the adaptor 35 coupled thereto.

[0069] In the fan cleaning device 40A, the non-implantation region 43 is provided for the fiber portions 42 such that the fiber portions 42 do not contact the side plates 33 of the heat exchanger 31 at both end portions of the brush 41A when the brush 41A etc. rotate in cleaning of the air blowing fan 38. Thus, the fan cleaning device 40A is configured so that a burden on the brush 41A can be reduced upon rotation of the brush 41A etc. Moreover, for the fan cleaning device 40A, the brush 41A can resist contamination.

[0070] The fan cleaning device 40A 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.

[0071] As described above, according to the second embodiment, the brush 41A of the fan cleaning device 40A can be easily attached or detached by mere sliding as in the first embodiment, and therefore, the brush 41A can be easily replaced.

[0072] In addition, according to the second embodiment, the burden on the brush 41A upon cleaning of the air blowing fan 38 can be reduced as compared to the first embodiment. Moreover, the brush 41A can resist contamination.

[0073] 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.

[0074] For example, the above-described embodiments are for clearly describing the gist of the present invention in detail. Thus, the present invention is not limited to one including all components described above. For the present invention, other components can be added to a certain component, and some components can be changed to other components. Moreover, for the present invention, some components can be omitted.

[0075] For example, in the above-described embodiments, it has been stated that the cleaner of the fan cleaning device 40 is the brush 41. However, the cleaner may include the elastic member made of sponge or rubber.

[0076] For example, the brush 41 can be changed as in a first variation illustrated in Fig. 13. Moreover, the holder 44 and the shaft 45 can be, for example, changed as in a second variation illustrated in Fig. 14.

<First Variation>

[0077] Fig. 13 is a perspective view of a configuration of a brush 41B (a cleaner) of a fan cleaning device 40B according to the first variation. As illustrated in Fig. 13, the fan cleaning device 40B according to the first variation is, as compared to the fan cleaning device 40A (see Fig. 11) of the second embodiment, different in that the fan cleaning device 40B includes the brush 41B instead of the brush 41A.

[0078] As compared to the brush 41A (see Fig. 11) of the second embodiment, the brush 41B of the first variation is different in that the brush 41B has a brush base 43z instead of the brush base 43 and the holder 44. The brush base 43z of the first variation is an integrated member of the brush base 43 (see Fig. 11) and the holder 44 (see Fig. 11) of the second embodiment. In an illustrated example, the brush base 43z of the first variation is, as viewed laterally, in such a shape that an inverted T-shaped portion is joined to a lower side of a rectangular portion, and fiber portions 42 are implanted into an upper surface of the brush base 43z.

[0079] The fan cleaning device 40A (see Fig. 11) of the second embodiment is configured such that the brush base 43 of the brush 41A (the cleaner), the holder 44, and the shaft 45 are separated bodies. On the other hand, the fan cleaning device 40B according to the first variation is configured such that the brush base 43z of the brush 41B (the cleaner) is the integrated member of the brush base 43 (see Fig. 11) and the holder 44 (see Fig. 11) of the second embodiment. Moreover, the fan cleaning device 40B according to the first variation is configured such that the brush base 43z and the shaft 45 are separated bodies.

[0080] For the fan cleaning device 40B according to the first variation as described above, the brush 41B can be easily attached or detached by mere sliding as in the first embodiment and the second embodiment, and therefore, can be easily replaced.

<Second Variation>

[0081] Fig. 14 is a perspective view of configurations of a holder 144 and a shaft 145 of a fan cleaning device 40C according to the second variation. As illustrated in Fig. 14, the fan cleaning device 40C according to the second variation is, as compared to the fan cleaning device 40A (see Fig. 11) of the second embodiment, different in that the fan cleaning device 40C includes the holder 144 and the shaft 145 instead of the holder 44 (see Fig. 11) and the shaft 45 (see Fig. 11).

[0082] As compared to the holder 44 (see Fig. 11) and the shaft 45 (see Fig. 11) of the second embodiment, the holder 144 and the shaft 145 of the second variation are in a reversed housing structure relationship. That is, the holder 144 of the second variation has a groove-shaped housing portion 144a, and the shaft 145 has a rail portion 145a. Moreover, the holder 144 of the second variation has such a structure that the holder 144 slidably houses the shaft 145.

[0083] For the fan cleaning device 40C according to the second variation as described above, the brush 41A can be easily attached or detached by mere sliding as in the first embodiment and the second embodiment, and therefore, can be easily replaced. Moreover, for the fan cleaning device 40C according to the second variation, the holder 144 can be easily attached or detached by mere sliding, and therefore, can be easily replaced.

DESCRIPTION OF REFERENCE SIGNS

[0084]

10	air-conditioner
11	indoor device
12	outdoor device
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
32	fin
33	side plate
34	motor (drive section, sealing member)
34a	rotary shaft
35	adaptor (sealing member)
36	attachment member (sealing member)
38	air blowing fan
40, 40A, 40B, 40C	fan cleaning device
41, 41A, 41B, 61	brush (cleaner)
42, 62	fiber portion (contact portion)
43, 43z, 63	brush base (base portion)
43a	implantation region
43b	non-implantation region
43c	handle portion
44, 144	holder (other members)
44a, 45a, 144a	housing portion
44b, 145a	rail portion
45, 145	shaft
59	attachment tool
60	filter cleaning device

Claims

1. An air-conditioner comprising:

a heat exchanger;
an air blowing fan; and
a fan cleaning device configured to clean the air blowing fan,
wherein the fan cleaning device includes

a shaft,
a motor configured to rotatably drive the shaft in a direction about an axis, and
a cleaner attached to the shaft, and

the cleaner and the shaft are separated bodies.

2. The air-conditioner according to claim 1, wherein
the cleaner is attached to the shaft to move in a longitudinal direction of the air blowing fan by a predetermined distance.

3. The air-conditioner according to claim 1, wherein
the cleaner includes

a fiber portion, and
a base portion configured to hold the fiber portion, and

elastic force of the base portion is greater than elastic force of the shaft.

4. The air-conditioner according to claim 1, wherein
the cleaner includes

a fiber portion, and
a base portion configured to hold the fiber portion, and

stiffness of the base portion is smaller than stiffness of the shaft.

5. The air-conditioner according to claim 1, wherein
the cleaner includes

a fiber portion, and
a base portion configured to hold the fiber portion,

the fan cleaning device has a holder configured to hold the base portion of the cleaner,
the cleaner, the shaft, and the holder are separated bodies, and
the cleaner is attached to the shaft through the holder.

6. The air-conditioner according to claim 5, wherein
elastic force of the base portion is greater than elastic force of the holder.

7. The air-conditioner according to claim 5, wherein
stiffness of the base portion is smaller than stiffness of the holder.

8. The air-conditioner according to claim 5, wherein
the holder has such stiffness that no deformation occurs due to friction force generated between the shaft and the holder upon attachment to the shaft.

9. The air-conditioner according to claim 1, wherein
one of the cleaner and the shaft has a groove-shaped housing portion configured to slidably house the other of the cleaner and the shaft in a longitudinal direction of the air blowing fan.

10. The air-conditioner according to claim 5, wherein
one of the holder and the shaft has a groove-shaped housing portion configured to slidably house the other of the holder and the shaft in a longitudinal direction of the air blowing fan.

11. The air-conditioner according to claim 5, wherein
one of the cleaner and the holder has a groove-shaped housing portion configured to slidably house the other of the cleaner and the holder in a longitudinal direction of the air blowing fan.

12. The air-conditioner according to claim 1, wherein
both end portions of the shaft to which the cleaner is attached are sealed with sealing members.

13. The air-conditioner according to claim 12, wherein
the sealing member arranged at one end portion of the shaft includes the motor or a member to be driven by the motor.

14. The air-conditioner according to claim 1, wherein
the cleaner has, at one or both end portions, a non-implantation region where no fiber portion configured to contact the air blowing fan is arranged.

15. The air-conditioner according to claim 1, wherein
the cleaner of the fan cleaning device has a fiber portion, and
a pitch of the fiber portion is smaller than a pitch of a fin provided at the heat exchanger.

16. The air-conditioner according to claim 1, wherein
the cleaner of the fan cleaning device has a fiber portion, and
a length of the fiber portion is longer than that of a fiber portion used for a filter cleaning device configured to clean a filter.

17. The air-conditioner according to claim 1, wherein
multiple cleaners are attachable to the shaft.

18. The air-conditioner according to claim 1, wherein
the cleaner is guided and attached to the shaft through an attachment tool configured to slidably hold the cleaner

in a longitudinal direction of the air blowing fan.

Amended claims under Art. 19.1 PCT

1. (Amended) An air-conditioner comprising:

a heat exchanger;
an air blowing fan; and
a fan cleaning device configured to clean the air blowing fan,
wherein the fan cleaning device includes

a shaft,
a motor configured to rotatably drive the shaft in a direction about an axis, and
a cleaner attached to the shaft,

the cleaner and the shaft are separated bodies, and
the cleaner is attached to the shaft to move in a longitudinal direction of the air blowing fan.

2. (Deleted)

3. The air-conditioner according to claim 1, wherein
the cleaner includes

a fiber portion, and
a base portion configured to hold the fiber portion, and

elastic force of the base portion is greater than elastic force of the shaft.

4. The air-conditioner according to claim 1, wherein
the cleaner includes

a fiber portion, and
a base portion configured to hold the fiber portion, and

stiffness of the base portion is smaller than stiffness of the shaft.

5. The air-conditioner according to claim 1, wherein
the cleaner includes

a fiber portion, and
a base portion configured to hold the fiber portion,

the fan cleaning device has a holder configured to hold the base portion of the cleaner,
the cleaner, the shaft, and the holder are separated bodies, and
the cleaner is attached to the shaft through the holder.

6. The air-conditioner according to claim 5, wherein
elastic force of the base portion is greater than elastic force of the holder.

7. The air-conditioner according to claim 5, wherein
stiffness of the base portion is smaller than stiffness of the holder.

8. The air-conditioner according to claim 5, wherein
the holder has such stiffness that no deformation occurs due to friction force generated between the shaft and the holder upon attachment to the shaft.

9. (Amended) An air-conditioner comprising:

a heat exchanger;
an air blowing fan; and
a fan cleaning device configured to clean the air blowing fan,
wherein the fan cleaning device includes

a shaft,
a motor configured to rotatably drive the shaft in a direction about an axis, and
a cleaner attached to the shaft,

the cleaner and the shaft are separated bodies, and
one of the cleaner and the shaft has a groove-shaped housing portion configured to slidably house the other of the cleaner and the shaft in a longitudinal direction of the air blowing fan.

10. The air-conditioner according to claim 5, wherein
one of the holder and the shaft has a groove-shaped housing portion configured to slidably house the other of the holder and the shaft in a longitudinal direction of the air blowing fan.

11. The air-conditioner according to claim 5, wherein
one of the cleaner and the holder has a groove-shaped housing portion configured to slidably house the other of the cleaner and the holder in a longitudinal direction of the air blowing fan.

12. (Amended) An air-conditioner comprising:

a heat exchanger;
an air blowing fan; and
a fan cleaning device configured to clean the air blowing fan,
wherein the fan cleaning device includes

a shaft,
a motor configured to rotatably drive the shaft in a direction about an axis, and
a cleaner attached to the shaft,

the cleaner and the shaft are separated bodies, and
both end portions of the shaft to which the cleaner is attached are sealed with sealing members.

13. The air-conditioner according to claim 12, wherein
the sealing member arranged at one end portion of the shaft includes the motor or a member to be driven by the motor.

14. The air-conditioner according to claim 1, wherein
the cleaner has, at one or both end portions, a non-implantation region where no fiber portion configured to contact the air blowing fan is arranged.

15. The air-conditioner according to claim 1, wherein
the cleaner of the fan cleaning device has a fiber portion, and
a pitch of the fiber portion is smaller than a pitch of a fin provided at the heat exchanger.

16. (Amended) An air-conditioner comprising:

a heat exchanger;
an air blowing fan; and
a fan cleaning device configured to clean the air blowing fan,
wherein the fan cleaning device includes

a shaft,
a motor configured to rotatably drive the shaft in a direction about an axis, and
a cleaner attached to the shaft,

the cleaner and the shaft are separated bodies,

the cleaner of the fan cleaning device has a fiber portion, and
a length of the fiber portion is longer than that of a fiber portion used for a filter cleaning device configured to clean a filter.

17. The air-conditioner according to claim 1, wherein
multiple cleaners are attachable to the shaft.

18. (Amended) An air-conditioner comprising:

a heat exchanger;
an air blowing fan; and
a fan cleaning device configured to clean the air blowing fan,
wherein the fan cleaning device includes

a shaft,
a motor configured to rotatably drive the shaft in a direction about an axis, and
a cleaner attached to the shaft,

the cleaner and the shaft are separated bodies, and
the cleaner is guided and attached to the shaft through an attachment tool configured to slidably hold the cleaner in a longitudinal direction of the air blowing fan.

FIG. 1

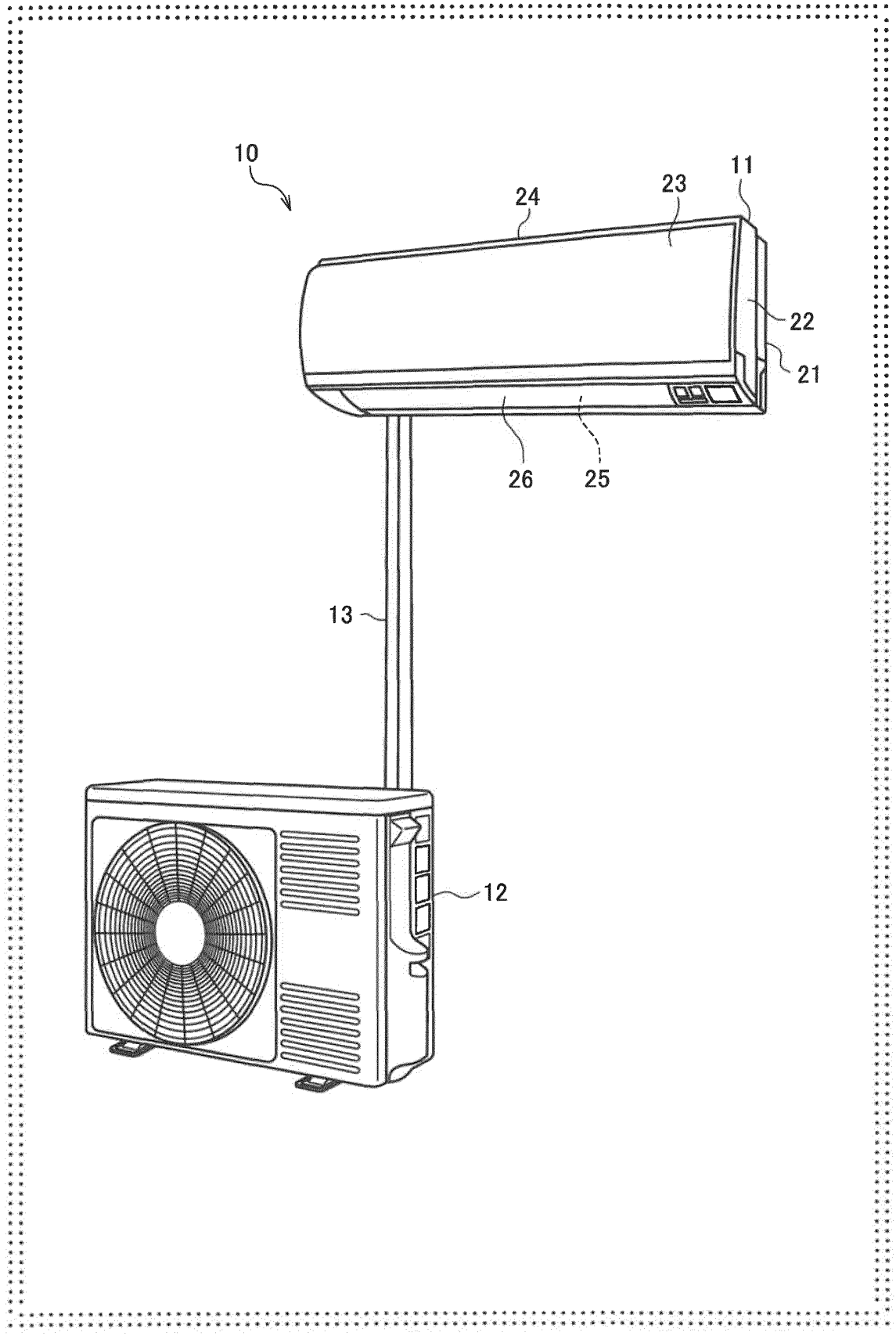


FIG. 2

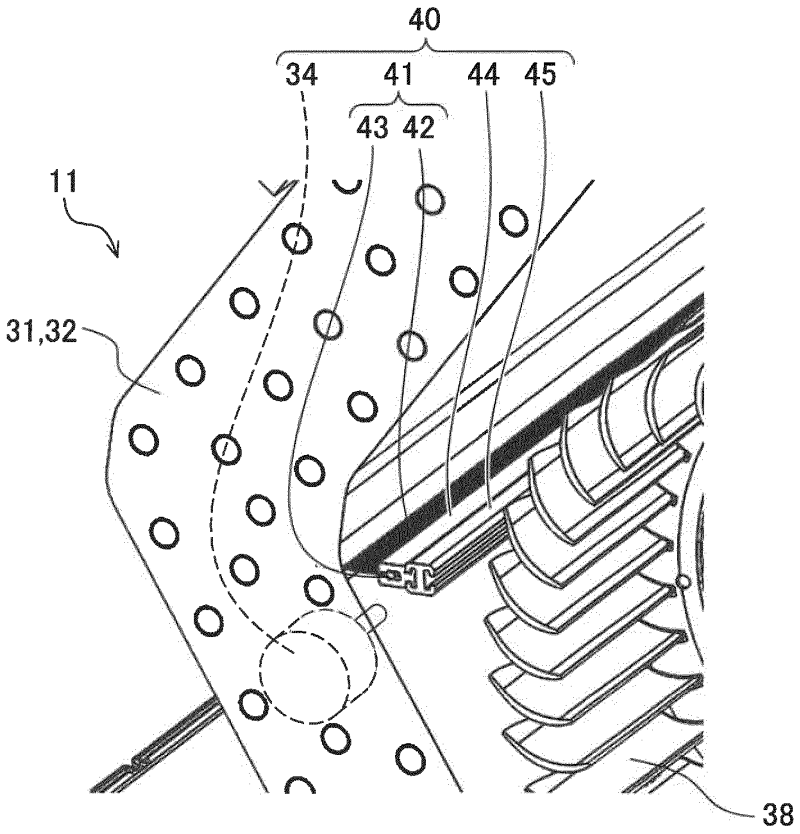


FIG. 3

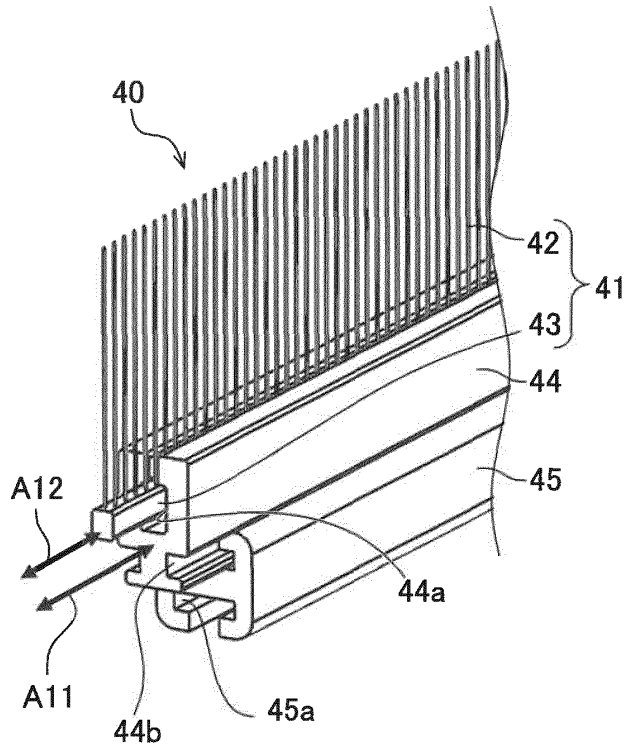


FIG. 4

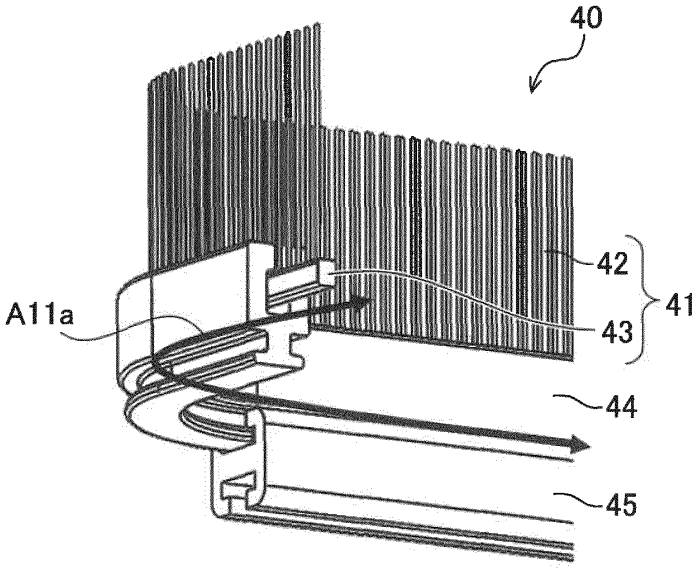


FIG. 5

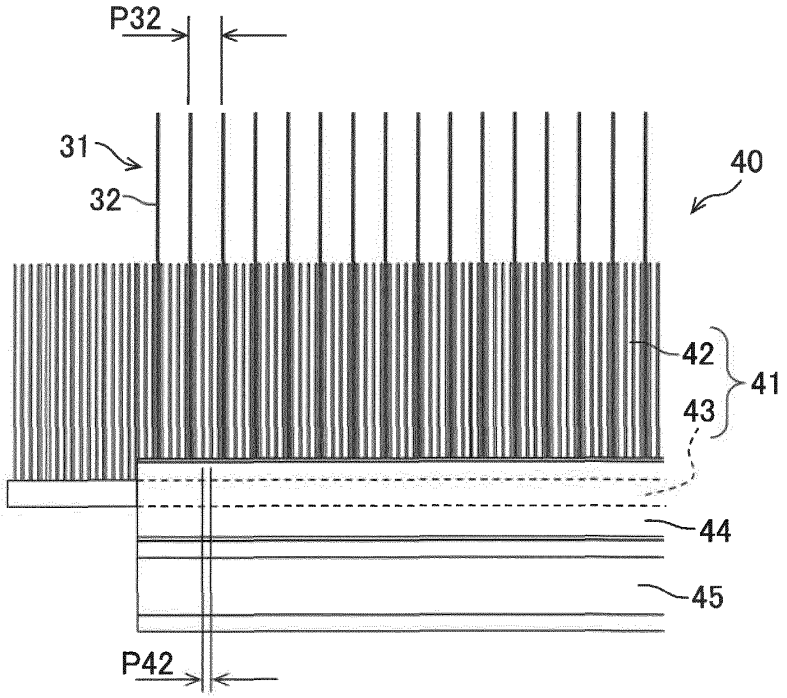


FIG. 6

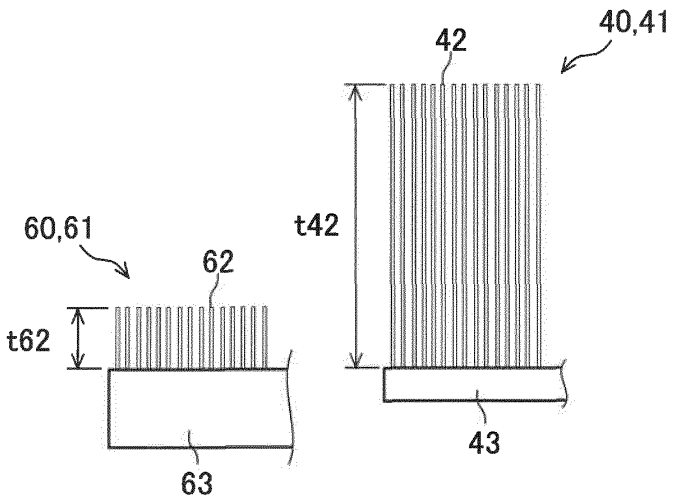


FIG. 7

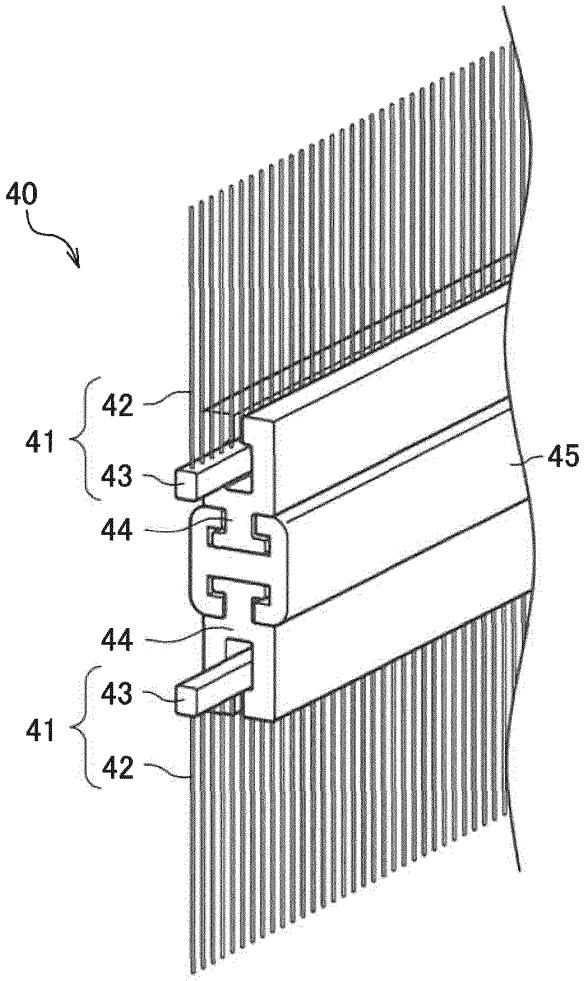


FIG. 8

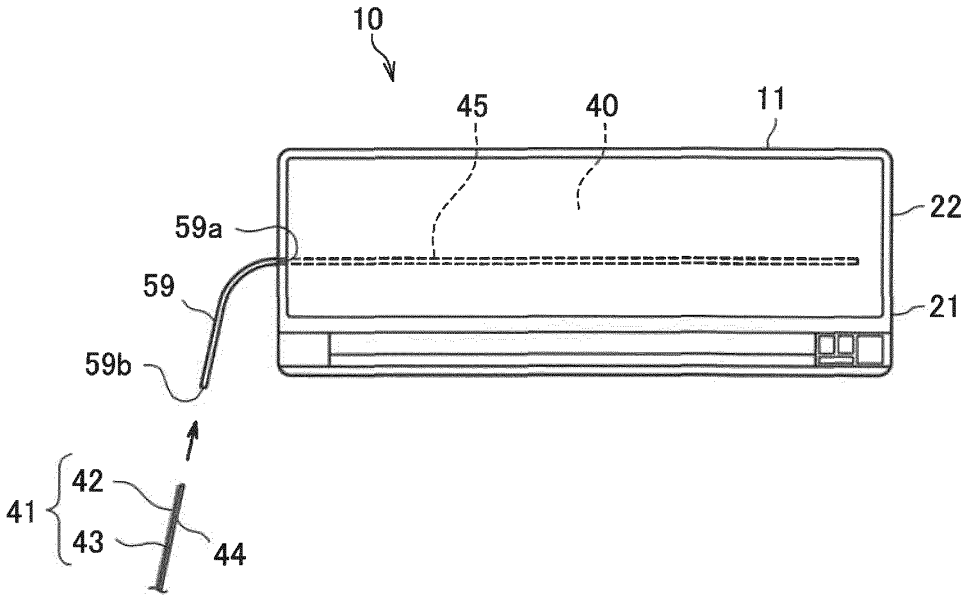

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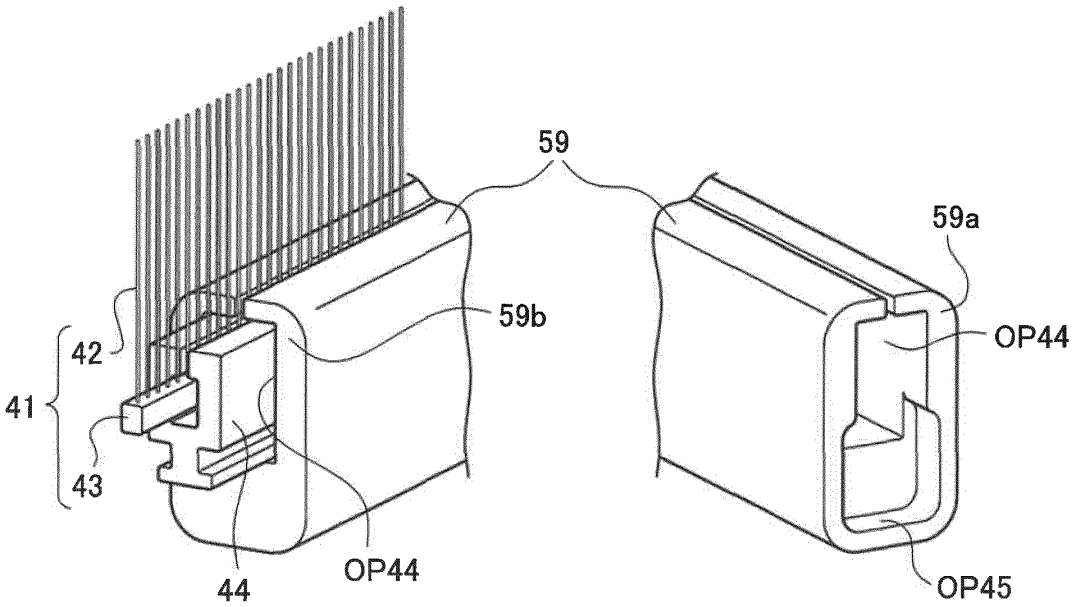
FIG. 9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59b
OP44
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OP44
OP45

FIG. 10

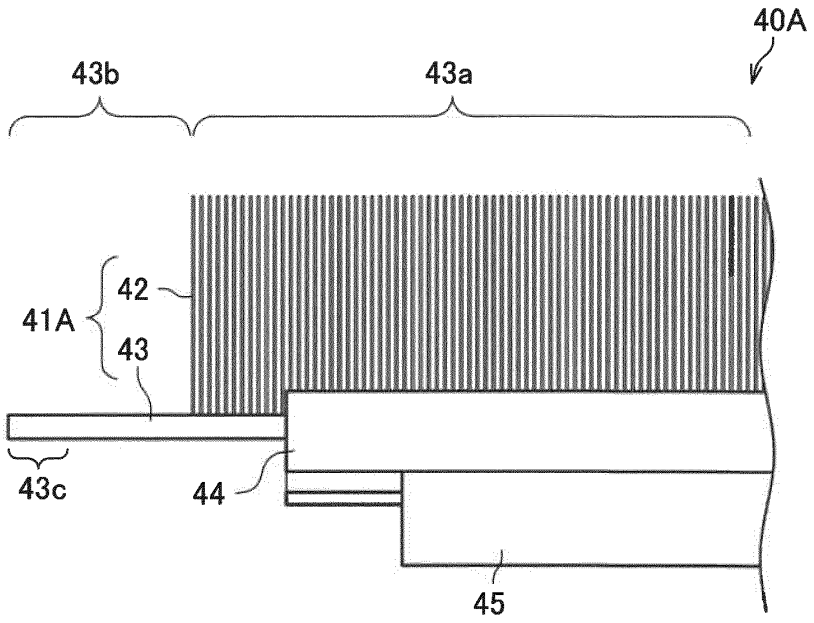


FIG. 11

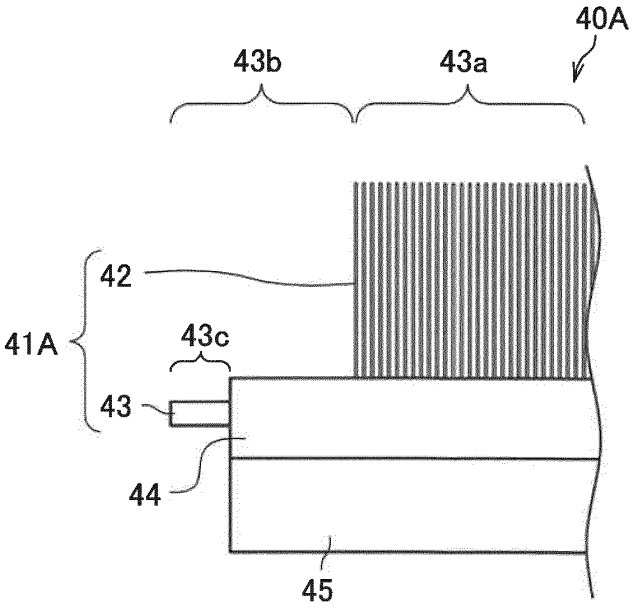


FIG. 12

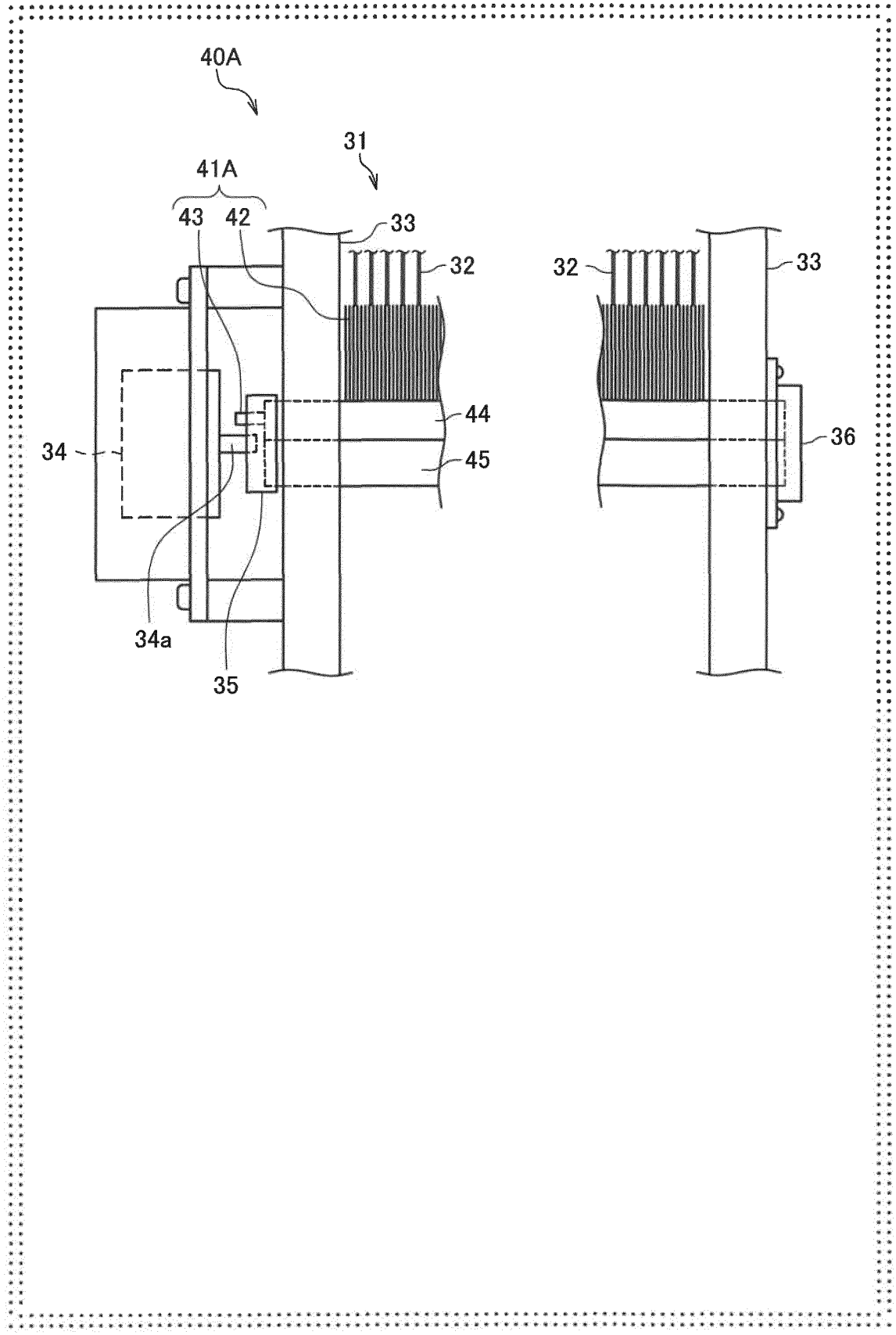


FIG. 13

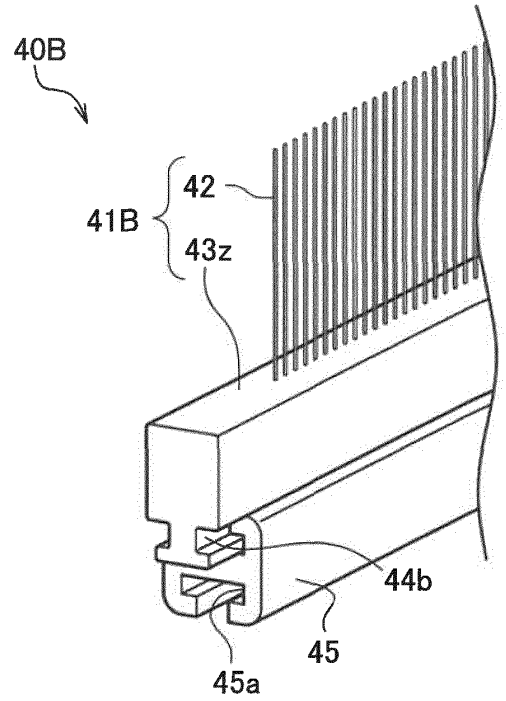
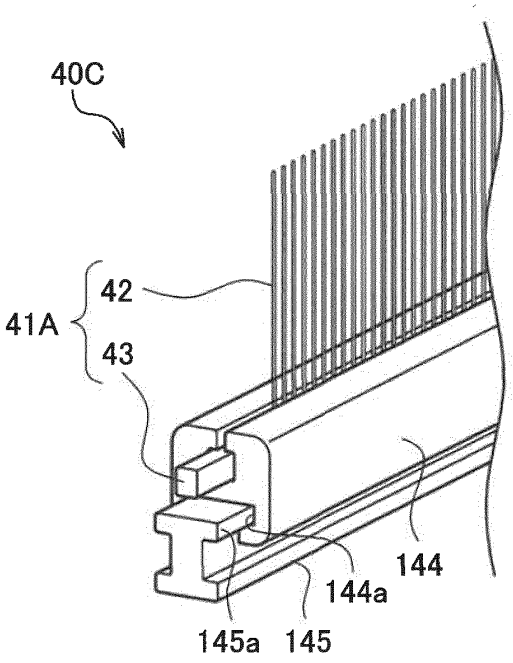


Fig. 14



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/018511

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F04D29/70(2006.01)i, F24F1/00(2011.01)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. F04D29/70, F24F1/00

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 Y A	JP 2006-308121 A (CORONA CORP) 09 November 2006, paragraphs [0012]-[0044], fig. 1-19 (Family: none)	1, 17 3-8, 14-15 2, 9-13, 16, 18
Y	US 5018944 A (BIELECKI, John R.) 28 May 1991, column 2, line 36 to column 3, line 51, fig. 1-4b (Family: none)	3-8, 14-15
Y	US 6782579 B1 (GRIMM, Charles L.) 31 August 2004, column 3, line 14 to column 5, line 55, fig. 1-7 (Family: none)	3-8, 14-15
A	JP 5-39800 A (SEIDENSHA KK) 19 February 1993, (Family: none)	1-18

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

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"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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03.07.2018	17.07.2018

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/018511

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2008-51430 A (TOSHIBA CARRIER CORP.) 06 March 2008, (Family: none)	1-18
A	JP 2008-29706 A (KOWA CO.) 14 February 2008, (Family: none)	1-18

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

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Patent documents cited in the description

- JP 4046755 B **[0003]**