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• **SAKASHITA, Akihiko**
Sakai-shi
Osaka 591-8511 (JP)
• **YOKOMIZO, Tsuyoshi**
Sakai-shi
Osaka 591-8511 (JP)

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(71) Applicant: **Daikin Industries, Ltd.**
Osaka 530-8323 (JP)

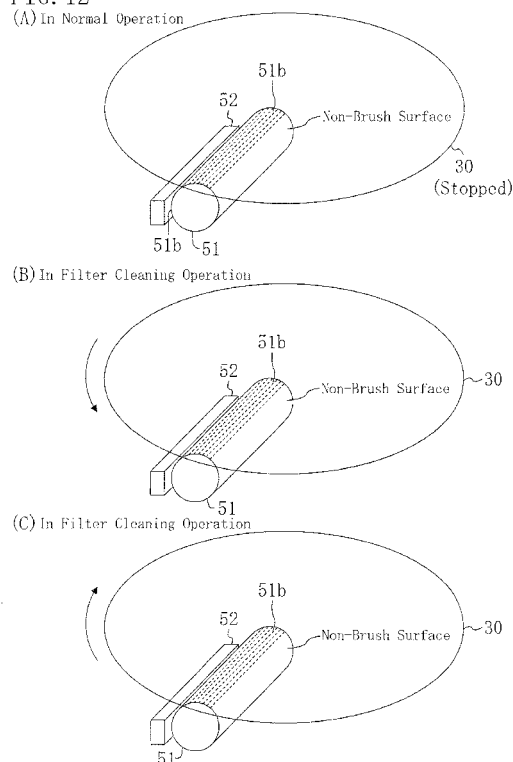
(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(72) Inventors:
• **MICHITSUJI, Yoshiharu**
Sakai-shi
Osaka 591-8511 (JP)

(54) **INDOOR UNIT OF AIR CONDITIONING APPARATUS**

(57) A disc-shaped air filter (30), a rotating brush (51) to be in contact with the air filter (30) for removing dust as the air filter (30) rotates, and a cleaning brush (52) for removing dust which has been trapped on the rotating brush (51) are provided. The air filter (30) rotates intermittently so that dust thereon is removed by the rotating brush (51), and the dust on the rotating brush (51) is removed by the cleaning brush (52) upon each stop of the intermittent rotation. The air filter (30) rotates in the opposite direction over a predetermined angle before the dust is removed by the cleaning brush (52).

FIG. 12



Description

TECHNICAL FIELD

[0001] The present invention relates to an indoor unit of an air conditioner including a brush member in contact with an air filter for removing dust.

BACKGROUND ART

[0002] Among indoor units of air conditioners having an air filter at an air inlet, those provided with dust removing means for removing dust trapped on the air filter have been known.

[0003] For example, an air conditioner disclosed in Patent Document 1 includes an air filter (pre-filter) formed in a disc shape. A rotating brush as the dust removing means is provided along the radial direction of the air filter so as to be in contact with the air filter. In this air conditioner, as the air filter rotates, the dust on the air filter is scraped off (removed) by the rotating brush.

PATENT DOCUMENT 1: Japanese Published Patent Application No. 2007-38215

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] Now, in the air conditioner of Patent Document 1 described above, dust which has been scraped off by the rotating brush gathers at one location to form a lump. That is, dust which has been scraped off of the air filter is gradually dragged by the rotation of the air filter in the rotation direction thereof so as to be unevenly placed in the rear side (i.e., the side of the rotation direction of the air filter) of the rotating brush. Eventually, the lump of dust comes off the rotating brush and falls into the room, etc. This as a result detracts from the reliability of the dust removing function.

[0005] The present invention has been made in view of the above, and has an object to provide an indoor unit of an air conditioner having a function of scraping off dust on an air filter by means of a brush member by moving the air filter and brush member relative to each other while they are in contact with each other, wherein the dust which has been scraped off by the brush member is reliably handled.

SOLUTION TO THE PROBLEM

[0006] A first aspect is directed to an indoor unit of an air conditioner including an indoor heat exchanger (22), an indoor fan (21), and an air filter (30) provided on an inlet side of the indoor fan (21), provided in a casing (10). The indoor unit of this aspect includes: a brush member (51) for removing dust on the air filter (30) while being in contact with the air filter (30); brush cleaning means (52)

for removing dust on the brush member (51) while being in contact with the brush member (51); and moving means (40) for selectively performing an operation of moving the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush member (51) so as to remove dust by the brush member (51), and another operation of moving the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush member (51) in a direction opposite to a moving direction during the first operation before removing dust on the brush member (51) by the brush cleaning means (52).

[0007] According to this aspect, as the air which has been sucked into the casing (10) by the indoor fan (21) passes through the air filter (34), dust contained in the air is trapped on the air filter (30). During the operation of removing dust from the air filter (30), the air filter (30) and the brush member (51) are moved relative to each other by the moving means (40) while the brush member (51) is in contact with the air filter (30). For example, the air filter (30) is moved relative to the brush member (51). Thus, dust on the air filter (30) is scraped off (removed) by the brush member (51). Then, the dust on the brush member (51) is removed by the brush cleaning means (52).

[0008] Now, during the dust removing operation, in the contact area between the brush member (51) and the air filter (30), removed dust is dragged by the relative movement between the brush member (51) and the air filter (30) in the direction of movement. Then, the removed dust may be unevenly placed in the direction of the relative movement, and may eventually form a lump and fall down. When dust is unevenly placed to form a lump at one location of the brush member (51), it will be difficult to remove by the brush cleaning means (52).

[0009] Therefore, in the present invention, before the dust on the brush member (51) is removed by the brush cleaning means (52), the air filter (30) and the brush member (51) are moved relative to each other by the moving means (40) in a direction opposite to the direction of the relative movement (i.e., the direction of movement during the operation of removing dust from the air filter (30)). Then, in the contact area between the brush member (51) and the air filter (30), the unevenly-placed dust is dragged in a direction opposite to that during the above operation. Then, the removed dust is evenly and reliably attached across the contact area of the brush member (51). Therefore, the dust trapped on the brush member (51) can be easily removed by the brush cleaning means (52).

[0010] A second aspect is according to the first aspect, wherein the brush member (51) includes a shaft (51a), and a brush (51 b) provided on an outer circumferential surface of the shaft (51a) for removing dust while being in contact with the air filter (30). The brush cleaning means is a cleaning brush member (52) located near an outer circumference of the shaft (51a) of the brush, member (51) and including a brush (52b) for removing dust

while being in contact with the brush (51b) of the brush member (51). On the other hand, the indoor unit of the present invention includes brush drive means (53) for rotating the brush member (51) about an axial center of the shaft (51a) so that an area of the brush (51b) of the brush member (51) that has been in contact with the air filter (30) is brought into contact with the brush (52b) of the cleaning brush member (52).

[0011] According to this aspect, dust scraped off of the air filter (30) is trapped on the brush (51b) of the brush member (51). Then, when the brush member (51) is rotated by the brush drive means (53), the brush (51b) of the brush member (51) comes into contact with the brush (52b) of the cleaning brush member (52) so that dust on the brush member (51) is scraped off (removed).

[0012] A third aspect is according to the second aspect, wherein the brush (51b) of the brush member (51) is provided so as to extend over a portion of an outer circumferential surface of the shaft (51a) in a circumferential direction thereof.

[0013] According to this aspect, the brush member (51) rotates and the brush (51b) comes into contact with the cleaning brush member (52), thereby removing dust which has been attached to the brush (51b). Therefore, although the brush (51b) is provided only on a portion of the shaft (51a), the removing capacity of the brush member (51) is maintained.

[0014] A fourth aspect is according to the second or third aspect, wherein the air filter (30) is formed in a disc shape, and the brush member (51) is arranged upstream of the air filter (30) so as to extend in a radial direction of the air filter (30). The moving means (40) is configured to move the air filter (30) by rotating the air filter (30) while the air filter (30) is in contact with the brush (51b) of the brush member (51).

[0015] According to this aspect, the air filter (30) is rotated by the moving means (40) while the air filter (30) is in contact with the brush (51b) of the brush member (51). Thus, dust on the air filter (30) is scraped off (removed) by the brush (51b).

[0016] A fifth aspect is according to the first aspect, wherein the moving means (40) is configured to relatively and intermittently move the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush (51b) of the brush member (51) to remove dust by the brush member (51), and to relatively move the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush member (51) in a direction opposite to a direction of the intermittent movement after the intermittent movement is stopped. This aspect includes brush drive means (53) for bringing an area of the brush member (51) that has been in contact with the air filter (30) into contact with the brush cleaning means (52) to remove dust on the brush member (51) after the reverse-direction movement of the air filter (30) by the moving means (40).

[0017] According to this aspect, during the operation of removing dust from the air filter (30), the air filter (30)

and the brush member (51) are moved relative to each other and stopped alternately by the moving means (40). For example, the air filter (30) moves intermittently relative to the brush member (51). Here, for example, for each of the intermittent stops, the air filter (30) moves relative to the brush member (51) in a direction opposite to the direction of movement. Thus, the dust trapped on the brush member (51) is evenly attached.

[0018] Then, after the air filter (30) is relatively moved in the reverse direction, the portion of the brush member (51) which has been in contact with the air filter (30) comes into contact with the brush cleaning means (52). Thus, dust on the brush member (51) is removed. That is, according to this aspect, the air filter (30) and the brush member (51) are intermittently moved relative to each other, and dust which has been trapped on the brush member (51) is removed by the brush cleaning means (52) upon each stop.

[0019] A sixth aspect is according to the first aspect, wherein the brush member (51) includes a shaft (51a), and a brush (51b) provided on an outer circumferential surface of the shaft (51a) for removing dust while being in contact with the air filter (30). The moving means (40) is configured to selectively perform an operation of moving the air filter (30) while the air filter (30) is in contact with the brush (51b) of the brush member (51) so as to remove dust by the brush member (51), and another operation of moving the air filter (30) while the air filter (30) is in contact with the brush (51b) of the brush member (51) in a direction opposite to a moving direction during the first operation before removing dust on the brush member (51) by the brush cleaning means (52). This aspect includes brush drive means (53) for rotating the brush member (51) about an axial center of the shaft (51a) in a direction opposite to the reverse-direction movement of the air filter (30), simultaneously with the reverse-direction movement of the air filter (30) by the moving means (40).

[0020] According to this aspect, during the operation of removing dust from the air filter (30), the air filter (30) is moved relative to the brush member (51). Thus, dust on the air filter (30) is trapped on the brush (51b) of the brush member (51). Then, before the dust on the brush member (51) is removed by the brush cleaning means (52), the air filter (30) is moved relative to the brush member (51) in a direction opposite to the direction of movement (i.e., the direction of movement during the operation of removing dust from the air filter (30)). Simultaneously with the reverse-direction movement of the air filter (30), the brush member (51) rotates in the opposite direction to the reverse-direction movement of the air filter (30). Then, dust which has been unevenly placed in the contact area between the brush member (51) and the air filter (30) is reliably dragged in a direction opposite to that during the above operation to an area of the brush member (51) where little dust is attached thereto. Thus, dust is more evenly and reliably attached across the contact area of the brush (51b) of the brush member (51).

[0021] A seventh aspect is according to the fourth aspect, wherein the moving means (40) is configured to intermittently rotate the air filter (30) over a predetermined rotation angle at a time while the air filter (30) is in contact with the brush (51b) of the brush member (51) to remove dust by the brush member (51), and to rotate back the air filter (30) over a predetermined angle in a direction opposite to the rotation direction while the air filter (30) is in contact with the brush (51b) of the brush member (51) after each stop of the intermittent rotation. The brush drive means (53) is configured to rotate the brush member (51), after the back rotation of the air filter (30) by the moving means (40), so that an area of the brush (51b) of the brush member (51) which has been in contact with the air filter (30) is brought into contact with the brush (52b) of the cleaning brush member (52), thereby removing dust on the brush member (51).

[0022] According to this aspect, during the operation of removing dust from the air filter (30), the air filter (30) is rotated over a predetermined rotation angle and stopped alternately by the moving means (40). Here, each time the air filter (30) is stopped, the air filter (30) is rotated back over a predetermined angle. Thus, the dust trapped on the brush member (51) is evenly attached.

[0023] After the air filter (30) is rotated back, the brush member (51) rotates so that the portion of the brush (51b) which has been in contact with the air filter (30) comes into the cleaning brush member (52). Thus, dust on the brush member (51) is removed. That is, according to this aspect, the air filter (30) rotates intermittently, and dust which has been trapped on the brush member (51) is removed by the cleaning brush member (52) upon each stop.

[0024] An eighth aspect is according to the second or third aspect, wherein the brush (51b) of the brush member (51) is made of pile fabric.

[0025] According to this aspect, since the brush (51 b) of the brush member (51) is made of pile fabric, the bristles thereof are relatively short. Thus, the distance between the air filter (30) and the brush member (51) is short.

[0026] A ninth aspect is according to the eighth aspect, wherein the brush (51b) of the brush member (51) is made of inclined pile whose bristles are inclined so as to oppose against a direction of the relative movement of the air filter (30) during the operation of removing dust on the air filter (30) by the brush member (51).

[0027] According to this aspect, where the air filter (30) moves relative to the brush member (51), for example, the bristles of the brush (51b) are inclined so as to oppose against the moving direction of the air filter (30). That is, the bristles of the brush (51b) are inclined in a direction opposite to the moving direction of the air filter (30). Where the brush member (51) moves relative to the air filter (30), the bristles of the brush (51b) are inclined in the same direction as the moving direction of the brush (51b) (i.e., the opposite direction to the direction of rela-

tive movement of the air filter (30)). Therefore, dust on the air filter (30) is more easily scraped off by the brush (51b).

[0028] Where the air filter (30) moves in the reverse direction relative to the brush member (51), the air filter (30) is moving in the same direction as the direction of the bristles of the brush (51b). Also where the brush member (51) moves in the reverse direction relative to the air filter (30), the air filter (30) is relatively moving in the same direction as the direction of the bristles of the brush (51b). By this operation, dust which has been removed or almost removed from the air filter (30) is reliably attached to the brush (51b) of the brush member (51).

[0029] A tenth aspect is according to the ninth aspect, wherein the brush (52b) of the cleaning brush member (52) is made of inclined pile of pile fabric whose bristles are inclined in a certain direction.

[0030] According to this aspect, since the brush (52b) of the cleaning brush member (52) is made of pile fabric, the bristles thereof are short, and the distance between the brush member (51) and the cleaning brush member (52) is short. Moreover, by determining the inclination direction of the brush (52b) of the cleaning brush member (52) based on the relationship between the rotation direction of the brush member (51) and the inclination direction of the brush (51b), dust on the brush member (51) can be more easily scraped off.

[0031] An eleventh aspect is according to one of the first to tenth aspects, including: a dust storing container (60) arranged upstream of the air filter (30) and provided with the brush member (51) and the brush cleaning means (52) for storing dust removed by the brush cleaning means (52); and dust transfer means (80) for introducing air blowing from the indoor fan (21) into the dust storing container (60) and transferring dust in the dust storing container (60) to a predetermined location along with the blowing air.

[0032] According to this aspect, dust which has been removed from the brush member (51) by the brush cleaning means (52) is stored in the dust storing container (60). On the other hand, according to this aspect, the air blowing from the indoor fan (21) is introduced into the dust storing container (60), and the dust is transferred to a predetermined location (e.g., to the outside of the casing (10)) along with the air. That is, dust which has been removed from the air filter (30) is transferred to another location by using the air blowing from the indoor fan (21).

ADVANTAGES OF THE INVENTION

[0033] As described above, according to an aspect of the present invention, there are provided the brush member (51) moved relative to the air filter (30) for removing dust on the air filter (30), and the brush cleaning means (52) for removing dust on the brush member (51), wherein the air filter (30) is moved relative to the brush member (51) in a direction opposite to the moving direction before performing the removal operation by the brush cleaning

means (52). Therefore, it is possible to prevent dust from being unevenly placed on the brush member (51), and the dust can be evenly attached. Thus, it is possible to prevent dust which has been removed from the air filter (30) from forming a lump and falling into the room, etc., and it is possible to easily scrape off (remove) dust from the brush member (51) by the brush cleaning means (52). As a result, it is possible to reliably handle dust on the air filter (30), and to improve the reliability of the cleaning function of the air filter (30).

[0034] According to the second aspect, the brush member (51) is rotated so that a portion of the brush member (51) which has been in contact with the air filter (30) is brought into contact with the cleaning brush member (52). Therefore, dust trapped on the brush member (51) can be removed. Since it does not require three-dimensional movement of the brush member (51), it is possible to reduce the size of the indoor unit (1).

[0035] According to the third aspect, although the brush (51b) is provided only on a portion of the outer circumferential surface of the brush member (51) in the circumferential direction thereof, the dust on the brush (51b) can be removed by the cleaning brush member (52). Thus, it is possible to reduce the cost of the brush member (51) while maintaining the removing capacity of the brush member (51).

[0036] According to the fourth aspect, the disc-shaped air filter (30) is rotated while the air filter (30) is in contact with the brush member (51) so as to move the air filter (30) and the brush member (51) relative to each other. Therefore, as compared with a case where the air filter (30) is formed in a rectangular shape and is moved in sliding motion, for example, it is possible to eliminate the space required for the movement of the air filter (30). Thus, it is possible to further reduce the size of the indoor unit (1).

[0037] The air filter (30) is relatively and intermittently moved relative to the brush member (51) in the fifth aspect, whereas the disc-shaped air filter (30) is intermittently rotated relative to the brush member (51) in the seventh aspect. According to the fifth and seventh aspect, the air filter (30) is relatively moved in the reverse direction or rotated in the reverse direction for each of the intermittent stops, after which dust on the brush member (51) is removed by the brush cleaning means (52). That is, in these aspects, the dust removal of the air filter (30) and the dust removal of the brush member (51) are performed alternately. Therefore, the dust removing function of the brush member (51) can be maintained at a high level across the entire air filter (30). As a result, dust can be reliably removed from across the entire air filter (30).

[0038] According to the sixth aspect, before the removal operation by the brush cleaning means (52) is performed, the air filter (30) is moved relative to the brush member (51) in a direction opposite to that during the dust removal, and the brush member (51) is rotated in a direction opposite to the reverse-direction movement of

the air filter (30). Thus, it is possible to reliably present dust from being unevenly placed on the brush member (51), and the dust can be evenly attached. Therefore, it is possible to better prevent dust which has been removed from the air filter (30) from forming a lump and falling into the room, etc., and it is possible to more easily remove dust from the brush member (51) by the brush cleaning means (52).

[0039] According to the eighth aspect, the brush (51b) of the brush member (51) is made of pile fabric. Therefore, since the bristles of the brush (51b) are short, it is possible to reliably remove dust from the air filter (30) while reducing the space for installing the brush member (51).

[0040] Moreover, according to the ninth aspect, the brush (51b) of the brush member (51) is made of inclined pile whose bristles are inclined so as to oppose against the direction of relative movement of the air filter (30). Therefore, dust can be reliably scraped off of the air filter (30). Thus, it is possible to improve the dust removing efficiency of the air filter (30) while reducing the space for installing the brush member (51).

[0041] Moreover, according to the tenth aspect, the brush (52b) of the cleaning brush member (52) is made of inclined pile. Therefore, the distance between the cleaning brush member (52) and the brush member (51) is reduced, thus reducing the space, and dust on the brush member (51) can be reliably scraped off.

[0042] According to the eleventh aspect, the dust storing container (60) is provided for storing dust removed from the air filter (30), wherein the dust in the dust storing container (60) is transferred to a predetermined location by the air blowing from the indoor fan (21). Therefore, dust which has been removed from the air filter (30) can be once stored and then easily moved to a predetermined location for an easier disposition. Thus, it is possible to avoid an increase in the size of the unit and an increase in the cost thereof because it is not necessary to provide a separate transfer means such as a suction fan, and it is possible to improve the efficiency in disposing of dust which has been removed from the air filter (30).

BRIEF DESCRIPTION OF THE DRAWINGS

[0043]

[FIG. 1] FIG. 1 is a vertical cross-sectional view showing a configuration of an indoor unit according to an embodiment.

[FIG. 2] FIG. 2 is a lateral cross-sectional view showing a configuration of an indoor unit according to the embodiment, as viewed from above.

[FIG. 3] FIG. 3 is a perspective view showing a configuration of a partition plate, an air filter and a dust storing container according to the embodiment.

[FIG. 4] FIG. 4 is a cross-sectional view showing the attachment of the air filter according to the embodiment.

[FIG. 5] FIG. 5 is a perspective view showing a configuration of filter drive means according to the embodiment.

[FIG. 6] FIG. 6 is a perspective view showing a configuration of dust removing means and the dust storing container according to the embodiment, as viewed from above.

[FIG. 7] FIG. 7 is a perspective view showing a configuration of the dust removing means and the dust storing container according to the embodiment, as viewed from below.

[FIG. 8] FIG. 8 is a lateral cross-sectional view showing a configuration of the dust storing container according to the embodiment.

[FIG. 9] FIG. 9 is a lateral cross-sectional view showing a configuration of storage amount detection means according to the embodiment, relative to the dust storing container.

[FIG. 10] FIG. 10 is a cross-sectional view showing a configuration of a major part of dust transfer means according to the embodiment.

[FIG. 11] FIG. 11 is a cross-sectional view showing a configuration of a major part of the dust transfer means according to the embodiment.

[FIG. 12] FIG. 12 schematically shows the relationship between the air filter and the dust removing means according to the embodiment, wherein (A) shows a state during a normal operation, and (B) and (C) each show a state during a filter cleaning operation.

[FIG. 13] FIG. 13 is a lateral cross-sectional view showing the air filter and the dust removing means during a dust removing operation according to the embodiment.

[FIG. 14] FIG. 14 is a lateral cross-sectional view showing an operation of the dust removing means during a brush cleaning operation according to the embodiment.

DESCRIPTION OF REFERENCE CHARACTERS

[0044]

1	Indoor unit
10	Casing
21	Indoor fan
22	Indoor heat exchanger
30	Air filter
40	Filter drive means (moving means)
51	Rotating brush (brush member)
51a	Shaft
51b	Brush
52	Cleaning brush (brush cleaning means, cleaning brush member)
52b	Brush
53	Brush drive means
60	Dust storing container
80	Dust transfer means

DESCRIPTION OF EMBODIMENTS

[0045] An embodiment of the present invention will now be described in detail with reference to the drawings.

[0046] An indoor unit (1) of the present embodiment forms a part of an air conditioner, and installed on a ceiling in a room. The air conditioner includes a refrigerant circuit, in which a compressor, an outdoor heat exchanger and an expansion valve provided in an outdoor unit are connected to an indoor heat exchanger (22) provided in the indoor unit (1). The refrigerant circuit performs a vapor compression refrigeration cycle, with refrigerant circulating in a reversible manner. The air conditioner performs a cooling operation in which the indoor heat exchanger (22) functions as an evaporator in the refrigerant circuit, and a heating operation in which the indoor heat exchanger (22) functions as a condenser in the refrigerant circuit.

20 <Configuration of Indoor Unit>

[0047] As shown in FIGS. 1 and 2, the indoor unit (1) includes a casing (10) and a decorative panel (11). The indoor heat exchanger (22), a drain pan (23), an indoor fan (21), an air filter (30), filter drive means (40), dust removing means (50), a dust storing container (60), dust transfer means (80), and a dust collection box (90) are provided in the casing (10).

[0048] The casing (10) is formed in the shape of a substantially rectangular parallelepiped box whose lower side is open. A heat insulator (17) is laminated on an inner surface of the casing (10). The casing (10) is arranged with its lower portion inserted in an opening in a ceiling board.

[0049] The decorative panel (11) is formed in the shape of a rectangular plate. The decorative panel (11) when viewed in plan is slightly larger than the casing (10) when viewed in plan. The decorative panel (11) is attached to the casing (10) so as to cover the lower side of the casing (10) with a sealant member (16) sandwiched therebetween. With the decorative panel (11) attached to the casing (10), the decorative panel (11) is exposed in the room.

[0050] The decorative panel (11) includes one inlet (13) and four outlets (14). The inlet (13) is formed in a rectangular shape, and is formed in a center portion of the decorative panel (11). A suction grille (12) formed with slits is fitted in the inlet (13). Each outlet (14) is formed in the shape of an elongated rectangle. The outlets (14) are formed along the sides of the decorative panel (11), respectively. An air flow direction adjuster plate (15) is provided at each outlet (14). The air flow direction adjuster plate (15) pivots to adjust the air flow direction (blowing direction).

[0051] The indoor fan (21) is a so-called turbo fan. The indoor fan (21) is arranged near the center of the casing (10), and is located over the inlet (13). The indoor fan (21) includes a fan motor (21a) and an impeller (21b).

The fan motor (21a) is fixed to a top plate of the casing (10). The impeller (21b) is connected to a rotation axis of the fan motor (21a). A bell mouth (24) communicating with the inlet (13) is provided under the indoor fan (21). The bell mouth (24) divides the space in the casing (10) upstream of the indoor heat exchanger (22) into a portion near the indoor fan (21) and a portion near the suction grille (12). The indoor fan (21) is configured to blow air sucked from below through the bell mouth (24) in a radial direction.

[0052] The indoor heat exchanger (22) is configured as a cross-fin type fin-and-tube heat exchanger. The indoor heat exchanger (22) is formed in the shape of a rectangular frame when viewed in plan, and is arranged to surround the indoor fan (21). In the indoor heat exchanger (22), heat is exchanged between the refrigerant and the indoor air sent by the indoor fan (21) (blowing air).

[0053] The drain pan (23) is provided under the indoor heat exchanger (22). The drain pan (23) receives drainage generated as a result of condensation of moisture in the air in the indoor heat exchanger (22). The drain pan (23) is provided with a drain pump (not shown) for discharging the drainage. The drain pan (23) is inclined so that the drainage is collected to the location at which the drain pump is provided.

[0054] A partition plate (25) is provided under the bell mouth (24). The partition plate (25) divides the space between the bell mouth (24) and the suction grille (12) into an upper portion and a lower portion. That is, the partition plate (25) divides the space upstream of the indoor heat exchanger (22) into a portion near the indoor heat exchanger (22) including the bell mouth (24) and a portion near the suction grille (12).

[0055] A vent (26) through which the air sucked through the inlet (13) flows into the bell mouth (24) is formed in the center of the partition plate (25). As shown in FIG. 3, the vent (26) is formed as a circular hole divided into fan-shaped portions by four radial members (27) extending in the radial direction of the circular hole. The radial members (27) are connected to one another at the center of the circle, at which a cylindrical filter rotation shaft (28) protrudes downwardly. The filter rotation shaft (28) is a rotation shaft about which the air filter (30) rotates. Two filter holders (29) are provided on one of the radial members (27).

[0056] As shown in FIG. 3, the air filter (30) is arranged under the partition plate (25), and is formed in a disc shape large enough to cover the inlet of the bell mouth (24). Specifically, the air filter (30) includes an annular filter body (31) and a mesh member (37). A gear portion (32) is provided on an outer circumferential surface of the filter body (31). A cylindrical shaft receiving portion (33) supported by six radial ribs (34) is provided in the annular central portion of the filter body (31). That is, the radial ribs (34) extend radially from the shaft receiving portion (33). An inner circumferential rib (35) and an outer circumferential rib (36), each formed in an annular shape concentric with the filter body (31), are provided in the

inner circle area of the filter body (31). The outer circumferential rib (36) is formed with a larger diameter than the inner circumferential rib (35). The mesh member (37) is provided to extend across the entire inner circle area of the filter body (31). The air sucked through the inlet (13) passes through the mesh member (37) of the air filter (30), and flows into the bell mouth (24). At this point, the dust in the air is trapped on the mesh member (37).

[0057] The air filter (30) is biased downwardly by the above-described filter holders (29) abutting the circumferential ribs (35,36). Therefore, the air filter (30) is pressed onto a rotating brush (51) of the dust removing means (50) to be described later. This improves the removing efficiency of the dust removing means (50).

[0058] As shown also in FIG. 4, the air filter (30) is attached as the shaft receiving portion (33) is fitted around the filter rotation shaft (28) of the partition plate (25). The air filter (30) is rotatable about the filter rotation shaft (28). The dust storing container (60) is arranged under the air filter (30). With the air filter (30) fitted around the shaft receiving portion (33), a filter attachment (68) of the dust storing container (60) is fixed to the shaft receiving portion (33) of the partition plate (25) by the fixing screw (28a). Thus, the air filter (30) is held between the partition plate (25) and the dust storing container (60).

[0059] The filter drive means (40) for rotating the air filter (30) while the air filter (30) is in contact with the rotating brush (51) to be described later is provided near the air filter (30) (see also FIG. 2). That is, the filter drive means (40) forms the moving means for moving the air filter (30) relative to the rotating brush (51).

[0060] Specifically, as shown in FIG. 5, the filter drive means (40) includes a filter drive motor (41) and a limit switch (44). A drive gear (42) is provided on the drive shaft of the filter drive motor (41), and the drive gear (42) meshes with the gear portion (32) of the filter body (31). A switch actuator portion (43), which is a protrusion, is provided on one end surface of the drive gear (42). The switch actuator portion (43) actuates the lever (44a) of the limit switch (44) as the drive gear (42) rotates. When the switch actuator portion (43) actuates the lever (44a), it is detected by the limit switch (44). That is, the switch actuator portion (43) and the limit switch (44) are for detecting the rotational position of the drive gear (42).

[0061] The filter drive means (40) performs an operation of intermittently rotating the air filter (30) over a predetermined angle at a time while the air filter (30) is in contact with the rotating brush (51) to thereby remove the dust by means of the rotating brush (51). Moreover, as a feature of the present invention, the filter drive means (40) performs an operation of rotating the air filter (30) in the opposite direction to the rotation direction during the above operation while the air filter (30) is in contact with the rotating brush (51) after the intermittent rotation stops. That is, before dust on the rotating brush (51) is removed by the cleaning brush (52) to be described later, the filter drive means (40) rotates back the air filter (30) over a predetermined angle. The details of these opera-

tions will be described later.

[0062] Next, the dust removing means (50), the dust storing container (60) and the dust transfer means (80) will be described with reference to FIGS. 6-11. The dust removing means (50), etc., are arranged below the partition plate (25) or the air filter (30) (see FIG. 1 or 2).

[0063] The dust removing means (50) is for removing the dust trapped on the air filter (30). The dust removing means (50) includes the rotating brush (51), a cleaning brush (52), and brush drive means (53). Note that the rotating brush (51) and the cleaning brush (52) form the brush member and the cleaning brush member (brush cleaning means), respectively, of the present invention.

[0064] As shown in FIG. 8, the rotating brush (51) and the cleaning brush (52) are provided in a brush opening (63) of the dust storing container (60) to be described later.

[0065] The rotating brush (51) includes an elongated cylindrical shaft (51a), and a brush (51b) provided on the outer circumferential surface of the shaft (51a). The brush (51b) is formed of a plurality of bristles. The brush (51b) is provided so as to extend over a portion of the shaft (51a) in the circumferential direction thereof, and to extend in the longitudinal direction of the shaft (51a). The cleaning brush (52) is arranged rearward of the rotating brush (51).

[0066] The cleaning brush (52) includes a body portion (52a), a brush (52b), and a spring portion (52c). The body portion (52a) is a plate-like member, and has the same length as the shaft (51a) of the rotating brush (51). The body portion (52a) is provided with a plate surface thereof facing the outer circumferential surface of the rotating brush (51). An upper portion of the body portion (52a) forms an arc portion corresponding to the outer circumferential surface of the shaft (51a) of the rotating brush (51). The brush (52b) is provided on the arc portion of the body portion (52a) extending in the longitudinal direction of the body portion (52a). The spring portion (52c) is provided at a lower end of the body portion (52a), and is attached to an inner wall of the dust storing container (60). That is, the body portion (52a) is supported by the spring portion (52c).

[0067] The rotating brush (51) and the cleaning brush (52) are each formed to a length greater than or equal to the radius of the air filter (30). The rotating brush (51) and the cleaning brush (52) are arranged to extend radially outwardly from the circular center of the air filter (30).

[0068] The rotating brush (51) is configured in such a manner that the dust is removed from the mesh member (37) as the brush (51b) comes into contact with the mesh member (37) of the rotating air filter (30). The rotating brush (51) is rotated by the brush drive means (53) in a reversible manner. As shown in FIGS. 6 and 7, the brush drive means (53) includes a brush drive motor (54), and a drive gear (55) and a driven gear (56) meshing with each other. The drive gear (55) is provided on the drive shaft of the brush drive motor (54), and the driven gear

(56) is provided at an end portion of the shaft (51a) of the rotating brush (51). With such a configuration, the rotating brush (51) is rotated about the axial center of the shaft (51a). The brush drive means (53) is configured to rotate the rotating brush (51) to thereby switch the state between a state where the brush (51b) is in contact with the air filter (30) and a state where it is spaced apart from the air filter (30), the details of which will be described later.

[0069] The brush (52b) of the cleaning brush (52) comes into contact with the brush (51b) of the rotating brush (51) when the rotating brush (51) is rotated by the brush drive means (53). By this contact, dust is removed from the brush (51b) of the rotating brush (51). That is, the cleaning brush (52) is for cleaning the rotating brush (51) by removing dust from the rotating brush (51). The details of the dust removing function of the rotating brush (51) and the cleaning brush (52) will be described later.

[0070] The brushes (51b, 52b) of the rotating brush (51) and the cleaning brush (52) are made of so-called pile fabric. The pile fabric is hairy fabric obtained by weaving a fiber (pile yarn) into base fabric, and has relatively short bristles. The pile fabric is inclined pile in which the bristles are inclined in a certain direction.

[0071] Specifically, the bristles of the brush (51b) of the rotating brush (51) are inclined leftward from the shaft (51a) in FIG. 8. That is, the bristles of the brush (51b) are inclined so as to oppose against the rotation direction (moving direction) of the air filter (30). If the air filter (30) rotates so as to oppose against the bristles of the brush (51b) as described above, dust on the mesh member (37) is scraped off efficiently. On the other hand, if the air filter (30) rotates on the bristles of the brush (51b) in the inclined direction thereof, dust on the mesh member (37) is not scraped off, but rather dust trapped on the brush (51b) is removed.

[0072] The bristles of the brush (52b) of the cleaning brush (52) are inclined downward from the body portion (52a) in FIG. 8. That is, the bristles of the brush (52b) are inclined so as to oppose against the rotation direction when the rotating brush (51) rotates clockwise in FIG. 8.

[0073] The dust storing container (60) is for containing dust removed from the rotating brush (51) by the cleaning brush (52), i.e., for storing dust removed by the dust removing means (50). The dust storing container (60) is a columnar container bent slightly in the shape of ">" when viewed from the side (when viewed from the right in FIG. 6). An upper portion of the dust storing container (60) is a removal portion (61) for removing the dust on the air filter (30), and a lower portion is a storing portion (62) for storing the dust removed from the air filter (30).

[0074] The brush opening (63) is formed in the top plate of the removal portion (61), extending in the longitudinal direction, and the rotating brush (51) and the cleaning brush (52) are provided in the brush opening (63) as described above. Note that the above-described filter attachment (68) is provided at one side surface of the removal portion (61). An edge portion (61a) of the brush

opening (63) on the rear side (i.e., the side opposite to the cleaning brush (52)) has a tapered shape whose width gradually decreases toward the rotating brush (51), and the end surface thereof is formed in an arch shape so as to conform to the brush (51b) of the rotating brush (51). Thus, the gap between an edge portion (6c) and the rotating brush (51) is made as small as possible. Therefore, dust on the air filter (30) which has accidentally passed the rotating brush (51) without being removed by the rotating brush (51) is immediately guided along the edge portion (61a) in the direction of movement of the air filter (30). That is, dust which has passed the rotating brush (51) smoothly moves while it is attached to the air filter (30) without being blocked by the top plate of the removal portion (61). Thus, by improving the edge portion (61a), it is possible to prevent dust from stagnating in the gap between the rotating brush (51) and the top plate of the removal portion (61). If dust stagnates, the dust gradually grows into a large lump, which is eventually thrown out of the gap into the room, etc. This can be prevented by the present embodiment. Moreover, since the gap between the edge portion (61a) and the rotating brush (51) is reduced, the hermeticity (sealed property) of the dust storing container (60) is improved.

[0075] The lower end side (bottom portion side) of the storing portion (62) is bulging in an arch shape. Dust removed from the rotating brush (51) by the cleaning brush (52) falls into, and is stored in, the arc portion of the storing portion (62). Opposite end portions (66,67) of the storing portion (62) in the longitudinal direction are opened. A damper box (81) of the dust transfer means (80) to be described later is connected to the first end portion (66) of the storing portion (62), and a transfer duct (88) of the dust transfer means (80) to be described later is connected to the second end portion (67).

[0076] As shown in FIG. 9, the dust storing container (60) is provided with storage amount detection means (70) for detecting the amount of dust (the amount of dust stored) in the storing portion (62).

[0077] The storage amount detection means (70) includes a sensor box (71). The sensor box (71) is provided close to the second end portion (67) of the storing portion (62) of the dust storing container (60) (see FIG. 6 or 7). The sensor box (71) extends in the transverse direction across the storing portion (62) so as to cover the bottom portion thereof. A light emitting LED (72) and a photo transistor (73) are accommodated in the sensor box (71). The light emitting LED (72) and the photo transistor (73) are arranged so as to face each other in the transverse direction across the storing portion (62) with the storing portion (62) interposed therebetween. On the other hand, a first transparent window (64) and a second transparent window (65) are provided on the wall surface of the storing portion (62) in areas corresponding to the light emitting LED (72) and the photo transistor (73).

[0078] In the storage amount detection means (70), the light intensity of light from the light emitting LED (72) which has successively passed through the first trans-

parent window (64) and the second transparent window (65) is detected by the photo transistor (73). The amount of dust stored in (i.e., the degree of fullness of) the storing portion (62) is detected based on the detected light intensity. That is, when the amount of dust stored is small, the transmittance of light (the amount of light transmitted) from the first transparent window (64) to the second transparent window (65) in the storing portion (62) is high, detecting a high light intensity. In contrast, if the amount of dust stored is large, the transmittance of light (the amount of light transmitted) from the first transparent window (64) to the second transparent window (65) in the storing portion (62) is low, detecting a low light intensity. Thus, for example, when the light intensity is less than or equal to a predetermined value, the storage amount detection means (70) can determine that the storage amount of the storing portion (62) has become full. That is, the storage amount detection means (70) of the present embodiment is configured to detect the amount of dust stored in the dust storing container (60) based on the amount of light transmitted through the storing portion (62).

[0079] As shown in FIGS. 2, 6 and 7, the dust transfer means (80) includes the damper box (81) and the transfer duct (88) described above, an introduction duct (86), and a suction duct (87).

[0080] The damper box (81) is formed in a rectangular parallelepiped shape extending in the longitudinal direction of the storing portion (62) of the dust storing container (60). The first end portion (66) of the storing portion (62) is connected to one end of the damper box (81) in the longitudinal direction. As shown in FIGS. 10 and 11, one damper (82), which is passage open/close means, is provided in the damper box (81). When the damper (82) is closed, the internal space of the damper box (81) is divided in the longitudinal direction. That is, the internal space of the damper box (81) is divided into a first room (81a) and a second room (81b). The first end portion (66) of the storing portion (62) is connected to the second room (81b) as described above.

[0081] As shown in FIG. 7 or 11, the dust transfer means (80) includes a damper drive motor (83) for opening/closing the damper (82), a drive gear (84), and a driven gear (85). The drive gear (84) is provided on the drive shaft of the damper drive motor (83), and the driven gear (85) is provided on the pivot shaft of the damper (82). The drive gear (84) and the driven gear (85) mesh with each other. With this configuration, the rotation of the damper drive motor (83) is transmitted to the rotation shaft of the damper (82) through the gears (84,85). Thus, the damper (82) pivots about the pivot shaft to perform the open/close operation.

[0082] The introduction duct (86) is connected to the upper surface of the damper box (81) and communicates with the first room (81a). As shown in FIG. 10, the introduction duct (86) extends vertical upward from the damper box (81), and passes through the partition plate (25). The introduction duct (86) includes an upstream-side

duct (86a) and a downstream-side duct (86b) whose lateral cross sections are circular, and the two members are connected to each other with the fixing screw (28a) in the vertical direction. The lateral cross-sectional area (flow path area) of the upstream-side duct (86a) is larger than the lateral cross-sectional area (flow path area) of the downstream-side duct (86b). The lower end (the lower side in FIG. 10) of the downstream-side duct (86b) is connected to the damper box (81). The upper end (the upper side in FIG. 10) of the upstream-side duct (86a) is in contact with a horizontally-extending member of the bell mouth (24) with a sealant member (86e) interposed therebetween. An inlet (86d) which is a through hole is formed in the horizontal member of the bell mouth (24). The upstream-side duct (86a) communicates with the space near the indoor fan (21) through the inlet (86d). That is, the introduction duct (86) is for introducing the air blowing from the indoor fan (21) into the damper box (81).

[0083] The junction between the upstream-side duct (86a) and the downstream-side duct (86b) of the introduction duct (86) is located in a through hole portion of the partition plate (25). Specifically, the ducts (86a, 86b) are connected to each other so that the edge of the through hole of the partition plate (25) is sandwiched between the bottom plate of the upstream-side duct (86a) and the upper end flange of the downstream-side duct (86b). This section including the junction and the sealant member (86e) is configured so that the introduction duct (86), the damper box (81) and the dust storing container (60) pivot together about the axial center of the introduction duct (86).

[0084] One end of the suction duct (87) on the inlet side is connected to the lower surface of the damper box (81) and communicates with the second room (81b). The other end of the suction duct (87) on the outlet side is connected to a cleaner insertion hole (not shown) formed in the decorative panel (11). The cleaner insertion hole is an opening for receiving a hose of a cleaner, etc., inserted therein for suction. Note that the suction duct (87) is formed by a flexible tube.

[0085] As shown in FIG. 1 or 2, one end of the transfer duct (88) is connected to the second end portion (67) of the storing portion (62) of the dust storing container (60), and the other end thereof is connected to the dust collection box (90) to be described later. The transfer duct (88) is formed by a flexible tube.

[0086] In the dust transfer means (80), the damper (82) of the damper box (81) is closed (see FIG. 11(A)) in a normal operation of performing cooling/heating. Therefore, the air blowing from the indoor fan (21) is not introduced into the damper box (81). In the dust transfer means (80), the damper (82) of the damper box (81) is opened (see FIG. 11(B)) when transferring the dust in the dust storing container (60) to the dust collection box (90). Therefore, the air blowing from the indoor fan (21) is introduced into the dust storing container (60) through the introduction duct (86) and the damper box (81). As a

result, the dust in the dust storing container (60) is transferred to the dust collection box (90) through the transfer duct (88) along with the air. That is, the dust in the dust storing container (60) is discharged.

[0087] Moreover, in the dust transfer means (80), the damper (82) of the damper box (81) is closed (see FIG. 11(C)) also when the dust in the dust collection box (90) is discharged out of the casing (10). In this case, by sucking from the cleaner suction hole by a cleaner, the dust in the dust collection box (90) is sucked into the cleaner through the transfer duct (88), the damper box (81) and the suction duct (87). That is, the dust transfer means (80) is configured to transfer the dust in the dust storing container (60) to a predetermined position by using the air blowing from the indoor fan (21).

[0088] As shown in FIGS. 1 and 2, the dust collection box (90) stores the dust transferred from the dust storing container (60) as described above. The dust collection box (90) is formed in a somewhat elongated, substantially rectangular parallelepiped shape, and is arranged under the partition plate (25) as is the dust storing container (60). The dust collection box (90) is arranged along one edge of the partition plate (25) so as not to overlap with the air filter (30) when viewed in plan. Thus, one end portion, opposite to the side where the transfer duct (88) is connected, of the dust collection box (90) for the air sucked in through the suction grille (12) serves as an exhaust port (91). The portion of the exhaust port (91) passes through the casing (10) and communicates with the inside of the room. Note that a sealant member (93) is provided in the portion where the exhaust port (91) passes through.

[0089] The portion of the exhaust port (91) of the dust collection box (90) is smaller in area than the other portion when viewed in plan. A side plate of the dust collection box (90) close to the air filter (30) is formed in an arch shape corresponding to the outer circumference of the air filter (30). Moreover, a filter (92) is provided in the dust collection box (90) close to the exhaust port (91). When transferring the dust from the dust storing container (60) to the dust collection box (90), the air inside the dust collection box (90) is discharged from the exhaust port (91). Then, the transferred dust does not flow out of the exhaust port (91) because of the provision of the filter (92). When the dust is discharged from the dust collection box (90) by suction of a cleaner, the indoor air flows into the dust collection box (90) through the exhaust port (91). Then, dust in the air flowing in is trapped on the filter (92). Thus, the air supply/exhaust through the exhaust port (91) keeps an appropriate pressure balance in the dust collection box (90), thereby allowing for appropriate transfer and discharge of dust to and from the dust collection box (90).

-Operation-

[0090] Next, an operation of the indoor unit (1) will be described with reference to FIGS. 12-14. The indoor unit

(1) is capable of selectively performing a normal operation of performing cooling/heating and a filter cleaning operation of cleaning the air filter (30).

<Normal Operation>

[0091] In the normal operation, the air filter (30) remains still while it is in contact with the brush (51b) of the rotating brush (51) as shown in FIG. 12(A). The damper (82) of the damper box (81) is closed (the state shown in FIG. 11(A)).

[0092] In this state, the indoor fan (21) is driven. Then, indoor air sucked into the indoor unit (1) through the inlet (13) passes through the air filter (30) and flows into the bell mouth (24). When the air passes through the air filter (30), dust in the air is trapped on the mesh member (37) of the air filter (30). The air which has flown into the bell mouth (24) blows out from the indoor fan (21). The blowing air exchanges heat with the refrigerant of the indoor heat exchanger (22) to be cooled or heated, after which it is supplied into the room through the outlets (14). Thus, the room is cooled or heated.

[0093] Thus, in the normal operation, since the damper (82) of the damper box (81) is closed, the air blowing from the indoor fan (21) is not introduced into the dust storing container (60) through the damper box (81). That is, the introduction of air into the dust storing container (60) is prohibited.

<Filter Cleaning Operation>

[0094] In the filter cleaning operation, the compressor is stopped in the refrigerant circuit, and the refrigerant does not circulate therethrough. In the filter cleaning operation, a "dust removing operation," a "brush cleaning operation," a "dust transfer operation," and a "dust discharge operation" can be performed selectively.

[0095] The "dust removing operation" is an operation of removing the dust trapped on the air filter (30) by the rotating brush (51). The "brush cleaning operation" is an operation of removing dust which has been trapped on the rotating brush (51) by the cleaning brush (52). The "dust transfer operation" is an operation of transferring the dust from the dust storing container (60) to the dust collection box (90). The "dust discharge operation" is an operation of discharging the dust from the dust collection box (90) to the outside of the casing (10).

[0096] In the present embodiment, the "dust removing operation" and the "brush cleaning operation" are performed alternately. First, in the "dust removing operation," the indoor fan (21) is kept still. Then, as shown in FIG. 12(B), the air filter (30) is rotated by the filter drive means (40) counterclockwise while it is in contact with the rotating brush (51). That is, as shown in FIG. 13(A), the air filter (30) moves so as to oppose against the bristles (inclined to the left) of the brush (51b) of the rotating brush (51). Note that at this point the rotating brush (51) is kept still.

[0097] Then, the dust on the air filter (30) is trapped on the brush (51b) of the rotating brush (51). Here, since the bristles of the brush (51b) are inclined so as to oppose against the rotation direction (moving direction) of the air filter (30), the dust on the air filter (30) is easily scraped off by the brush (51b). Therefore, the dust removing efficiency of the rotating brush (51) is improved. Then, when the lever (44a) of the limit switch (44) of the filter drive means (40) is actuated, the filter drive motor (41) is stopped, and the air filter (30) stops. That is, the air filter (30) stops after rotating over a predetermined angle. Thus, dust is removed from an area of the air filter (30) that has passed the brush (51b) of the rotating brush (51). When the air filter (30) is stopped, the operation is switched from the "dust removing operation" to the "brush cleaning operation."

[0098] However, after the air filter (30) is stopped, dust is unevenly placed to the right of the brush (51b) of the rotating brush (51) (i.e., toward the moving direction of the air filter (30)) as shown in FIG. 13(B). This is because dust which has been scraped off by the brush (51b) is dragged by the movement of the air filter (30). As it is, the lump of dust may grow larger, and eventually fall into the room, etc.

[0099] In view of this, in the "brush cleaning operation," the air filter (30) is rotated back clockwise by the filter drive means (40) over a predetermined angle as shown in FIG. 12(C). That is, as shown also in FIG. 14(A), the air filter (30) rotates in a direction opposite to that during the "dust removing operation," i.e., the same direction as the direction of the bristles of the brush (51b) of the rotating brush (51). In the present embodiment, the air filter (30) rotates to move over a predetermined angle that corresponds to the width of the brush (51b) of the rotating brush (51). Note that during this operation, the indoor fan (21) and the rotating brush (51) continue to remain still.

[0100] Then, as shown in FIG. 14(A), the dust which has been unevenly placed to the right of the brush (51b) of the rotating brush (51) is evened out by the air filter (30). That is, the dust is evenly attached across the entire brush (51b). Thus, dust on the air filter (30) is reliably trapped on the brush (51b). As a result, it is possible to more reliably prevent a lump of dust from falling into the room, etc.

[0101] Then, in the "brush cleaning operation," the rotating brush (51) rotates to the left (counterclockwise) in FIG. 14 while the indoor fan (21) and the air filter (30) are kept still. At this point, the rotating brush (51) rotates with dust trapped on the brush (51b). The rotating brush (51) rotates while the brushes (51b, 52b) of the rotating brush (51) and the cleaning brush (52) are kept in contact with each other (see FIG. 14(B)). Then, the rotating brush (51) stops after rotating over a predetermined rotation angle.

[0102] Then, the rotating brush (51) rotates in a direction opposite to the above (i.e., to the right (clockwise) in FIG. 14). Then, dust attached to the brush (51b) of the rotating brush (51) is trapped on the brush (52b) of the cleaning brush (52) (see FIG. 14(C)). Since the bristles

of the brush (52b) of the cleaning brush (52) are inclined downward, i.e., since the bristles are inclined so as to oppose against the rotation direction of the rotating brush (51), dust is easily scraped off of the brush (51b) of the rotating brush (51). Moreover, since the dust is evenly attached across the entire brush (51b) of the rotating brush (51) because of the operation of rotating back the air filter (30) shown in FIG. 14(A), the dust can be scraped off by the cleaning brush (52) even more easily and reliably.

[0103] As the brushes (51b,52b) come into contact with each other, the body portion (52a) of the cleaning brush (52) is pushed backward, but the body portion (52a) is biased by the spring portion (52c) toward the rotating brush (51). Thus, the brushes (51b,52b) are not separated from each other, but the cleaning brush (52) is appropriately pressed against the rotating brush (51). Therefore, dust is more reliably removed from the brush (51b) of the rotating brush (51). As described above, dust is trapped on the brush (52b) of the cleaning brush (52). The rotating brush (51) stops after rotating to the original state (the state shown in FIG. 14(A)).

[0104] Then, the rotating brush (51) again rotates to the left (counterclockwise) over a predetermined angle as shown in FIG. 14(D). Then, dust which has been trapped on the brush (52b) of the cleaning brush (52) is scraped off by the brush (51b) of the rotating brush (51), and falls into the storing portion (62) of the dust storing container (60). Since the bristles of the brush (51b) of the rotating brush (51) are inclined in the rotation direction, dust is reliably scraped off of the brush (52b) of the cleaning brush (52). Also in this operation, the cleaning brush (52) is appropriately pressed against the rotating brush (51) by the spring portion (52c) as described above, and dust is more reliably removed from the cleaning brush (52). As described above, dust which has been trapped on the rotating brush (51) is removed and is stored in the storing portion (62) of the dust storing container (60). Then, the rotating brush (51) again rotates to the right (clockwise) and returns back to the original state (the state shown in FIG. 14(A)), once ending the "brush cleaning operation."

[0105] When the "brush cleaning operation" is ended, the "dust removing operation" described above is performed again. That is, the air filter (30) is rotated again, and when the lever (44a) of the limit switch (44) is actuated again, the air filter (30) stops. Thus, dust on an area of the air filter (30) that has passed the brush (51b) of the rotating brush (51) is trapped on the brush (51b) of the rotating brush (51) (the state shown in FIG. 14(A)). The "dust removing operation" and the "brush cleaning operation" are alternately repeated as described above. As a result, dust is removed from a predetermined area of the air filter (30) at a time. When dust is removed from the entire area of the air filter (30), the "dust removing operation," and the "brush cleaning operation" are completely ended. For example, when the lever (44a) of the limit switch (44) has been actuated a predetermined

number of times, it is determined that the air filter (30) has made one revolution, and the operation is ended.

[0106] Here, during the "dust removing operation" and the "brush cleaning operation" described above, the amount of dust stored in the dust storing container (60) is detected by the storage amount detection means (70). That is, light from the light emitting LED (72) passes through the transparent windows (64,65) of the storing portion (62) and the dust therein. The light intensity of the transmitted light is detected by the photo transistor (73). Then, when the light intensity detected by the photo transistor (73) is less than or equal to a predetermined value (the lower limit value), the operation is switched to the "dust transfer operation" assuming that the amount of dust in the dust storing container (60) has reached a predetermined amount.

[0107] In the "dust transfer operation," the rotating brush (51) and the air filter (30) are kept still. Note that the brush (51b) of the rotating brush (51) is in contact with the air filter (30). The damper (82) of the damper box (81) is in the open state (the state shown in FIG. 11 (B)). In this state, the indoor fan (21) is driven. The air blowing from the indoor fan (21) is introduced into the dust storing container (60) passing through the introduction duct (86) and the damper box (81) in this order. This transfers the dust in the dust storing container (60) to the dust collection box (90) along with the air through the transfer duct (88). Then, the amount of dust stored in the dust storing container (60) decreases, and the light intensity detected by the photo transistor (73) increases accordingly. Then, when the detected light intensity is greater than or equal to a predetermined value (the upper limit value), the "dust transfer operation" is ended assuming that most of the dust in the dust storing container (60) has been transferred (discharged). Thereafter, the "dust removing operation" or "brush cleaning operation" is resumed.

[0108] If the light intensity detected by the photo transistor (73) does not readily increase (e.g., if the detected light intensity does not change over a certain amount of time) during the "dust transfer operation" described above, it is determined that the air is not appropriately flowing through the introduction duct (86) or the transfer duct (88). For example, the air flow may be inhibited by reasons such as the introduction duct (86), or the like, being clogged, or the damper (82) being broken and not open. In such a case, the indoor fan (21) is stopped to once end the "dust transfer operation." Then, the "dust transfer operation" is resumed after this problem is solved by an inspection, etc.

[0109] In the filter cleaning operation of the present embodiment, the "dust discharge operation" is performed based on a predetermined condition. For example, the "dust discharge operation" is performed when the "dust transfer operation" has been performed a predetermined number of times (over a predetermined amount of time). Alternatively, it may be performed based on a remote controller operation by the user.

[0110] In "dust discharge operation," the rotating brush (51) and the air filter (30) are kept still as in the "dust transfer operation" described above. The damper (82) of the damper box (81) is in the closed state (the state shown in FIG. 11(C)). In this state, the user inserts the hose of a cleaner into the cleaner insertion hole of the decorative panel (11). By the suction operation thereof, dust in the dust collection box (90) is sucked into the cleaner passing through the transfer duct (88), the dust storing container (60) and the suction duct (87) in this order. At this point, dust in the dust storing container (60) is also sucked into the cleaner through the suction duct (87). As a result, dust in the dust collection box (90) and the dust storing container (60) is discharged to the outside of the casing (10).

-Advantages of Embodiment-

[0111] In the "brush cleaning operation" of the present embodiment, the air filter (30) is rotated back over a predetermined angle before rotating the rotating brush (51) to remove dust by the cleaning brush (52). Thus, dust which has been removed from the air filter (30) is prevented from being unevenly placed on the brush (51b) of the rotating brush (51), and the dust can be evenly attached. Therefore, it is possible to prevent dust which has been removed from the air filter (30) from forming a lump and falling into the room, etc. Moreover, dust can be easily scraped off (removed) from the rotating brush (51) by the cleaning brush (52). Therefore, it is possible to improve the reliability of the indoor unit (1) having the function of cleaning the air filter (30).

[0112] In the present embodiment, the brush (51b) is provided so as to extend over only a portion of the rotating brush (51) in the circumferential direction thereof, but dust on the brush (51b) of the rotating brush (51) can be removed by the cleaning brush (52). Therefore, it is possible to reduce the material cost of the rotating brush (51) while maintaining the removing capacity of the rotating brush (51).

[0113] Moreover, in the present embodiment, the air filter (30) is rotated intermittently so as to alternately perform the "dust removing operation" and the "brush cleaning operation." Therefore, dust which has been removed from the air filter (30) can be reliably handled (i.e., stored in the dust storing container (60)), and the dust removing efficiency can be maintained at a high level across the entire air filter (30). Thus, it is possible to further improve the reliability of the indoor unit (1).

[0114] In the present embodiment, the air filter (30) formed in a disc shape is rotated so as to move the air filter (30) and the rotating brush (51) relative to each other. Therefore, as compared with a case where the air filter (30) is formed in a rectangular shape and is moved in sliding motion, for example, it is possible to eliminate the space required for the movement of the air filter (30). Thus, it is possible to reduce the size of the indoor unit (1).

[0115] In the present embodiment, dust is transferred

by introducing the air blowing from the indoor fan (21) into the dust storing container (60). Therefore, the dust in the dust storing container (60) can be easily moved to a predetermined location for an easier disposition without providing a separate transfer means such as a suction fan. Therefore, it is possible to improve the dust handling efficiency without increasing the size or the cost of the unit.

[0116] Moreover, since the dust storing container (60) is arranged under the air filter (30) in the present embodiment, it presents a resistance (hindrance) to the air flow. Therefore, it is necessary to reduce the volume of the dust storing container (60) as much as possible. Then, it is no longer possible to store a large amount of dust in the dust storing container (60). In view of this, in the present embodiment, the dust collection box (90) having a larger volume than the dust storing container (60) is provided at a location where it does not present a resistance to the air flow, so that dust is transferred from the dust storing container (60) to the dust collection box (90). Therefore, it is possible to store a large amount of dust removed from the air filter (30) while reducing the resistance to the flow of the sucked air by reducing the size of the dust storing container (60) as much as possible. As a result, it is possible to reduce the trouble of handling dust by the user while preventing a decrease in the air conditioning function.

[0117] In the present embodiment, the brush (51b) of the rotating brush (51), and also the brush (52b) of the cleaning brush (52), are made of pile fabric. Therefore, the brushes (51b, 52b) have short bristles, and it is possible to reduce the space for installing the rotating brush (51) and the cleaning brush (52). As a result, it is possible to further reduce the size of the indoor unit (1).

[0118] Because the brushes (51b, 52b) of the rotating brush (51) and the cleaning brush (52) have short bristles, and because the brush (51b) of the rotating brush (51) is provided so as to extend over only a portion thereof in the circumferential direction, it is possible to reduce the resistance to the flow of the air (i.e., the air blowing from the indoor fan (21)) in the dust storing container (60). Therefore, it is possible to improve the transfer efficiency of the dust transfer operation and the discharge efficiency of the dust discharge operation.

[0119] Moreover, since the bristles of the brush (51b) of the rotating brush (51) are inclined pile which opposes against the moving direction (rotation direction) of the air filter (30), dust on the air filter (30) can be easily and reliably scraped off. By rotating the air filter (30) in the reverse direction, it is possible to easily even out the dust across the entire brush (51b). Since the brush (52b) of the cleaning brush (52) also uses inclined pile, dust on the rotating brush (51) can be easily and reliably scraped off.

<<Other Embodiments>>

[0120] The embodiment above may employ configu-

rations as follows.

[0121] For example, while the air filter (30) is rotated during the dust removing operation and the brush cleaning operation in the filter cleaning operation in the embodiment above, the dust storing container (60) (including the rotating brush (51) and the cleaning brush (52)) may be moved relative to the air filter (30). In such a case, the dust storing container (60) revolves around the shaft receiving portion (33) of the air filter (30). That is, the present invention may be configured so that the air filter (30) and the rotating brush (51) move relative to each other.

[0122] The "brush cleaning operation" of the embodiment above may be performed as follows. In the "brush cleaning operation," the air filter (30) is first rotated back clockwise over a predetermined angle as described above (see FIGS. 12(C) and 14(A)). Here, simultaneously with the back rotation of the air filter (30), the rotating brush (51) is rotated to the right (clockwise) in FIG. 14. That is, simultaneously with the backward movement of the air filter (30), the rotating brush (51) is rotated over a predetermined angle in a direction opposite to the backward movement. Then, due to the relative movement between the air filter (30) and the rotating brush (51), dust which has been unevenly placed to the right of the brush (51b) of the rotating brush (51) (to the right in FIG. 14) is further dragged to the left (to the left in FIG. 14). Thus, dust is uniformly attached across the entire brush (51b) more reliably. Since the rotating brush (51) is rotating, dust is dragged to an area of the brush (51b) where little dust is attached thereto, and the dragged dust is reliably attached to the brush (51b).

[0123] In the "brush cleaning operation" above, the rotating brush (51) may be rotated in the same direction as the backward movement of the air filter (30). That is, in the present invention, simultaneously with the back rotation of the air filter (30), the rotating brush (51) may be rotated to the left in FIG. 14 over a predetermined angle. In this process, the rotational speed of the air filter (30) and the rotational speed of the rotating brush (51) are set so that there is a speed difference therebetween. The rotational speed difference evens out the unevenly-placed dust across the brush (51b).

[0124] While the air filter (30) is first rotated back in the "brush cleaning operation" of the embodiment above, the present invention may instead be as follows. First, the rotating brush (51) may stop after rotating to the left (counterclockwise) in FIG. 14 over a predetermined angle, after which the air filter (30) is rotated counterclockwise (i.e., the same direction as that during the "dust removing operation") over a predetermined angle. By the rotation of the rotating brush (51), dust which has been unevenly placed to the right (to the right in FIG. 14) is drawn to the left (to the left in FIG. 14). By the following rotation of the air filter (30), dust drawn to the left is drawn to the right so as to be evenly attached across the brush (51b).

[0125] While the air filter (30) is formed in a circular

shape in the embodiment above, the present invention is not limited to this, and the air filter (30) may be formed in a rectangular shape. In such a case, the air filter (30) moves straight relative to the rotating brush (51), for example.

[0126] While the air filter (30) is rotated intermittently, and the brush cleaning operation is performed for each of the intermittent stops in the embodiment above, it is understood that the brush cleaning operation may be performed after the air filter (30) is rotated continuously over one revolution or a few revolutions in the present invention.

[0127] While inclined pile (pile fabric) is used for the brushes (51b, 52b) of the rotating brush (51) and the cleaning brush (52) in the embodiment above, it is understood that other brush materials may also be used.

[0128] While the embodiment above has been directed to the indoor unit (1) installed on the room ceiling, the present invention is not limited to this, and may also be applied to a so-called wall-suspended indoor unit attached to a wall in the room.

[0129] While the air blowing from the indoor fan (21), before it passes through the indoor heat exchanger (22), is introduced into the damper box (81) in the embodiment above, a similar dust transfer operation can be performed in the present invention also by introducing the air which has passed through the indoor heat exchanger (22). Note that in such a case, during a cooling operation, for example, the air having been cooled through the indoor heat exchanger (22) flows through the dust storing container (60), etc., which may cause condensation on the dust storing container (60), etc. Therefore, in such a case, the dust storing container (60) and the ducts (86, 88) may be covered with a heat insulator in order to prevent the condensation.

[0130] While dust is transferred from the dust storing container (60) to the dust collection box (90) by using the air blowing from the indoor fan (21) in the embodiment above, a dedicated transfer fan may be provided in the present invention.

[0131] Note that the embodiment described above is essentially a preferred embodiment, and is not intended to limit the scope of the present invention, the applications thereof, or the uses thereof.

INDUSTRIAL APPLICABILITY

[0132] As described above, the present invention is useful for an indoor unit of an air conditioner having a dust removing function of removing dust on an air filter by means of a brush member.

Claims

1. An indoor unit of an air conditioner comprising an indoor heat exchanger (22), an indoor fan (21), and an air filter (30) provided on an inlet side of the indoor

fan (21), provided in a casing (10), the indoor unit comprising:

a brush member (51) for removing dust on the air filter (30) while being in contact with the air filter (30);
brush cleaning means (52) for removing dust on the brush member (51) while being in contact with the brush member (51); and
moving means (40) for selectively performing an operation of moving the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush member (51) so as to remove dust by the brush member (51), and another operation of moving the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush member (51) in a direction opposite to a moving direction during the first operation before removing dust on the brush member (51) by the brush cleaning means (52).

2. The indoor unit of an air conditioner of claim 1, wherein

the brush member (51) includes a shaft (51a), and a brush (51b) provided on an outer circumferential surface of the shaft (51a) for removing dust while being in contact with the air filter (30),
the brush cleaning means is a cleaning brush member (52) located near an outer circumference of the shaft (51a) of the brush member (51) and including a brush (52b) for removing dust while being in contact with the brush (51b) of the brush member (51), and the indoor unit includes brush drive means (53) for rotating the brush member (51) about an axial center of the shaft (51a) so that an area of the brush (51b) of the brush member (51) that has been in contact with the air filter (30) is brought into contact with the brush (52b) of the cleaning brush member (52).

3. The indoor unit of an air conditioner of claim 2, wherein

the brush (51b) of the brush member (51) is provided so as to extend over a portion of an outer circumferential surface of the shaft (51a) in a circumferential direction thereof.

4. The indoor unit of an air conditioner of claim 2 or 3, wherein

the air filter (30) is formed in a disc shape,
the brush member (51) is arranged upstream of the air filter (30) so as to extend in a radial direction of the air filter (30), and
the moving means (40) is configured to move the air filter (30) by rotating the air filter (30) while the air filter (30) is in contact with the brush (51b) of the brush member (51).

5. The indoor unit of an air conditioner of claim 1, wherein

the moving means (40) is configured to relatively and intermittently move the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush (51b) of the brush member (51) to remove dust by the brush member (51), and to relatively move the air filter (30) relative to the brush member (51) while the air filter (30) is in contact with the brush member (51) in a direction opposite to a direction of the intermittent movement after the intermittent movement is stopped, and
the indoor unit includes brush drive means (353) for bringing an area of the brush member (51) that has been in contact with the air filter (30) into contact with the brush cleaning means (52) to remove dust on the brush member (51) after the reverse-direction movement of the air filter (30) by the moving means (40).

6. The indoor unit of an air conditioner of claim 1, wherein

the brush member (51) includes a shaft (51a), and a brush (51b) provided on an outer circumferential surface of the shaft (51a) for removing dust while being in contact with the air filter (30),
the moving means (40) is configured to selectively perform an operation of moving the air filter (30) while the air filter (30) is in contact with the brush (51b) of the brush member (51) so as to remove dust by the brush member (51), and another operation of moving the air filter (30) while the air filter (30) is in contact with the brush (51b) of the brush member (51) in a direction opposite to a moving direction during the first operation before removing dust on the brush member (51) by the brush cleaning means (52), and the indoor unit includes brush drive means (53) for rotating the brush member (51) about an axial center of the shaft (51a) in a direction opposite to the reverse-direction movement of the air filter (30), simultaneously with the reverse-direction movement of the air filter (30) by the moving means (40).

7. The indoor unit of an air conditioner of claim 4, wherein

the moving means (40) is configured to intermittently rotate the air filter (30) over a predetermined rotation angle at a time while the air filter (30) is in contact with the brush (51b) of the brush member (51) to remove dust by the brush member (51), and to rotate back the air filter (30) over a predetermined angle in a direction opposite to the rotation direction while the air filter (30) is in contact with the brush (51b) of the brush member (51) after each stop of the intermittent rotation, and
the brush drive means (53) is configured to rotate the brush member (51), after the back rotation of the air filter (30) by the moving means (40), so that an

area of the brush (51b) of the brush member (51) which has been in contact with the air filter (30) is brought into contact with the brush (52b) of the cleaning brush member (52), thereby removing dust on the brush member (51).

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8. The indoor unit of an air conditioner of claim 2 or 3, wherein the brush (51b) of the brush member (51) is made of pile fabric.

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9. The indoor unit of an air conditioner of claim 8, wherein the brush (51b) of the brush member (51) is made of inclined pile whose bristles are inclined so as to oppose against a direction of the relative movement of the air filter (30) during the operation of removing dust on the air filter (30) by the brush member (51).

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10. The indoor unit of an air conditioner of claim 9, wherein the brush (52b) of the cleaning brush member (52) is made of inclined pile of pile fabric whose bristles are inclined in a certain direction.

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11. The indoor unit of an air conditioner of claim 2 or 3, comprising:

a dust storing container (60) arranged upstream of the air filter (30) and provided with the brush member (51) and the brush cleaning means (52) for storing dust removed by the brush cleaning means (52); and

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dust transfer means (80) for introducing air blowing from the indoor fan (21) into the dust storing container (60) and transferring dust in the dust storing container (60) to a predetermined location along with the blowing air.

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FIG. 1

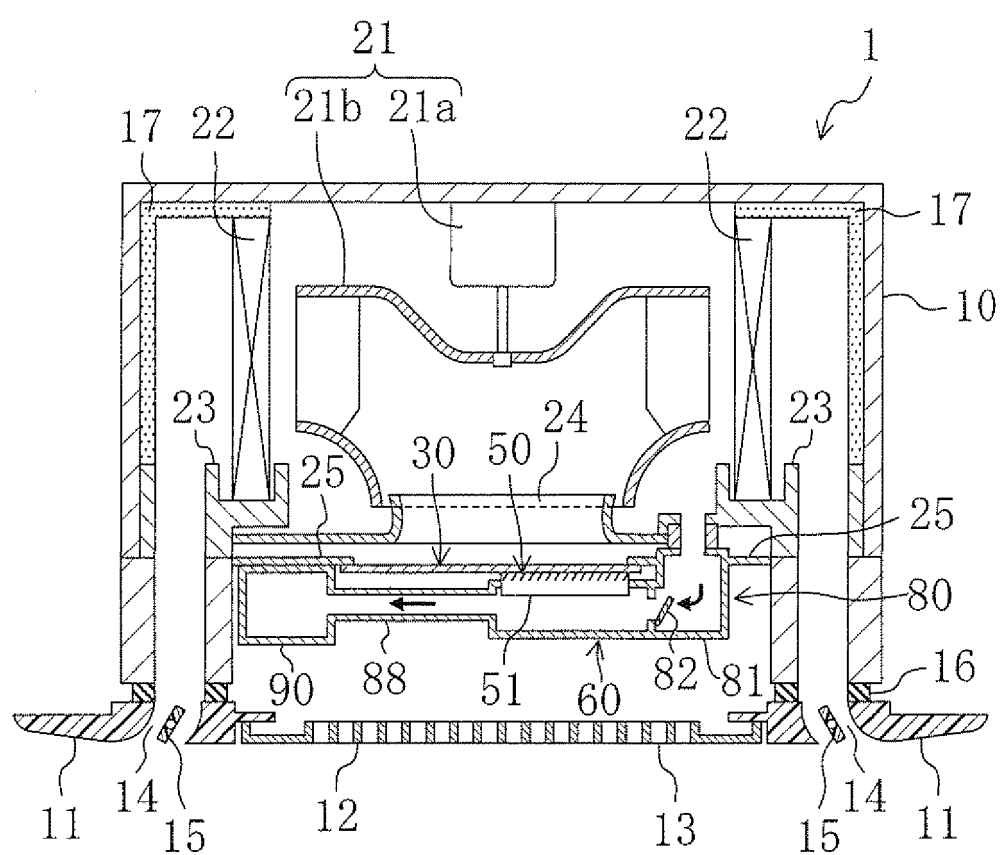


FIG. 2

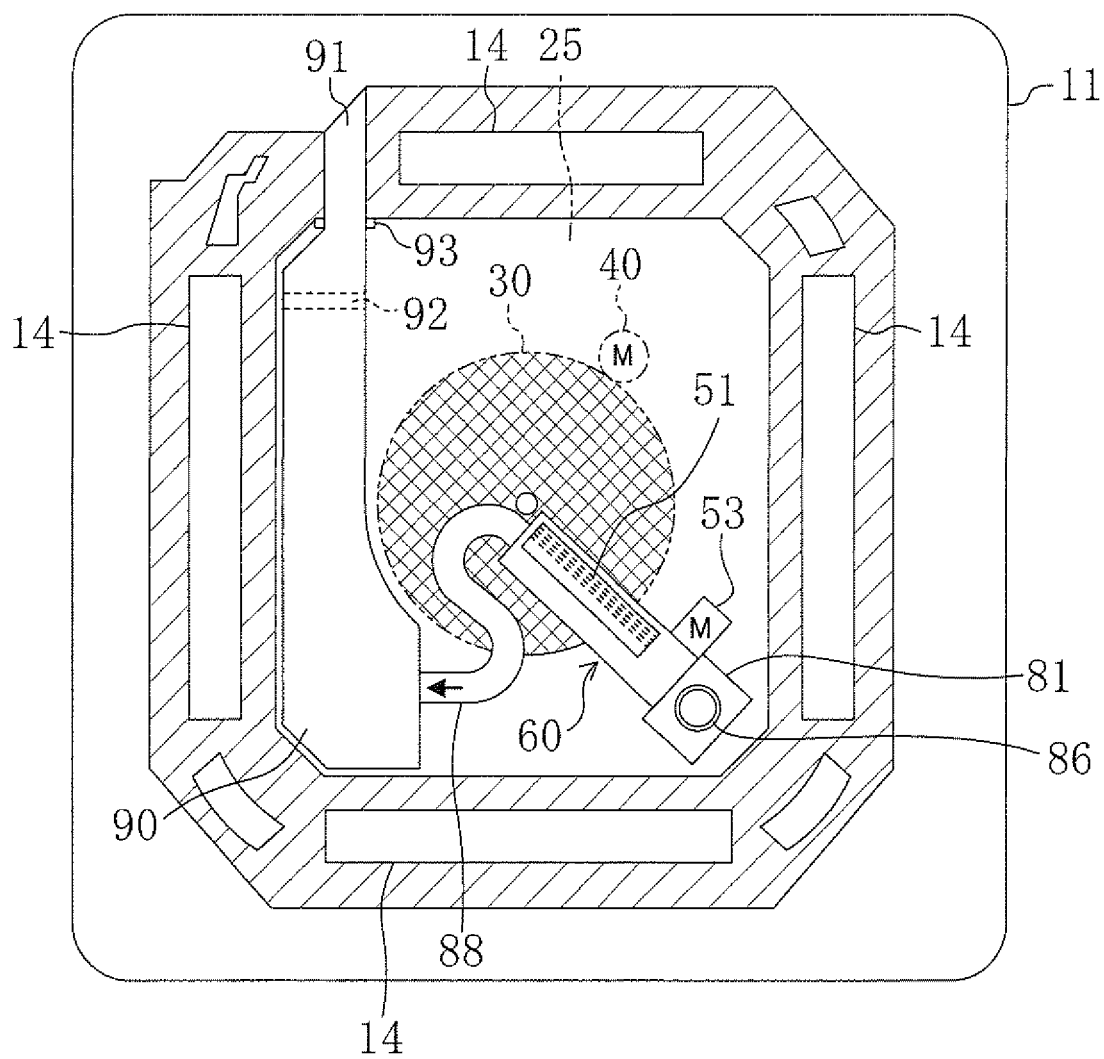


FIG. 3

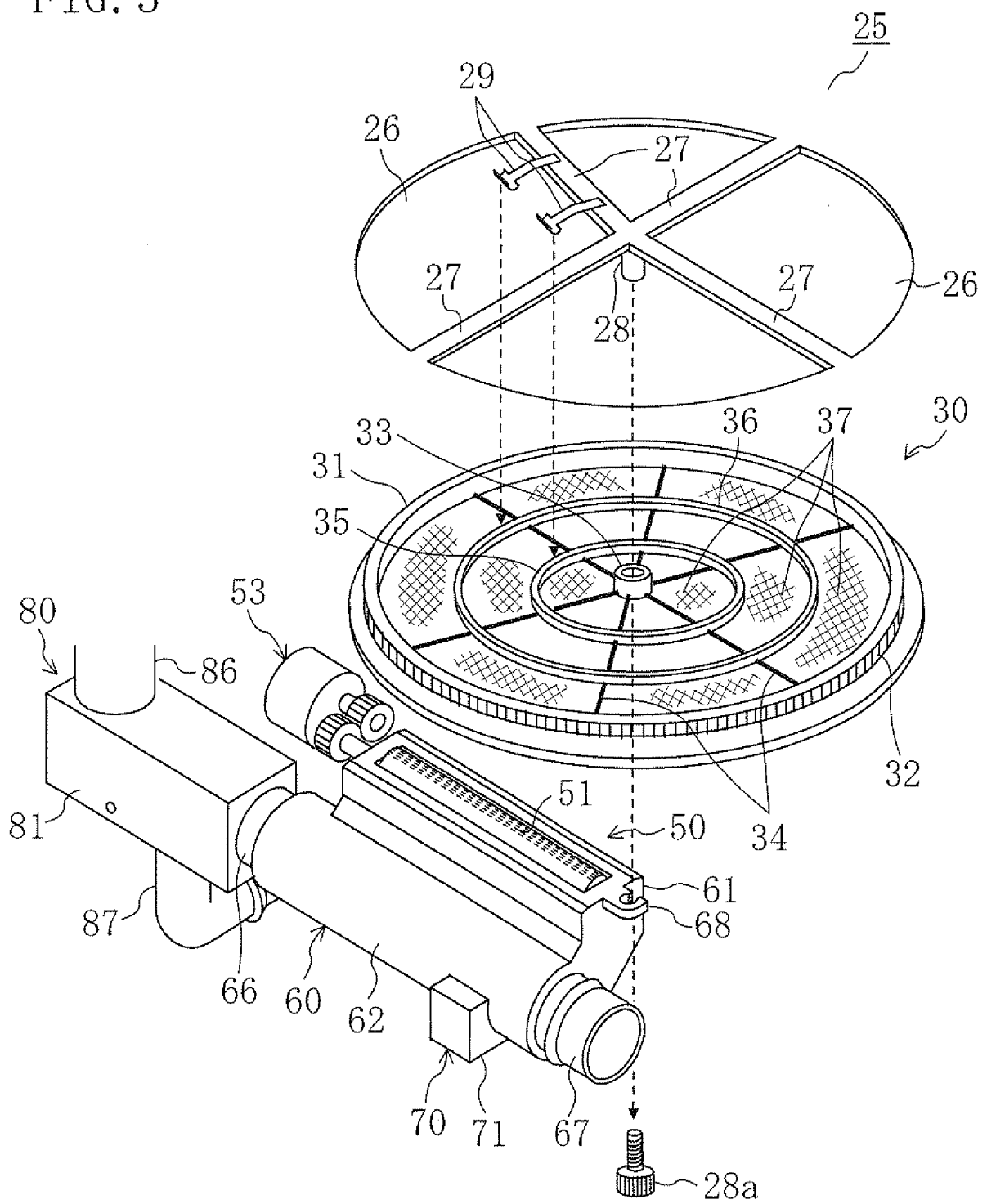


FIG. 4

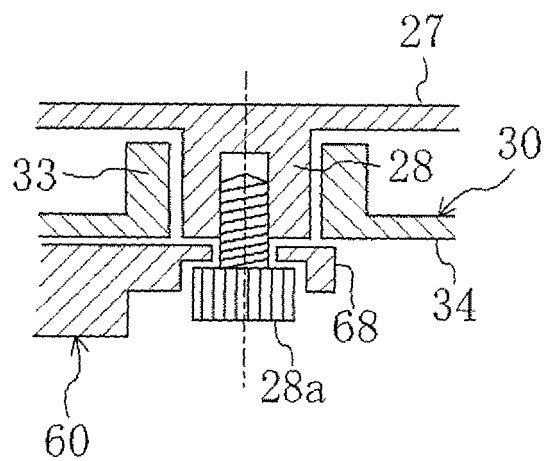


FIG. 5

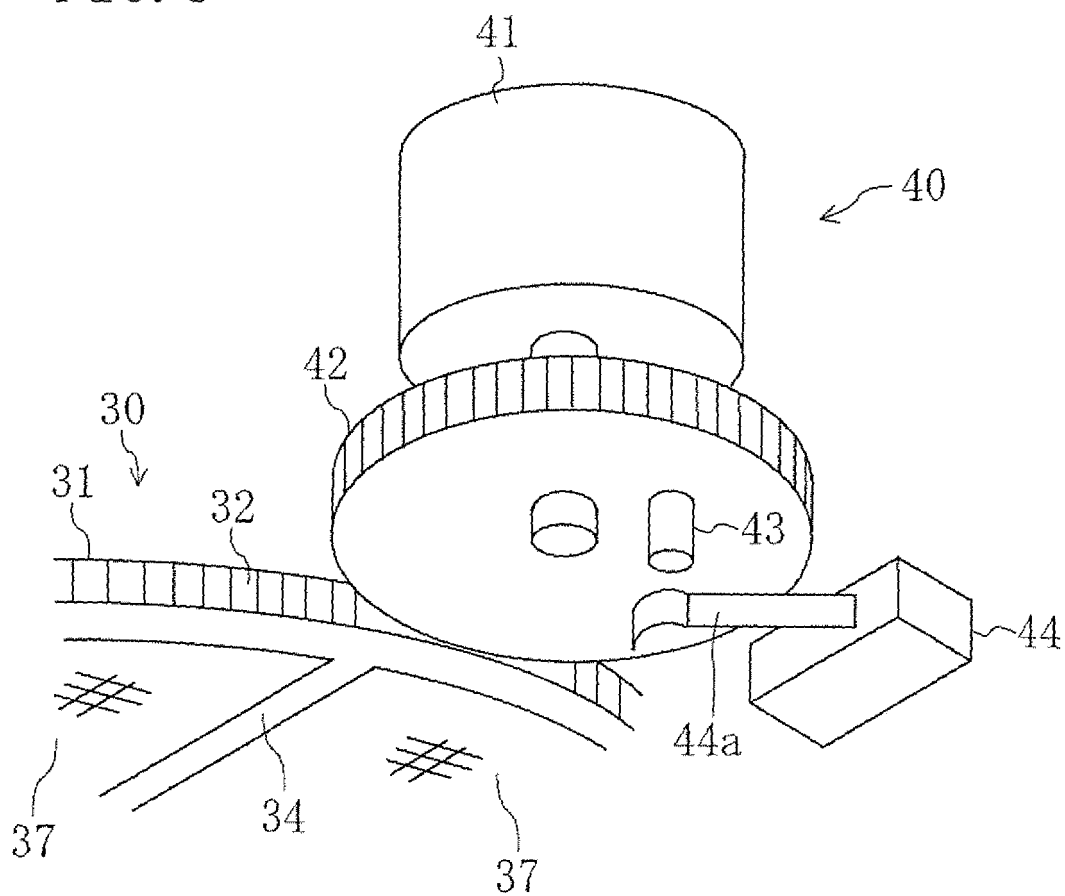


FIG. 6

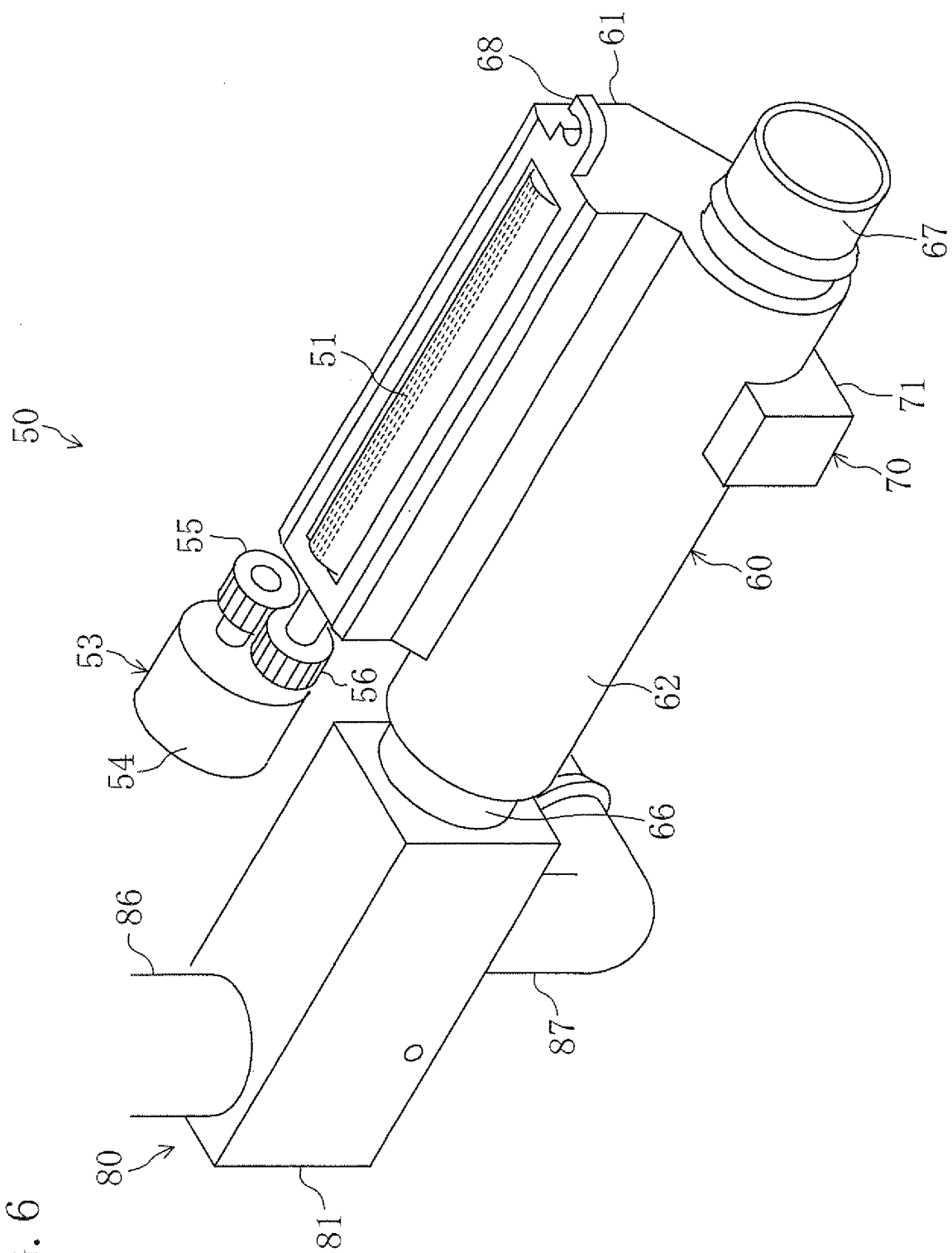


FIG. 7

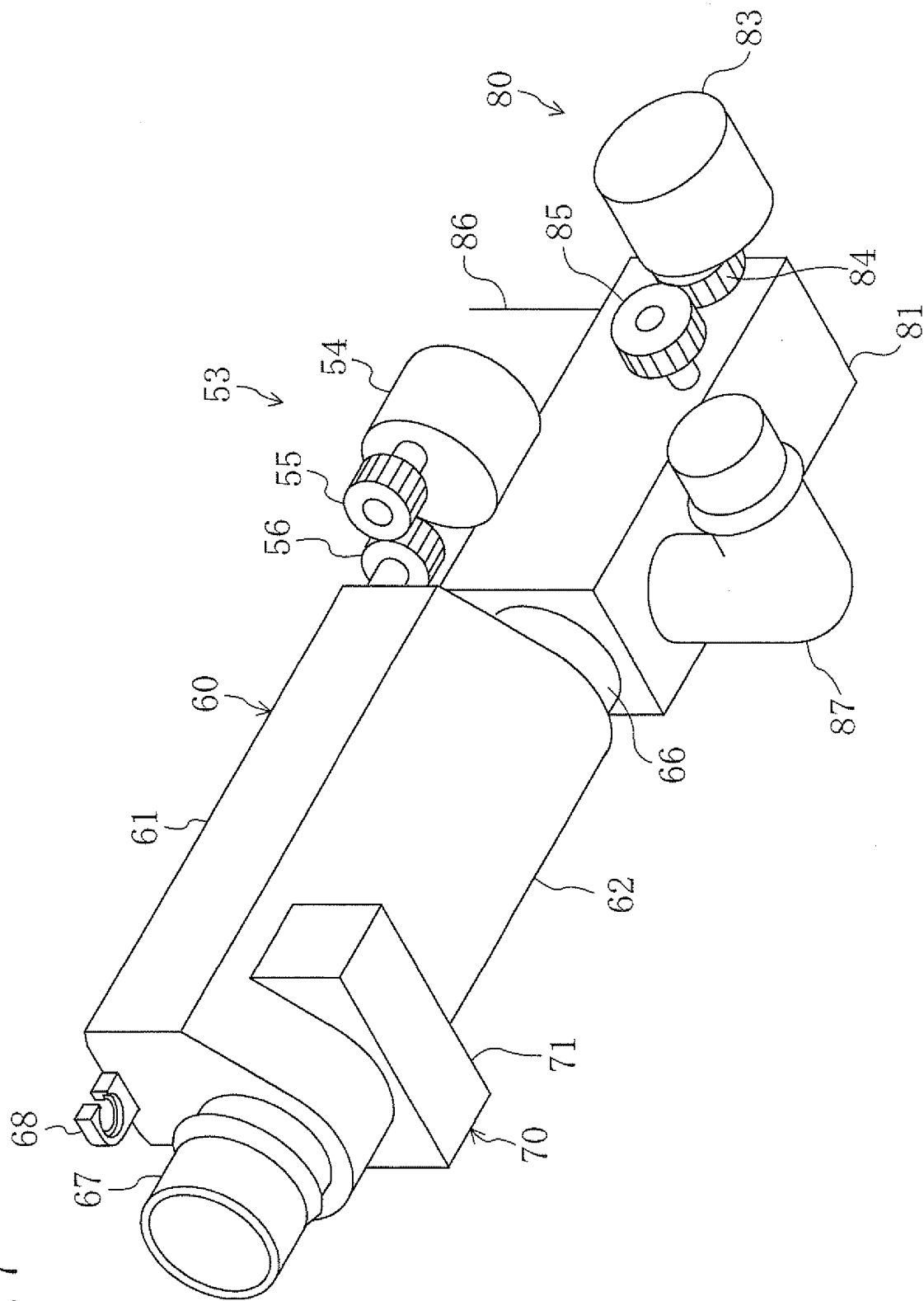


FIG. 8

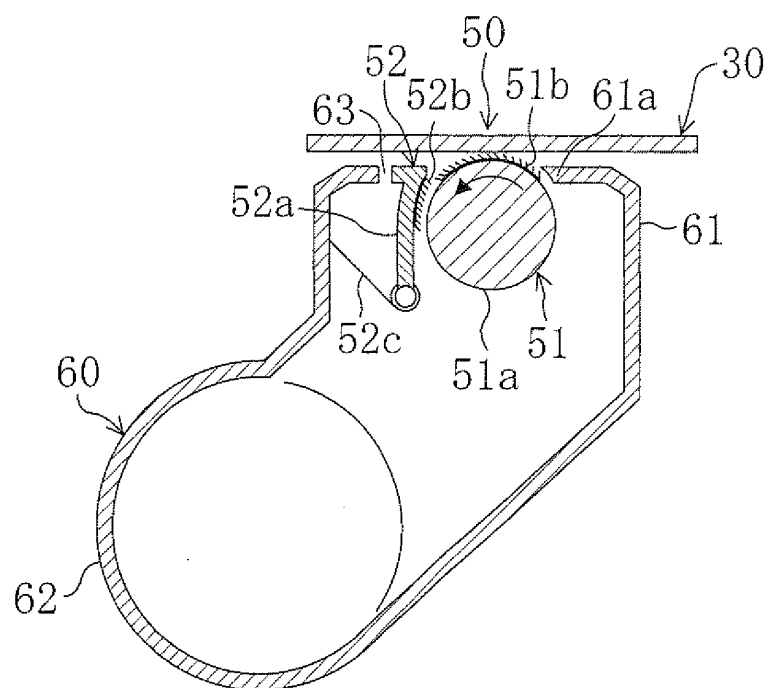


FIG. 9

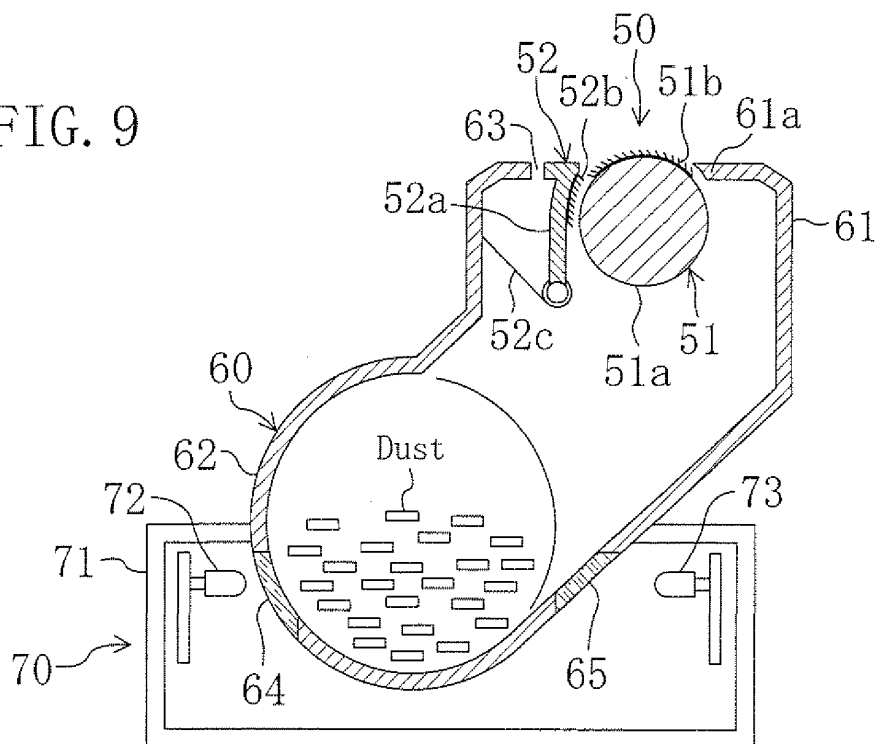


FIG. 10

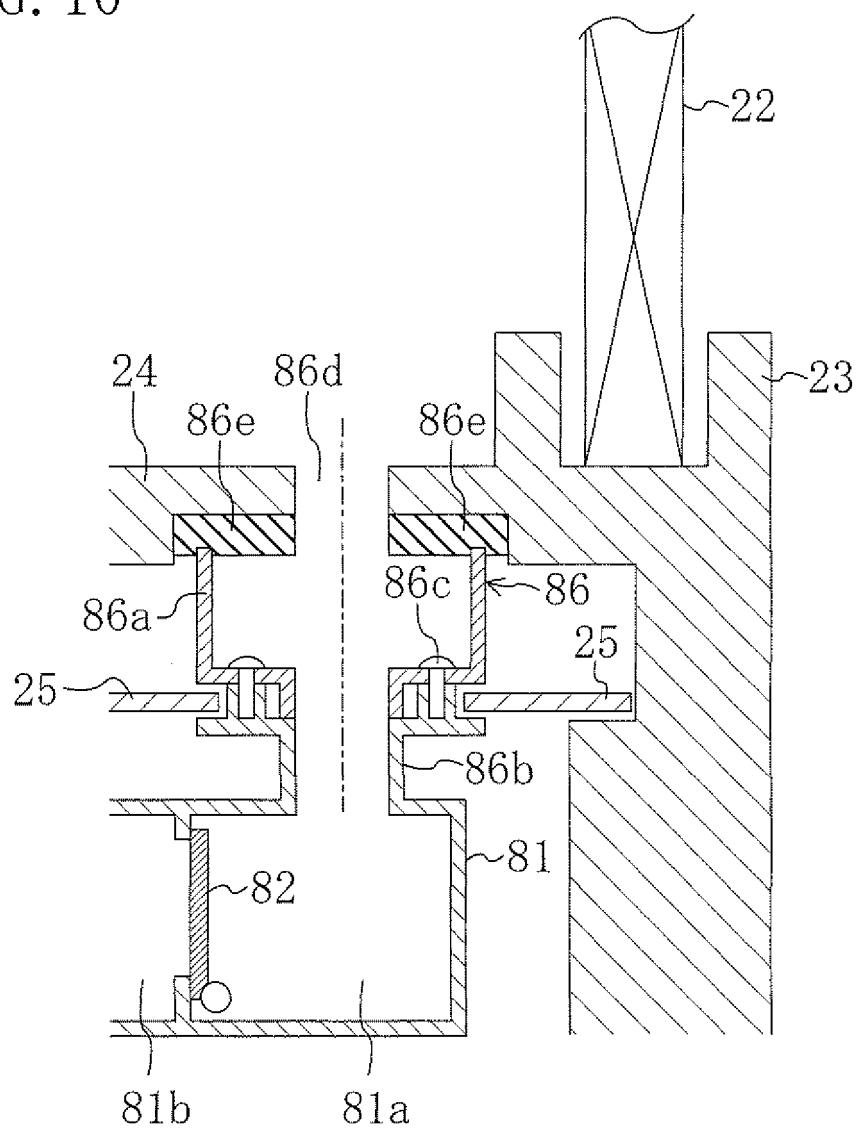
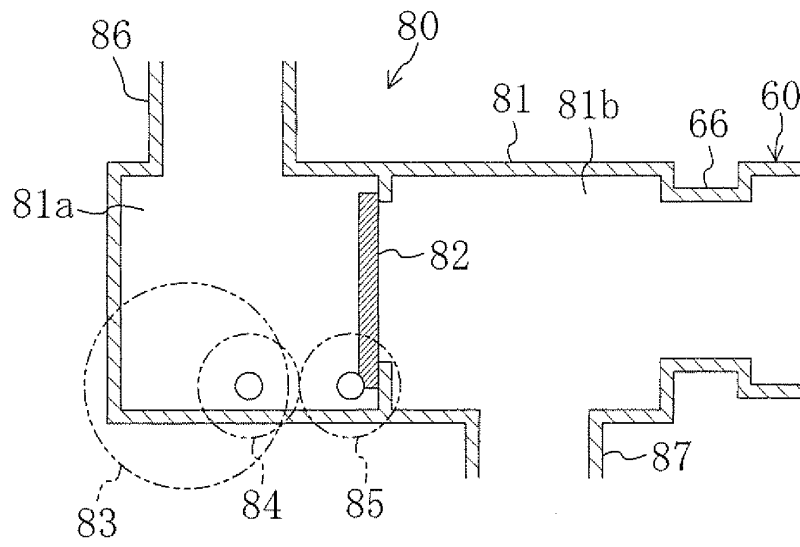
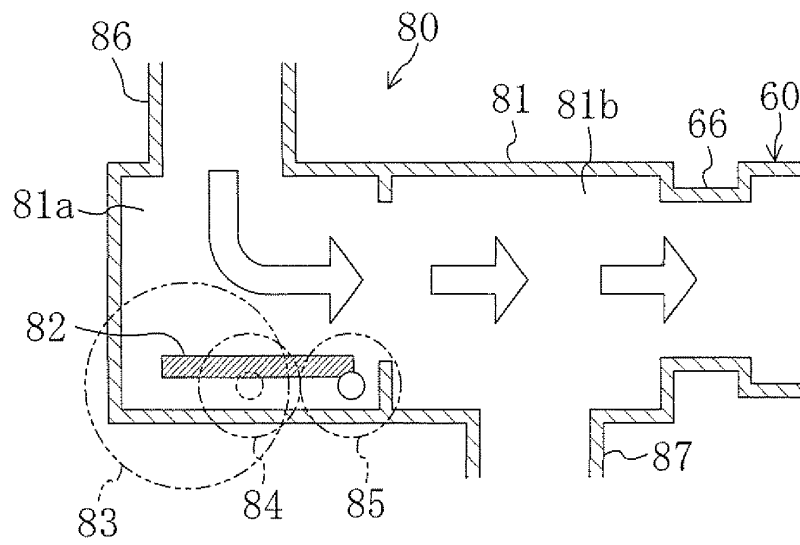


FIG. 11

(A)



(B)



(C)

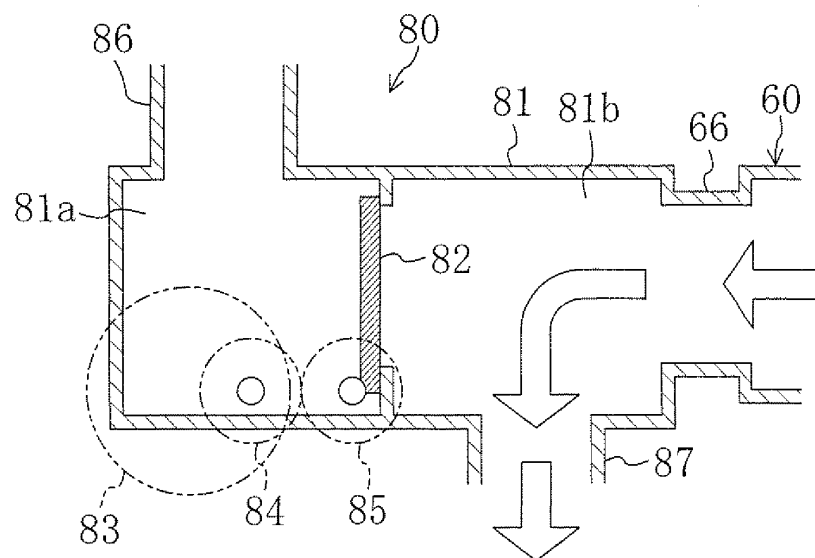
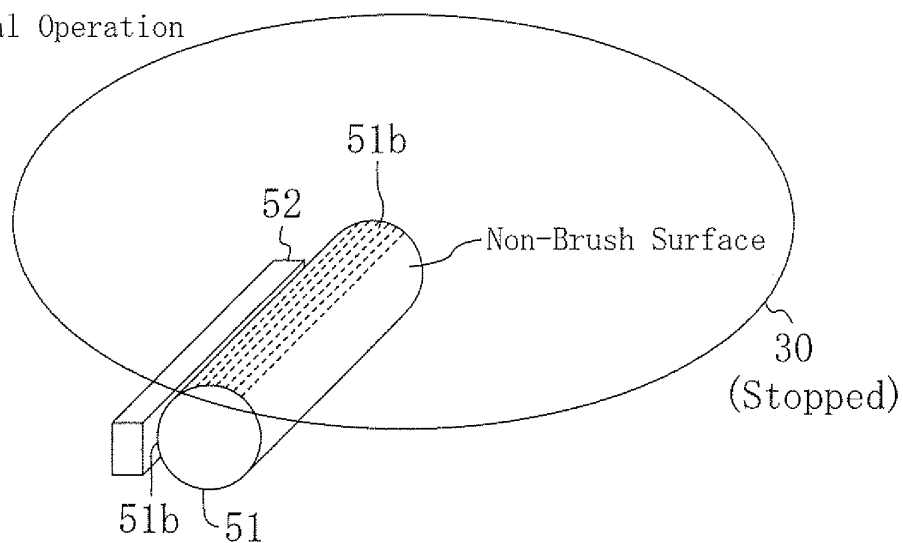
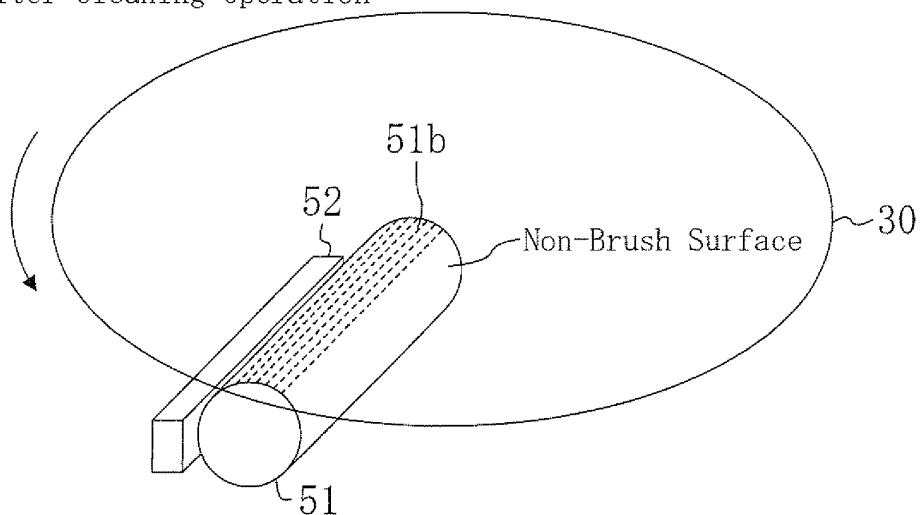


FIG. 12

(A) In Normal Operation



(B) In Filter Cleaning Operation



(C) In Filter Cleaning Operation

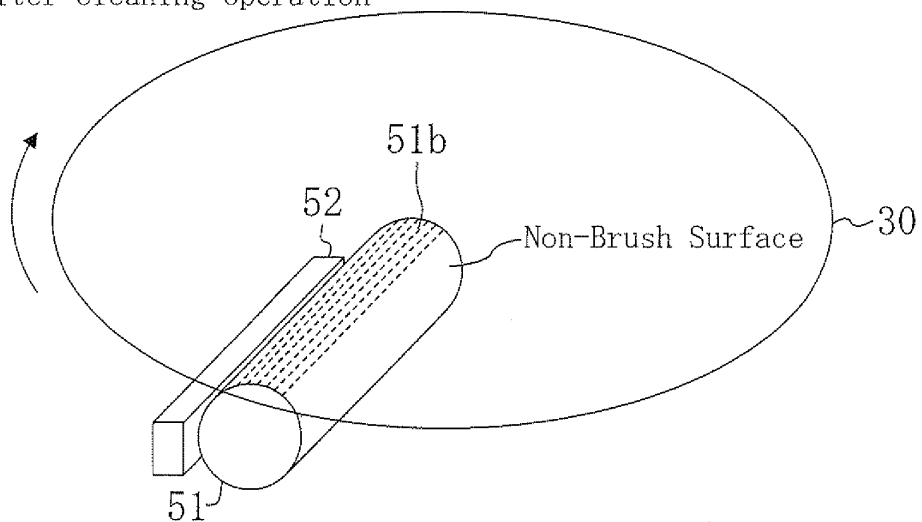
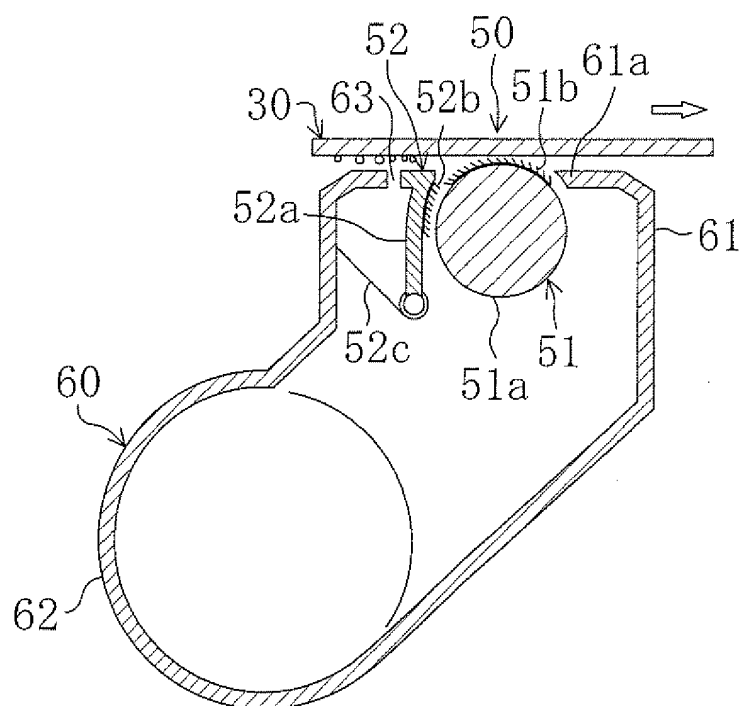


FIG. 13

(A)



(B)

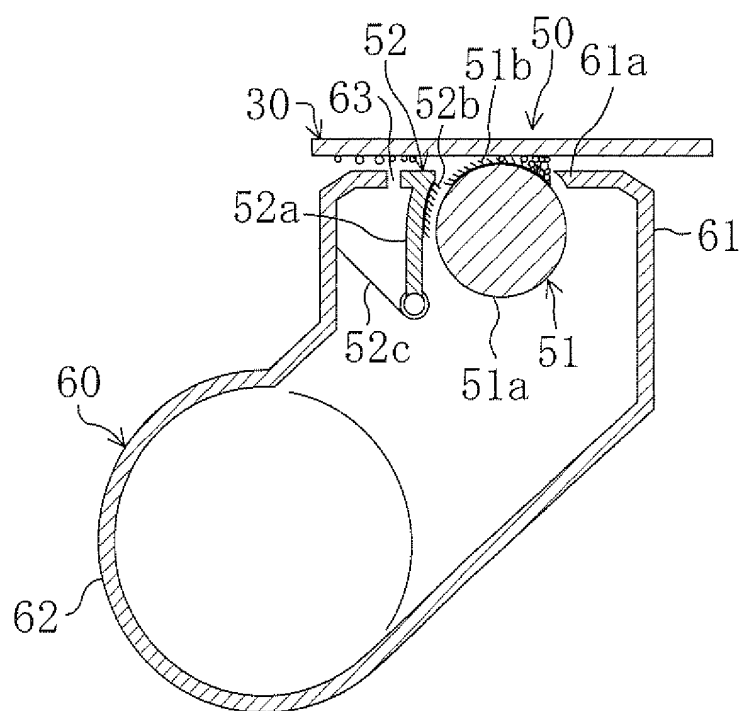
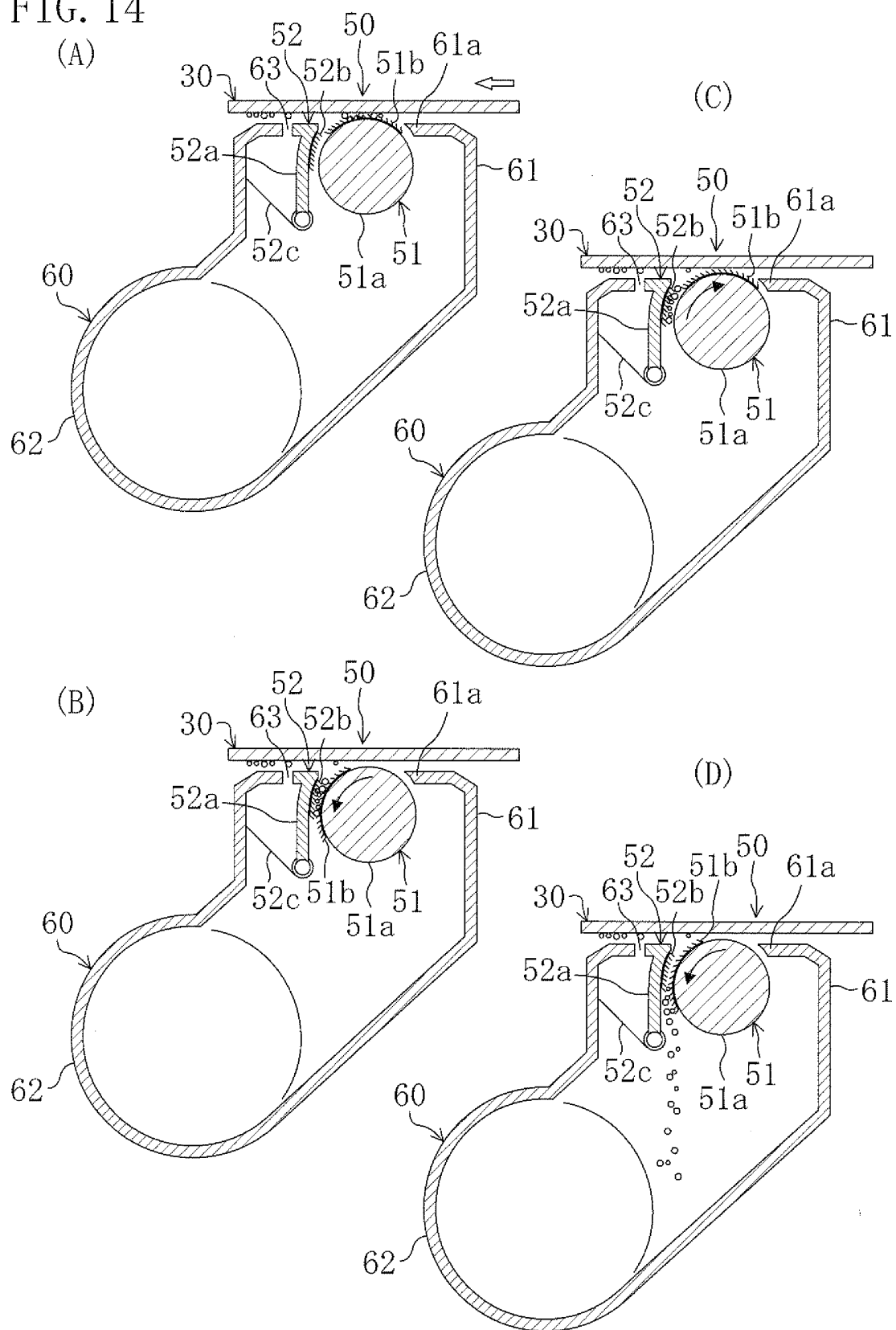


FIG. 14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/000155

A. CLASSIFICATION OF SUBJECT MATTER

F24F13/28(2006.01) i, F24F11/02(2006.01) 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)

F24F13/28, F24F11/02

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2009

Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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.
Y	JP 2006-214663 A (Matsushita Electric Industrial Co., Ltd.), 17 August, 2006 (17.08.06), Full text; all drawings (Family: none)	1-10
Y	JP 2007-309584 A (Toshiba Carrier Corp.), 29 November, 2007 (29.11.07), Full text; all drawings (Family: none)	1-10
Y	JP 2007-271174 A (Fujitsu General Ltd.), 18 October, 2007 (18.10.07), Par. Nos. [0023] to [0030]; Figs. 4, 6 (Family: none)	1-10

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

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"&" document member of the same patent family

Date of the actual completion of the international search
13 April, 2009 (13.04.09)Date of mailing of the international search report
21 April, 2009 (21.04.09)Name and mailing address of the ISA/
Japanese Patent Office

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Form PCT/ISA/210 (second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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