

Description

Title of Invention

FILTER CLEANING DEVICE AND AIR CONDITIONER

5 Technical Field

[0001]

An embodiment of the present invention relates to a filter cleaning device for removing dust from a filter and relates to an air conditioner that includes the filter cleaning
10 device.

Background Art

[0002]

Conventionally, an air conditioner that includes: a filter for catching dust; and a filter cleaning device for removing dust from the filter has been known (Patent Literature 1).
15

[0003]

The air conditioner disclosed in Patent Literature 1 is as follows. The air conditioner includes a cleaning unit for cleaning a filter by removing dust from the filter. The cleaning unit includes: a brush unit for removing dust from the filter by moving along the filter; a driver section for driving the brush unit; and a plurality of guide rails along
20 which the movement of the brush unit is guided. The brush
25

unit is supported on each of the plurality of guide rails via a plurality of bearings. The brush unit includes: a rotating brush for removing dust from the filter; a duster for removing, from the rotating brush, the dust removed from the filter; and an open-top box-shaped dust container for collecting the removed dust.

Citation List

[Patent Literature]

[0004]

[Patent Literature 1]

Japanese Patent Application Publication, Tokukai, No. 2016-8754

Summary of Invention

Technical Problem

[0005]

However, the air conditioner disclosed by the Patent Literature 1 has an issue in that, since the duster is located inside the dust container, the dust container is capable of containing only a small amount of dust, and this leads to an increase in frequency of dust disposal.

[0006]

An embodiment of the present invention was made in order to solve the above conventional issue, and an object

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thereof is to provide a filter cleaning device that is capable of reducing the frequency of dust disposal by including a dust container capable of containing a large amount of dust and that also allows for easy dust disposal, and to provide
5 an air conditioner including the filter cleaning device.

Solution to Problem

[0007]

In order to attain the above object, Aspect 1 of the
10 present invention is a filter cleaning device for removing dust from a to-be-cleaned surface of a filter, including: a rotational cleaning unit configured to remove dust from the to-be-cleaned surface; a dust container that is configured to store dust and that has an opening; a cover that is attached
15 to the opening of the dust container; and a duster that is provided to the cover and that is configured to remove dust from the rotational cleaning unit, wherein the cover has an opening and is arranged such that a part of the rotational cleaning unit projects through the opening of the cover, the
20 rotational cleaning unit is attachable and detachable and is rotatably supported in the vicinity of the opening of the dust container, top edges of at least three side walls of the dust container, including side walls at opposite ends of the dust container in an axial direction of the rotational cleaning unit,
25 are positioned higher than a bottommost part of the

rotational cleaning unit, and an end portion of the duster extends in a direction from the cover toward an interior of the dust container.

5 Advantageous Effects of Invention

[0008]

One aspect of an invention directed to a filter cleaning device makes it possible to reduce the frequency of dust disposal by including a dust container capable of containing
10 a large amount of dust, and also allows for easy dust disposal.

Brief Description of Drawings

[0009]

15 Fig. 1 is a perspective view illustrating an air conditioner in accordance with an embodiment of the present invention.

Fig. 2 is a perspective view illustrating the air conditioner whose back panel is not shown.

20 Fig. 3 is a perspective view illustrating a filter cleaning device in accordance with an embodiment of the present invention.

Fig. 4 is an exploded perspective view of the filter cleaning device in accordance with an embodiment of the
25 present invention.

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Fig. 5 is an exploded front view of the filter cleaning device in accordance with an embodiment of the present invention.

Fig. 6 is a cross-sectional view taken along line A-A of Fig. 3.

Fig. 7 is a partial enlarged cross-sectional view of the air conditioner and illustrates how dust is removed.

(a) to (d) of Fig, 8 are cross-sectional views illustrating embodiments of the filter cleaning device in accordance with the present invention.

Fig. 9 is a cross-sectional view illustrating an embodiment of a filter cleaning device in accordance with the present invention.

Fig. 10 is a cross-sectional view illustrating another embodiment of a filter cleaning device in accordance with an embodiment of the present invention.

Description in accordance with Embodiments

[0010]

The following description will discuss embodiments of the present invention with reference to drawings. Note, however, that these embodiments are not intended to limit the present invention.

[0011]

Fig. 1 is a perspective view illustrating the back side of

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an air conditioner in accordance with an embodiment of the present invention. Fig. 2 is a perspective view illustrating the air conditioner whose back panel is not shown. The following description will discuss the outline of the air conditioner in accordance with an embodiment of the present invention with reference to Figs. 1 and 2.

[0012]

The air conditioner 10 includes a back panel 11 that has an air inlet 11a in the form of a grid. The air conditioner 10 includes a main body 10a that includes an air passage (not illustrated) which is configured to guide air coming in through the air inlet 11a to an air outlet 12. The main body 10a includes: a main filter (not illustrated); a prefilter 13; a supply fan (not illustrated); and a filter cleaning device 1 for removing dust from the prefilter 13. The prefilter 13 and the filter cleaning device 1 are attached to the back side of the back panel 11; therefore, the filter cleaning device 1 can be removed from the air conditioner 10 by: first removing the back panel 11 from the air conditioner 10 and turning it over; and detaching the filter cleaning device 1 from the back panel 11.

[0013]

On the back side of the back panel 11, there are parallel disposed rollers 14a and 14b that are opposite each other in the vertical direction. One end of the prefilter 13 is

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fixed to and wrapped around the roller 14a and the other end of the prefilter 13 is fixed to the roller 14b such that the prefilter 13 spans the rollers 14a and 14b. When the prefilter 13 is to be cleaned, a gear unit 15 converts a power received from the air conditioner main body 10a into a rotational power, and thereby causes the roller 14b and a rotational cleaning unit 2 of the filter cleaning device 1 to rotate. Then, the roller 14b winds the prefilter 13 therearound while the rotational cleaning unit 2 is removing dust from the prefilter 13, and, when the cleaning of the prefilter 13 by the filter cleaning device 1 completes, the roller 14a rotates under spring force and thereby the prefilter 13 is wound back onto the roller 14a.

[0014]

Fig. 3 is a perspective view illustrating a filter cleaning device in accordance with Embodiment 1. Fig. 4 is an exploded perspective view of the filter cleaning device in accordance with Embodiment 1. Fig. 5 is an exploded front view of the filter cleaning device in accordance with Embodiment 1. Fig. 6 is a cross-sectional view taken along line A-A of Fig. 3. Fig. 7 is a partial enlarged cross-sectional view of the air conditioner and illustrates how the filter cleaning device in accordance with Embodiment 1 removes dust. The following description will discuss the filter cleaning device in accordance with Embodiment 1 of the

present invention with reference to Figs. 3 to 7.

[0015]

The filter cleaning device 1 in accordance with Embodiment 1 includes: a rotational cleaning unit 2
5 configured to remove dust from a to-be-cleaned surface; a dust container 3 that is configured to store dust and that has an opening 3a; a cover 4 attached to the opening 3a of the dust container 3; and a duster 5 that is configured to remove dust from the rotational cleaning unit 2 and that is
10 constituted by comb teeth 5a provided on the cover 4. The rotational cleaning unit 2 includes: a rotary shaft 2a constituted by a rotor and brackets attached at the opposite ends of the rotor; and a cleaning member 2e placed on the rotary shaft 2a.

15 [0016]

The cover 4 has an opening 4a, and is arranged such that the cleaning member 2e, which is a part of the rotational cleaning unit 2, projects through the opening 4a. The rotational cleaning unit 2 is attachable to and
20 detachable from the dust container 3, and is rotatably supported in the vicinity of the opening 3a of the dust container 3. Specifically, the cover 4 has shaft accommodations 4b at the opposite ends in the longitudinal direction of the cover 4, and the dust container 3 also has
25 shaft accommodations 3b at the opposite ends in the

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longitudinal direction of the dust container 3 such that the shaft accommodations 3b correspond in position to the shaft accommodations 4b. The rotary shaft 2a of the rotational cleaning unit 2 is held and supported between the shaft accommodations 3b and the shaft accommodations 4b. Note that the rotary shaft 2a of the rotational cleaning unit 2 has a gear 6 attached to one end thereof, and the gear 6 engages with a gear of the gear unit 15, which has been described with reference to Fig. 2. Then, the rotational cleaning unit 2 is rotated clockwise in Figs. 3, 4, and 6, and thereby dust is removed from the cleaning member 2e by the comb teeth 5a and falls with the force of gravity into the dust container 3.

[0017]

Furthermore, top edges 3g of at least three side walls, including side walls 3c and 3d at the opposite ends of the dust container 3 in the axial direction of the rotational cleaning unit 2, of side walls 3c, 3d, 3e, 3f of the dust container are positioned higher than a bottommost part 2c of the rotational cleaning unit 2, and an end portion 5e of the duster 5 extends in a direction from the cover 4 toward the interior of the dust container 3 (see Fig. 6). Furthermore, as illustrated in Fig. 5, the comb teeth of the duster 5 are inclined in one direction along the length of the rotational cleaning unit 2. In addition, the duster 5 is arranged such that the rotational cleaning unit 2 abuts side walls 5b that

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define valleys between the comb teeth 5a but does not abut bottoms 5c of the valleys. This arrangement makes it possible to reduce the load imposed on the rotational cleaning unit during the rotation of the rotational cleaning unit 2 and thus possible to cause the rotational cleaning unit 2 to rotate with a low torque.

[0018]

Furthermore, as described earlier, the rotational cleaning unit 2 is supported by the dust container 3 and the cover 4. Note that the cover 4 includes a securing piece 8, with which the cover 4 is detachably secured to the dust container 3. Specifically, a recess 8a in the securing piece 8 catches a protrusion (not illustrated) on the outer surface of the side wall 3f of the dust container 3, and thereby the cover 4 is secured to the dust container 3. This eliminates the likelihood that the cover 4 will be accidentally detached and the rotational cleaning unit 2 will fall when, for example, a user carries the filter cleaning device 1. Furthermore, as illustrated in Fig. 6, the end portion 5e of the duster 5 is positioned lower than a rotation center 2b of the rotational cleaning unit 2. This makes it possible to increase the contact area between the end portion 5e of the duster 5 and the rotational cleaning unit 2 and thus possible to improve the efficiency of removing dust from the rotational cleaning unit 2. Moreover, the direction in which the duster 5 extends

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from its root portion 5d to the end portion 5e is at an angle to the vertical direction and is inclined toward the rotation center 2b. With this, dust is pushed out by the rotational cleaning unit 2 during cleaning, and thereby dust attached on the duster 5 is moved to a position that allows the dust to fall without contacting the rotational cleaning unit 2. It follows that the dust easily falls off from the duster 5 into the dust container.

[0019]

Since the filter cleaning device 1 is arranged as described above and the duster 5 is provided to the cover 4, the dust container 3 is capable of containing a large amount of dust. This makes it possible to reduce the frequency of dust disposal. Furthermore, since the rotational cleaning unit 2 is attachable to and detachable from the dust container 3, this allows for easy disposal of dust collected in the dust container 3.

[0020]

The filter cleaning device 1 arranged as described above is structured as below. As illustrated in Fig. 7, the roller 14b is rotated clockwise and concurrently the rotational cleaning unit 2 is rotated clockwise, and thereby dust 7 on the prefilter 13 is scraped off with the rotational cleaning unit 2 whereas dust 7 on the rotational cleaning unit 2 is picked up by the duster 5 and falls into the dust container 3.

[0021]

(a) of Fig. 8 is a cross-sectional view of the foregoing filter cleaning device 1 in accordance with Embodiment 1. As described earlier, the filter cleaning device 1 in accordance with Embodiment 1 is arranged such that: the cover 4 has the shaft accommodations 4b at the opposite ends in the longitudinal direction of the cover 4; the dust container 3 also has the shaft accommodations 3b at the opposite ends in the longitudinal direction of the dust container 3 such that the shaft accommodations 3b correspond in position to the shaft accommodations 4b; and the rotary shaft 2a of the rotational cleaning unit 2 is held and supported between the shaft accommodations 3b and the shaft accommodations 4b. This makes it possible to easily remove the rotational cleaning unit 2 by detaching the cover 4 from the dust container 3, and does not necessitate a separately provided support means for supporting the rotational cleaning unit 2. This allows for easy dust disposal and reduces production cost for the filter cleaning device 1.

[0022]

(b) of Fig. 8 is a cross-sectional view illustrating a filter cleaning device 1A in accordance with Embodiment 2. In the filter cleaning device 1A in accordance with Embodiment 2, a cover 24 does not have any shaft accommodation, and a dust container 23 has shaft accommodations 23b at the opposite

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ends in the longitudinal direction of the dust container 23. A rotary shaft 2a of a rotational cleaning unit 2 is supported between the shaft accommodations 23b and the cover 24. Note that the cover 24 is not in contact with the rotary shaft 2a, and there is a gap 16 between the cover 24 and the rotary shaft 2a. According to Embodiment 2, the cover 24 prevents the rotary shaft 2a from dropping off of the shaft accommodations 23b when the filter cleaning device 1A is turned upside down. As such, the rotational cleaning unit 2 is supported by both the dust container 23 and the cover 24. [0023]

(c) of Fig. 8 is a cross-sectional view illustrating a filter cleaning device 1B in accordance with Embodiment 3. In the filter cleaning device 1B in accordance with Embodiment 3, a cover 34 does not have any shaft accommodation, and a dust container 33 has shaft accommodations 33b at the opposite ends in the longitudinal direction of the dust container 33. A rotary shaft 2a of a rotational cleaning unit 2 is supported between the shaft accommodations 33b and the cover 34. Note that the cover 34 is not in contact with the rotary shaft 2a, and there is a gap 26 at a rotary-shaft-insertion opening of each shaft accommodation 33b. The gap 26 is smaller than the diameter of the rotary shaft 2a. Since the dust container 33 is made of resin, when the rotary shaft 2a is pushed against the rotary-shaft-insertion opening toward the

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shaft accommodation 33b from above, the gap 26 expands sideways and thus the rotary shaft 2a can be inserted and fixed in the shaft accommodation 33b.

[0024]

5 (d) of Fig. 8 is a cross-sectional view illustrating a filter cleaning device 1C in accordance with Embodiment 4. In the filter cleaning device 1C in accordance with Embodiment 4, a dust container 43 does not have any shaft accommodation, and a cover 44 has shaft accommodations 44b at the
10 opposite ends in the longitudinal direction of the cover 44. A rotary shaft 2a of a rotational cleaning unit 2 is supported between the shaft accommodations 44b and the dust container 43. Note that the dust container 43 is not in contact with the rotary shaft 2a, and there is a gap 36 at a
15 rotary-shaft-insertion opening of each shaft accommodation 44b. The gap 36 is smaller than the diameter of the rotary shaft 2a. Since the cover 44 is made of resin, when the rotary shaft 2a is pushed against the rotary-shaft-insertion opening toward the shaft accommodation 44b from below,
20 the gap 36 expands sideways and thus the rotary shaft 2a can be inserted and fixed in the shaft accommodation 44b.

[0025]

Fig. 9 is a cross-sectional view illustrating a filter cleaning device 1D in accordance with Embodiment 5. The
25 filter cleaning device 1D in accordance with Embodiment 5 is

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arranged such that a duster 25, which is constituted by comb teeth 25a, extends downward in the vertical direction. In regard to the duster 5 discussed in Embodiment 1, the direction in which the duster 5 extends from its root portion 5d to the end portion 5e is at an angle to the vertical direction; however, any arrangement in which this direction is not at an angle to the vertical direction, like Embodiment 5, also falls within the scope of the present invention.

[0026]

Fig. 10 is a cross-sectional view illustrating a filter cleaning device 1E in accordance with Embodiment 6. A dust container 53 of the filter cleaning device 1E in accordance with Embodiment 6 is the same as the dust container 3 of the filter cleaning device 1 in accordance with Embodiment 1, except that the dust container 53 does not have the side wall 3e. Accordingly, a cover 4 is supported on three top edges 3g, that is, top edges 3g of side walls 3c and 3d at the opposite ends of the dust container in the axial direction of a rotational cleaning unit 2 and a side wall 3f of the dust container. This arrangement also falls within the scope of the present invention, provided that the top edges 3g of the remaining side walls 3c, 3d, 3f of the dust container are positioned higher than a bottommost part 2c of the rotational cleaning unit 2.

[0027]

[Recap]

Aspect 1 of the present invention is a filter cleaning device for removing dust from a to-be-cleaned surface of a filter, including: a rotational cleaning unit configured to
5 remove dust from the to-be-cleaned surface; a dust container that is configured to store dust and that has an opening; a cover that is attached to the opening of the dust container; and a duster that is provided to the cover and that is configured to remove dust from the rotational cleaning unit,
10 wherein the cover has an opening and is arranged such that a part of the rotational cleaning unit projects through the opening of the cover, the rotational cleaning unit is attachable and detachable and is rotatably supported in the vicinity of the opening of the dust container, top edges of at
15 least three side walls of the dust container, including side walls at opposite ends of the dust container in an axial direction of the rotational cleaning unit, are positioned higher than a bottommost part of the rotational cleaning unit, and an end portion of the duster extends in a direction
20 from the cover toward the interior of the dust container.

[0028]

According to Aspect 1 of the present invention, since the duster is provided to the cover, the dust container is capable of containing a large amount of dust. This makes it
25 possible to reduce the frequency of dust disposal.

Furthermore, since the rotational cleaning unit is attachable to and detachable from the dust container, this allows for easy disposal of dust collected in the dust container.

[0029]

5 Aspect 2 of the present invention is arranged such that, in Aspect 1, the rotational cleaning unit is supported by the dust container and the cover. This makes it possible to easily remove the rotational cleaning unit 2 by detaching the cover from the dust container, and does not necessitate a
10 separately provided support means for supporting the rotational cleaning unit. This allows for easy dust disposal and reduces production cost for the filter cleaning device.

[0030]

15 Aspect 3 of the present invention is arranged such that, in Aspect 1 or 2, the end portion of the duster is positioned lower than a rotation center of the rotational cleaning unit. That is, the duster extends from the cover to a position lower than the rotation center of the rotational cleaning unit. This makes it possible to increase the contact area between the
20 duster and the rotational cleaning unit and thus possible to improve the efficiency of removing dust from the rotational cleaning unit.

[0031]

25 Aspect 4 of the present invention is arranged such that, in any one of Aspects 1 to 3, a direction in which the duster

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extends from a root portion thereof to the end portion thereof is at an angle to a vertical direction. That is, the direction in which the duster extends is inclined with respect to the vertical direction. It follows that the dust easily falls from the duster.

[0032]

Aspect 5 of the present invention is an air conditioner including: a main body that includes an air passage which is configured to guide air coming in through an air inlet to an air outlet, the main body including a filter, a supply fan, and a filter cleaning device that is configured to remove dust from the filter and that is recited in any one of Aspects 1 to 4. Thus, it is possible to provide an air conditioner that is capable of reducing the frequency of dust disposal by including a dust container capable of containing a large amount of dust and that also allows for easy dust disposal.

[0033]

One aspect of an invention directed to a filter cleaning device makes it possible to improve the efficiency of removing dust from a rotational cleaning unit. One aspect of an invention directed to a filter cleaning device makes dust easily fall off from a duster. One aspect of an invention directed to an air conditioner makes it possible to reduce the frequency of dust disposal by including a dust container capable of containing a large amount of dust and also allows

for easy dust disposal.

[0034]

The present invention is not limited to the embodiments, but can be altered by a skilled person in the art within the scope of the claims. The present invention also encompasses, in its technical scope, any embodiment derived by combining technical means disclosed in differing embodiments. Further, it is possible to form a new technical feature by combining the technical means disclosed in the respective embodiments.

Industrial Applicability

[0035]

A filter cleaning device in accordance with an embodiment of the present invention is for use in removing dust from a filter. An air conditioner in accordance with an embodiment of the present invention is for use as an air conditioner that includes a filter cleaning device.

Reference Signs List

[0036]

- 1 filter cleaning device
- 2 rotational cleaning unit
- 2a rotary shaft
- 2b rotation center
- 2c bottommost part of rotational cleaning unit

	2e	cleaning member
	3	dust container
	3a	opening of dust container
	3b	shaft accommodation
5	3c, 3d, 3e, 3f	side walls
	4	cover
	4a	opening of cover
	4b	shaft accommodation
	5	duster
10	5a	comb teeth
	5b	lateral wall defining valley
	5c	bottom of valley
	5d	root portion
	5e	end portion
15	6	gear
	7	dust
	10	air conditioner
	10a	main body
	11	back panel
20	11a	air inlet
	12	air outlet
	13	prefilter
	14a, 14b	roller
	15	gear unit
25	16	gap

Claims

Claim 1

A filter cleaning device for removing dust from a to-be-cleaned surface of a filter, comprising:

5 a rotational cleaning unit configured to remove dust from the to-be-cleaned surface;

 a dust container that is configured to store dust and that has an opening;

10 a cover that is attached to the opening of the dust container; and

 a duster that is provided to the cover and that is configured to remove dust from the rotational cleaning unit, wherein

15 the cover has an opening and is arranged such that a part of the rotational cleaning unit projects through the opening of the cover,

 the rotational cleaning unit is attachable and detachable and is rotatably supported in the vicinity of the opening of the dust container,

20 top edges of at least three side walls of the dust container, including side walls at opposite ends of the dust container in an axial direction of the rotational cleaning unit, are positioned higher than a bottommost part of the rotational cleaning unit, and

25 an end portion of the duster extends in a direction from

the cover toward an interior of the dust container.

Claim 2

5 The filter cleaning device according to claim 1, wherein
the rotational cleaning unit is supported by the dust
container and the cover.

Claim 3

10 The filter cleaning device according to claim 1 or 2,
wherein the end portion of the duster is positioned lower
than a rotation center of the rotational cleaning unit.

Claim 4

15 The filter cleaning device according to any one of claims
1 to 3, wherein a direction in which the duster extends from
a root portion thereof to the end portion thereof is at an
angle to a vertical direction.

Claim 5

20 An air conditioner comprising:
a main body that includes an air passage which is
configured to guide air coming in through an air inlet to an
air outlet,
the main body including
25 a filter,

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a supply fan, and

a filter cleaning device that is configured to remove dust from the filter and that is recited in any one of claims 1 to 4.