

DESCRIPTION

Title of the Invention: AIR PURIFIER

Technical Field

[0001] The present invention relates to an air purifier provided with a cleaning device that cleans a filter.

Background Art

[0002] Patent Document 1 identified below discloses a conventional air purifier. The air purifier has a housing in which a suction port and a blowout port are open. Inside the housing, there is provided an air passage through which the suction port and the blowout port are coupled together, and inside the air passage, a fan is arranged. A pre-filter (filter) is arranged to face the suction port.

[0003] In the air purifier structured as described above, when its operation is started, the fan is driven to suck in air in a room through the suction port. The air sucked in through the suction port is, after having dust collected by the pre-filter, fed out through the blowout port. In this way, air in a room can be purified.

[0004] In recent years, there is increasing demand for air purifiers provided with a cleaning device that cleans a pre-filter. Patent Document 2 identified below discloses a cleaning device that cleans a filter which is arranged to face a suction port in a projector. The cleaning device includes a supply roll, a winding roll, a brush, a supply-roll motor, a winding-roll motor, a brush motor, and a dust collection box.

[0005] The supply roll has a sheet-form filter wound around it. The winding roll rotates as the winding-roll motor is driven, and winds up the filter pulled out from the supply roll. The brush has brush bristles formed radially on its shaft member, and rotates as the brush motor is driven during rotation of the winding roll so that the brush bristles rub against the filter to remove dust from it. The dust collection box collects the dust removed from the filter by the brush. The supply roll is driven to rotate by the supply-roll motor, and winds back up the filter wound around the winding roll. In this way, dust on the filter is removed and the filter is cleaned.

List of Citations

Patent Literature

[0006] Patent Document 1: JP-A-2009-66466 (pages 8 and 9; Fig. 1)

Patent Document 2: JP-B-5627066 (pages 6 and 7; Figs. 1 and 4)

Summary of the Invention

Technical Problem

[0007] According to the cleaning device of Patent Document 2 identified above, the supply-roll motor is provided separately in addition to the winding-roll motor. This inconveniently increases the number of components required in a cleaning device; thus, providing such a cleaning device in an air purifier inconveniently increases the manufacturing cost of the air purifier.

[0008] An object of the present invention is to provide an air purifier that operates with reduced manufacturing cost.

Means for Solving the Problem

[0009] To achieve the above object, according to one aspect of the present invention, an air purifier includes: a housing in which a suction port and a blowout port are open; an air passage through which the suction port and the blowout port are coupled together; a fan arranged inside the air passage; a filter arranged to face the suction port; and a cleaning device which cleans the filter. The cleaning device includes: a supply roll around which the filter, which is in a sheet form, is wound; a winding roll which winds up the filter around it; a driving motor which drives the winding roll to rotate; a biasing member having a spiral spring which biases, during winding of the winding roll, a rotary shaft of the supply roll in the direction opposite to the winding direction; and a brush which slides on the filter as the winding roll rotates.

[0010] According to another aspect of the present invention, in the air purifier structured as described above, preferably, the supply roll is removably arranged on the housing. Preferably, the biasing member includes: a first rotary member which engages with the shaft of the supply roll and which is fitted with one end of the spiral spring; a second rotary member which is fitted with the other end of the spiral spring and of which the rotation in a direction in which the biasing force of the spiral spring decreases is

restricted; and a handle with which the second rotary member is operated to rotate.

[0011] According to another aspect of the present invention, in the air purifier structured as described above, preferably, the biasing member includes: a coupling member which is arranged between the handle and the second rotary member and which restricts rotation of the handle in the direction in which the biasing force of the spiral spring decreases. Preferably, the coupling member rotates together with the second rotary member.

[0012] According to another aspect of the present invention, in the air purifier structured as described above, preferably, the filter has, in its opposite end parts in the winding direction, bars which extend in the axial direction. Preferably, a shaft of the supply roll and a shaft of the winding roll are each a shaft that includes a core which extends in the axial direction and which has in it a groove of which opposite inner wall surfaces incline, and a sleeve which is fitted outside the core and which is formed of an elastic material with a C-shaped section. Preferably, the bars are each held between the sleeve and the groove with elasticity.

[0013] According to another aspect of the present invention, in the air purifier structured as described above, preferably, the core is made of metal, and the sleeve is made of a molding of resin.

[0014] According to another aspect of the present invention, in the air purifier structured as described above, preferably, the housing includes: a body in which the fan is arranged; a cover which is removably fitted to the body and in which the suction port is open. Preferably, the driving motor is arranged in the body, and the supply roll and the winding roll are arranged in the cover.

Advantageous Effects of the Invention

[0015] According to the present invention, there are provided a driving motor which drives to rotate a winding roll which winds up a filter around it, and a biasing member which has a spiral spring which biases, during winding of a winding roll, the rotary shaft of a supply roll in the direction opposite to the winding direction. Thus, there is no need to separately provide, in addition to the driving motor, a supply-roll motor as in the conventional example for rotating the supply roll in the direction opposite to the winding direction of the winding roll. This helps reduce the manufacturing cost of an

air purifier.

Brief Description of Drawings

[0016] [Fig. 1] is a front view of an air purifier according to a first embodiment of the present invention;

[Fig. 2] is a side sectional view of an air purifier according to the first embodiment of the present invention;

[Fig. 3] is an exploded perspective view of a cleaning device of an air purifier according to the first embodiment of the present invention;

[Fig. 4] is a plan view of a pre-filter of an air purifier according to the first embodiment of the present invention;

[Fig. 5] is a side sectional view of a supply roll in a cleaning device of an air purifier according to the first embodiment of the present invention;

[Fig. 6] is a perspective view showing, with respect to a cleaning device of an air purifier according to the first embodiment of the present invention, a winding roll, a dust collector, and the interior of a gear unit;

[Fig. 7] is an enlarged perspective view of the interior of a gear unit in a cleaning device of an air purifier according to the first embodiment of the present invention;

[Fig. 8] is an exploded perspective view of a biasing member in a cleaning device of an air purifier according to the first embodiment of the present invention;

[Fig. 9] is a side view of a supporting member on a cover of an air purifier according to a second embodiment of the present invention, as observed before a supply roll is fitted to the supporting member;

[Fig. 10] is a side view of a supporting member on a cover of an air purifier according to the second embodiment of the present invention, as observed after a supply roll has been fitted to the supporting member;

[Fig. 11] is a side view of a supporting member on a cover of an air purifier according to a third embodiment of the present invention, as observed before a supply roll is fitted to the supporting member;

[Fig. 12] is a side view of a supporting member on a cover of an air purifier according to the third embodiment of the present invention, as observed after a supply roll has been fitted to the supporting member;

[Fig. 13] is a plan view of a pre-filter of an air purifier according to a fourth embodiment of the present invention; and

[Fig. 14] is a perspective view of a presser of an air purifier according to a fifth embodiment of the present invention.

Description of Embodiments

[0017] <First Embodiment>

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings. Figs. 1 and 2 are a front view and a side sectional view, respectively, of an air purifier according to a first embodiment. There, arrows S indicate currents of air. The air purifier 1 has a housing 2, in which a suction port 3 and blowout ports 4 and 5 are open and which is placed, for example, on a floor in a room. The housing 2 has a body 20 and a cover 21. The cover 21 is removably arranged at the rear face of the body 20, and has the suction port 3 open. The body 20 has the blowout ports 4 and 5 open in an upper part of the front face and in the top face respectively.

[0018] The blowout ports 4 and 5 are provided with wind deflectors 14 and 15, respectively, which change the direction of wind. The wind deflector 14 comprises a flat plate, and is supported so as to be swingable in the up-down direction about a swing shaft (unillustrated) provided on the wind deflector 14. On the bottom face of the wind deflector 14, there are perpendicularly provided a plurality of vertical louvers 14a arrayed in the left-right direction. The vertical louvers 14a in opposite end parts of the wind deflector 14 incline outward in the left-right direction as one goes frontward.

[0019] The wind deflector 15 comprises a flat plate, and is supported so as to be swingable in the up-down direction about a swing shaft 15b arranged in a front part of the wind deflector 15. On the bottom face of the wind deflector 15, there are perpendicularly provided a plurality of vertical louvers 15a arrayed in the left-right direction. The vertical louvers 15a in opposite end parts of the wind deflector 15 incline outward in the left-right direction as one goes rearward.

[0020] The wind deflectors 14 and 15 keep the blowout ports 4 and 5, respectively, closed when the air purifier 1 is out of operation and open when the air purifier 1 is in operation.

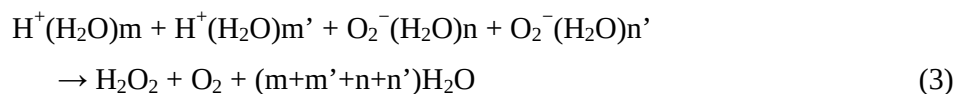
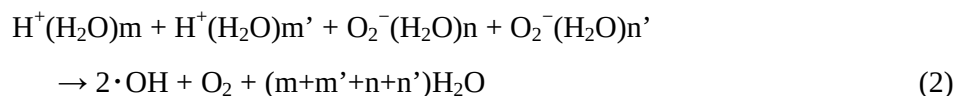
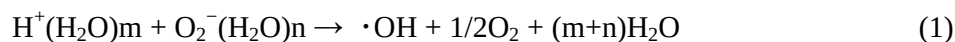
- [0021] Inside the housing 2, there is provided an air passage 8 through which the suction port 3 and the blowout ports 4 and 5 are coupled together. Inside the air passage 8, there are provided, in order from the suction port 3 toward the blowout ports 4 and 5 (from upstream to downstream with respect to the current of air), a pre-filter (filter) 6, a deodorant filter 7, a dust-collecting filter 9, a humidifier 200, a fan 10, an ion generating device 11, and a damper 12.
- [0022] The air passage 8 branches on the downstream side of the ion generating device 11 into a first branch passage 8a and a second branch passage 8b. The first branch passage 8a and the second branch passage 8b communicate with the blowout ports 4 and 5 respectively, and the sectional area of an air flow passage in the first branch passage 8a is smaller than the sectional area of an air flow passage in the second branch passage 8b.
- [0023] The damper 12 is formed in the shape of a thin plate, and is supported by a swing shaft 12a so as to be swingable in the up-down direction. The damper 12 can swing from a position in which it closes the first branch passage 8a (see Fig. 2) in a direction in which it opens the first branch passage 8a (in the counter-clockwise direction in Fig. 2). The damper 12 can adjust the balance between the air volumes in the first branch passage 8a and the second branch passage 8b.
- [0024] The fan 10 comprises a centrifugal fan such as a sirocco fan that is driven by a motor 10a, and sucks in air in the axial direction and discharges it in the radial direction.
- [0025] The pre-filter 6 comprises a sheet-form mesh of, for example, polypropylene, and is arranged in the cover 21 so as to face the suction port 3. The pre-filter 6 can collect coarse dust in air.
- [0026] The deodorant filter 7 is formed in the shape of a honeycomb, and can adsorb odoriferous components in air and deodorize it.
- [0027] The dust-collecting filter 9 comprises a HEPA filter, and has a frame (unillustrated) welded, with hot-melt adhesive, to a filtering member (unillustrated) so as to cover it. The dust-collecting filter 9 can collect fine dust and ultrafine particles having a particle diameter smaller than a predetermined particle diameter (for example 3 μm), such as PM 2.5 particles, present in air.
- [0028] The humidifier 200 has a lower part of a humidification filter 202 soaked in water

inside a tray 201, and humidifies the air passing through the humidification filter 202. Thus, humidified air is sent out through the blowout ports 4 and 5.

[0029] The ion generating device 11 has an ion generating surface 11a which generates ions when a high voltage is applied to it, and the ion generating surface 11a faces into the air passage 8. To the ion generating surface 11a, a voltage with an alternating-current waveform or an impulse waveform is applied. Applying a positive voltage to the ion generating surface 11a generates positive ions chiefly comprising $H^+(H_2O)_m$; applying a negative voltage to the ion generating surface 11a generates negative ions chiefly comprising $O_2^-(H_2O)_n$. Here, m and n are each an integer. The ions $H^+(H_2O)_m$ and $O_2^-(H_2O)_n$ clump together on the surface of airborne microorganisms and odoriferous components in air and enclose them.

[0030] Then, as formulated by formulae (1) to (3) below, through collision, the ions cohere to generate active species such as $[•OH]$ (hydroxyl radical) and H_2O_2 (hydrogen peroxide) on the surface of microbes and the like, and thereby destroy airborne microorganisms and the like. Here, m' and n' are each an integer. Thus, it is possible, by generating positive and negative ions and sending them out through the blowout ports 4 and 5, to sterilize and deodorize the room.

[0031]



[0032] In a front part of the top face of the body 20, an operation panel 19 is provided. The operation panel 19 has a plurality of buttons (unillustrated), and by operating these buttons, the user can make settings as to the operation of the air purifier 1. By operating the buttons, the user can change the volume of air sent out through the blowout ports 4 and 5, change the direction in which air is blown out, and so forth.

[0033] The cover 21 is provided with a cleaning device 30 which cleans the pre-filter 6. Fig. 3 is an exploded perspective view of the cleaning device 30. The cleaning device

30 includes a supply roll 40, a winding roll 50, a gear unit 60, a biasing member 70, a brush 80, a dust collector 90, and a driving motor 100 (see Fig. 2).

[0034] The supply roll 40 and the winding roll 50 are arranged in an upper part and in a lower part of the cover 21 respectively to hold opposite ends of the pre-filter 6. The pre-filter 6 is, when the cleaning device 30 is out of operation, wound around the supply roll 40, and is, when the cleaning device 30 is in operation, fed out from the supply roll 40 to be wound up around the winding roll 50.

[0035] The supply roll 40 has a shaft 41 that extends in the left-right direction, and has caps 48 fitted onto opposite end parts of the shaft 41. The caps 48 are rotatably supported on the supporting members 49 arranged in a top end part of the inner face of the cover 21. Thus, the supply roll 40 is arranged so as to be rotatable about an axis of rotation that extends in the left-right direction. Here, one end (the right end) of the supply roll 40 is coupled via the cap 48 to the biasing member 70.

[0036] The winding roll 50 has a shaft 51 that extends in the left-right direction, and has caps 58 fitted onto opposite end parts of the shaft 51. The left and right caps 58 are rotatably supported on a supporting member 59 and the gear unit 60, respectively, which are arranged in a bottom end part of the inner face of the cover 21. Thus, the winding roll 50 is arranged so as to be rotatable about an axis of rotation that extends in the left-right direction.

[0037] Fig. 4 is a plan view of the pre-filter 6. The pre-filter 6 has, in its opposite end parts in the winding direction W, bars 6a which extend in the left-right direction and which are held on the supply roll 40 and the winding roll 50 respectively. The pre-filter 6 has a ventilation portion 6b which is arranged to face the suction port 3 when the cleaning device 30 is out of operation and a housed portion 6c which is fed out from the supply roll 40 when the cleaning device 30 is in operation.

[0038] The housed portion 6c has a pattern 6g on it which can be visually recognized through the suction port 3 for distinction from the ventilation portion 6b. In this embodiment, red letters saying "cleaning in progress" are used in the pattern 6g. There is no particular limitation on the pattern 6g; it may instead be, for example, a striped pattern using a color different from the ventilation portion 6b.

[0039] Fig. 5 is a side sectional view of the supply roll 40. The structure of the winding roll 50 is similar to that of the supply roll 40, and thus the supply roll 40 will be

described representatively. The shaft 41 forming the shaft of the supply roll 40 has a core 41a and a sleeve 41d.

[0040] The core 41a is formed of an extrusion molding of metal such as aluminum with a C-shaped section, and has, in its circumferential surface, a groove 41b which extends in the axial direction. Opposite inner wall surfaces 41c of the groove 41b incline such that the width of the groove 41b in the circumferential direction is increasingly large outward. The circumferential surface of the bar 6a of the pre-filter 6 is supported between the inner wall surfaces 41c of the groove 41b.

[0041] The sleeve 41d is formed of a molding of resin with a C-shaped section having an opening 41e which extends in the axial direction, and is fitted outside the core 41a. The pre-filter 6 of which the bar 6a is supported in the groove 41b is inserted in the opening 41e. The width of the opening 41e in the sleeve 41d is smaller than the diameter of the bar 6a; this prevents the bar 6a supported on the core 41a from slipping off. The elasticity of the sleeve 41d allows its opposite end parts in the circumferential direction to press the bar 6a so that the bar 6a is held with the elasticity between the groove 41b in the core 41a and the sleeve 41d.

[0042] Applying a force to the sleeve 41d in a direction widening the opening 41e in the sleeve 41d (in the left-right direction in Fig. 5) causes the sleeve 41d to elastically deform. Via the widened opening 41e, the bar 6a of the pre-filter 6 can be inserted into and removed from the shaft 41. Likewise, the bottom end-side bar 6a of the pre-filter 6 can be inserted into and removed from the shaft 51. This makes it possible to easily remove the pre-filter 6 from the cleaning device 30, for example, to replace the pre-filter 6.

[0043] In Fig. 3, the brush 80 is arranged in the dust collector 90, which is removably fitted to the cover 21. The brush 80 has a shaft 81 of which opposite end parts in the axial direction are supported on the dust collector 90, and removes dust on the pre-filter 6 while rotating when the cleaning device 30 is driven as will be described later. On one end (the right end) of the shaft 81, a spur gear 68 is provided, and in the circumferential surface of the shaft 81, brush bristle bundles 82 are embedded spirally at predetermined intervals.

[0044] The dust collector 90 includes a lid 91, a container 92, and a comb 93, and is removably arranged on the cover 21. The container 92 is formed of transparent resin,

has its top face open, and supports at its opposite end parts the brush 80. The lid 91 has an opening 91a open from the left end to the right end, and covers the top face of the container 92. The brush bristle bundles 82 of the brush 80 are exposed to the outside through the opening 91a. The comb 93 is formed to extend in the left-right direction, and is arranged in the container 92 with its tooth ends pointing upward. The brush bristle bundles 82 of the brush 80 which rotates make contact with the tooth ends of the comb 93. The comb 93 removes dust attached to the brush bristle bundles 82 from them.

[0045] The dust removed from the pre-filter 6 by the brush 80 and the dust removed from the brush 80 by the comb 93 are collected in the container 92. Here, with the container 92 formed of transparent resin, the user can easily check how much dust is collected in the container 92.

[0046] The driving motor 100 (see Fig. 2) is arranged inside the body 20 of the housing 2, and the rotary shaft (unillustrated) of the driving motor 100 protrudes rearward from the rear face of the body 20.

[0047] In front of the pre-filter 6, a presser 22 is arranged across a predetermined clearance. The presser 22 is removably fitted to the cover 21. The presser 22 has a rectangular frame 22a formed of synthetic resin such as ABS. Within the frame 22a, there are provided a rib 22b which extends in the up-down direction and a plurality of (in this embodiment, three) ribs 22c which extend in the left-right direction and which are arrayed in the up-down direction. This gives the presser 22 windows arranged in a plurality of rows by a plurality of columns. With the presser 22, it is possible to arrange the pre-filter 6 along the suction port 3 in a stable state, and to prevent loosening of the pre-filter 6 due to the flow of sucked air.

[0048] In a middle part of a right side end part of the frame 22a of the presser 22, a magnet 23 is provided. In the body 20, at a position facing the magnet 23, a Hall effect sensor (unillustrated) is provided. The air purifier 1 can check, with the Hall effect sensor, whether or not the cover 21 is fitted to the body 20. Then, the air purifier 1 prohibits the operation of the fan 10 if it is determined that the cover 21 is not fitted to the body 20. This prevents blowing operation of the air purifier 1 when the cover 21 is not fitted to the body 20.

[0049] The gear unit 60 and the biasing member 70 are arranged in one end part (right end

part) of the cover 21. This forms, inward of the inner face of the cover 21, a space SP between the gear unit 60 and the biasing member 70. In the space SP, there is attached a tape-form member 300 on which information on instructions for operation of the air purifier 1 is written. The information includes information on how to remove the pre-filter 6 from the cleaning device 30 and information on how to operate a handle 73, which will be described later, of the biasing member 70.

[0050] Thus, after removing the cover 21 from the body 20, the user can see the above-mentioned information and easily understand how to remove the pre-filter 6 from the cleaning device 30 and how to operate the handle 73 of the biasing member 70. Thus, it is possible to improve the usability of the air purifier 1.

[0051] Fig. 6 is a perspective view showing, with respect to the cleaning device 30, the winding roll 50, the dust collector 90, and the interior of the gear unit 60. Fig. 7 is an enlarged perspective view of the interior of the gear unit 60. The gear unit 60 includes, inside a housing 60a (see Fig. 3), a bevel gear 61 (first intersecting-axis gear), a bevel gear 62 (second intersecting-axis gear), a spur gear 63 (first parallel-axis gear), a spur gear 64 (second parallel-axis gear), an internal gear 65, a spur gear 66, and a spur gear 67. The housing 60a is screwed onto the cover 21 (see Fig. 3).

[0052] The bevel gear 61 is arranged with its axial direction aligned with the front-rear direction, and has, on its axis, a fitting hole 61a in which the rotary shaft (unillustrated) of the driving motor 100 (see Fig. 2) is fitted. The bevel gear 62 is arranged with its axial direction aligned with the left-right direction, and meshes with the bevel gear 61. The spur gear 63 is formed integrally, and concentrically, with the bevel gear 62.

[0053] A shaft 63a of the spur gear 63 has a fitting hole (unillustrated) in which a convexity 58a (see Fig. 3) of the cap 58 is fitted. Thus, the spur gear 63 and the bevel gear 62 are coupled to the winding roll 50.

[0054] The spur gear 64 is arranged under the spur gear 63, and meshes with the spur gear 63. The internal gear 65 is provided integrally with the spur gear 64. The spur gear 66 meshes with the internal gear 65. The spur gear 67 is formed integrally, and concentrically, with the spur gear 66. The spur gear 68, which is provided at one end of the brush 80, meshes with the spur gear 67.

[0055] As the driving motor 100 is driven, the winding roll 50 rotates via the bevel gear

61 and the bevel gear 62. As the spur gear 63 arranged integrally with the bevel gear 62 rotates, the brush 80 rotates via the spur gear 64, the internal gear 65, the spur gear 66, the spur gear 67, and the spur gear 68. The spur gear 63 arranged integrally with the bevel gear 62 meshes with the spur gear 64 coupled to the brush 80; this makes it possible to easily rotate the brush 80 arranged parallel to the winding roll 50.

[0056] Here, owing to the internal gear 65 arranged integrally with the spur gear 64, the spur gear 68 on the axis of rotation of the brush 80 can be arranged between the axis of rotation (shaft 63a) of the spur gear 63 and the axis of rotation of the spur gear 64. This makes it possible to easily arrange the brush 80, which slides on the pre-filter 6 on the winding roll 50, close to the winding roll 50.

[0057] The bevel gears 61 and 62 may be any intersecting-axis gears. The spur gears may be any parallel-axis gears, and thus helical gears or the like may be used.

[0058] Fig. 8 is an exploded perspective view of the biasing member 70 in the cleaning device 30. The biasing member 70 has a rotary member 71 (first rotary member) and a rotary member 72 (second rotary member) housed in housings 78 and 79 screwed together. The rotary member 71 has a holding member 71a formed on one end surface to protrude from it in the axial direction and has a groove 71b in the other end surface. In the groove 71b, a locking member 48a provided on the cap 48 is fitted. This permits the rotary member 71 to engage with the shaft of the supply roll 40, with the result that the supply roll 40 is connected to the biasing member 70.

[0059] The rotary member 72 houses in a rotary member 71-side part of it a spiral spring 75. One end (inner end) of the spiral spring 75 is held on the holding member 71a of the rotary member 71, and the other end (outer end) of the spiral spring 75 is fitted to the inner circumferential surface of the rotary member 72. As the rotary member 71 rotates in the clockwise direction with respect to the rotary member 72 as seen from the right side surface (as seen from the direction indicated by arrow A), the biasing force of the spiral spring 75 increases. That is, as the rotary member 72 rotates in the clockwise direction with respect to the rotary member 71 as seen from the direction indicated by arrow A, the biasing force of the spiral spring 75 decreases.

[0060] On the outer circumferential surface of an outer-side (right-side) part of the rotary member 72 in the axial direction, a plurality of claws 72a are provided at predetermined intervals. In the housing 78, a stopper 77 is pivoted, and the stopper 77

is biased in a direction pressing the rotary member 72 by a twist coil spring 77a. Thus, the engagement of the stopper 77 with the claw 72a restricts the clockwise rotation of the rotary member 72 as seen from the direction indicated by arrow A, which rotation decreases the biasing force of the spiral spring 75.

[0061] In the right side surface of the housing 78, an opening 78a is open, and the handle 73 in a cylindrical shape is arranged so as to cover the opening 78a. Inside the housing 78, there is arranged a flange 73a which has a diameter larger than that of the opening 78a. Via the opening 78a, the handle 73 and the flange 73a are screwed together with a predetermined clearance from the outer wall of the housing 78 in the axial direction. In this way, the handle 73 is rotatably fitted to the housing 78.

[0062] Inside the housing 78, a coupling member 74 is arranged inward (on the left side) of the flange 73a in the axial direction. Between the rotary member 72 and the coupling member 74, a compression spring 76 is arranged, and the coupling member 74 is biased outward (rightward) in the axial direction. In the circumferential surface of the coupling member 74, a plurality of cut portions 74c are formed at predetermined intervals. In an outer end part of the rotary member 72 in the axial direction, there are formed a plurality of ribs 72c which extend radially to be fitted in the cut portions 74c. This permits the coupling member 74 and the rotary member 72 to rotate together.

[0063] The coupling member 74 is formed to have a diameter larger than those of the flange 73a and the opening 78a. On an outer (right-side) surface of the coupling member 74 in the axial direction, there are provided a plurality of inclined portions 74a and a plurality of ribs 74b at predetermined intervals. The inclined portion 74a is formed such that its height increases gradually in the counter-clockwise direction as seen from the direction indicated by arrow A. The rib 74b abuts a top part of the inclined portion 74a and extends radially, and is formed to be higher than the top part.

[0064] On an inner surface (left-side surface) of the flange 73a in the axial direction, there are provided a plurality of ribs 73b which extend radially to engage with the ribs 74b. On an inner wall surface of the housing 78, there are provided protrusions (unillustrated) which engage with the ribs 74b.

[0065] As the handle 73 is rotated in the clockwise direction as seen from the direction indicated by arrow A, the ribs 74b engage with the ribs 73b, and also engage with the protrusions on the housing 78. This restricts the rotation of the handle 73.

[0066] On the other hand, as the handle 73 is rotated in the counter-clockwise direction as seen from the direction indicated by arrow A, the ribs 73b slide on the inclined portions 74a. Thus, the coupling member 74 moves inward in the axial direction against the biasing force of the compression spring 76, and the ribs 74b move away from the protrusions on the housing 78 in the axial direction. This permits the handle 73 to rotate; then, the ribs 74b engage with the ribs 73b, and the rotary member 72 rotates in a direction in which the biasing force of the spiral spring 75 increases. That is, the rotary member 72 is operated to rotate with the handle 73.

[0067] In the air purifier 1 structured as described above, when its operation is started through operation on the operation panel 19, it is checked whether or not the cover 21 is fitted to the body 20. If it is determined that the cover 21 is fitted to the body 20, the fan 10 and the ion generating device 11 are driven. Thus, air in the room is sucked in through the suction port 3 and flows through the air passage 8. Here, the pre-filter 6 collects coarse dust in the air. The deodorant filter 7 deodorizes the air, and the dust-collecting filter 9 collects fine dust and ultrafine particles such as PM 2.5 particles, present in the air.

[0068] Then, ions generated by the ion generating device 11 are added to the air. The air containing ions is blown out into the room from one or both of the blowout ports 4 and 5. In this way, blowing operation of the air purifier 1 is performed, and air in a room is purified.

[0069] Now, the operation of the cleaning device 30 will be described. At a predetermined time, the cleaning device 30 is driven to start its cleaning operation. The cleaning operation starts, for example, when the cumulative operating time of the air purifier 1 within a predetermined period exceeds a predetermined time. When the cleaning device 30 is driven, the fan 10 stops.

[0070] As the cleaning device 30 is driven, the driving motor 100 rotates, and the bevel gear 61 (see Figs. 6 and 7) rotates in the counter-clockwise direction as seen from in front. The bevel gear 62 and the spur gear 63 rotate in the clockwise direction as seen from their respective right side surfaces (as seen from the direction indicated by arrow A). Thus, the winding roll 50 rotates in the clockwise direction as seen from its right side surface, and pulls out the pre-filter 6 from the supply roll 40 and winds it up.

[0071] The spur gear 64, the internal gear 65, the spur gear 66, and the spur gear 67 rotate

in the counter-clockwise direction as seen from their respective right side surfaces while the spur gear 68 rotates in the clockwise direction as seen from its right side surface. Thus, the brush 80 rotates in the clockwise direction as seen from its right side surface. Here, the brush bristle bundles 82 of the brush 80 slide on the pre-filter 6 on the winding roll 50. In this way, dust on the pre-filter 6 is removed and collected in the container 92.

[0072] Here, the rotation direction of the winding roll 50 and the rotation direction of the brush 80 are the same. Thus, the brush bristle bundles 82 of the brush 80 slide on the pre-filter 6 from the direction opposite to the forward direction of the pre-filter 6. Thus, the brush 80 can reliably remove dust on the pre-filter 6.

[0073] The peripheral velocity of the brush 80 is preferably higher than the peripheral velocity of the winding roll 50. Then the length of contact of the brush bristle bundles 82 on the pre-filter 6 in the circumferential direction is larger than the length of one cycle at which the brush bristle bundles 82 make contact with the pre-filter 6, and the brush bristle bundles 82 can make contact with the pre-filter 6 with no gap left in between.

[0074] The brush bristle bundles 82 on the shaft 81 which rotates are combed by the comb 93, and thereby dust attached to the brush bristle bundles 82 falls into the container 92.

[0075] When the pre-filter 6 is wound up around the winding roll 50, the rotary member 71 (see Fig. 8) of the biasing member 70 coupled to the supply roll 40 rotates in the clockwise direction as seen from the right side surface of the rotary member 71 (as seen from the direction indicated by arrow A). This winds up the spiral spring 75, and thus increases the biasing force of the spiral spring 75.

[0076] Here, the pattern 6g (see Fig. 4) on the housed portion 6c of the pre-filter 6 moves downward to be visually recognized via the suction port 3. This permits the user to easily understand that the cleaning device 30 is being driven. Thus, it is possible to prevent the user from misunderstanding that the fan 10 has stopped due to failure. Here, when the cleaning device 30 is driven, the fan 10 can be operated at low speed.

[0077] When the rotation amount of the driving motor 100 reaches a predetermined value, the driving motor 100 is reversed. Thus, the bevel gear 61 rotates in the direction opposite to its rotation direction during winding (in the clockwise direction in this embodiment). Here, the winding roll 50 and the brush 80 rotate in the counter-

clockwise direction as seen from their respective right side surfaces.

- [0078] The biasing force of the spiral spring 75 observed when winding of the pre-filter 6 by the winding roll 50 is completed is larger than that observed before the winding. Thus, when the driving motor 100 is reversed, by the restoring force of the spiral spring 75, the rotary member 71 rotates in the counter-clockwise direction as seen from its right side surface. In this way, the pre-filter 6 is wound up around the supply roll 40.
- [0079] When the rotation amount of the driving motor 100 reaches a predetermined value, the driving motor 100 stops. This ends the cleaning operation of the cleaning device 30.
- [0080] A sensor may be provided which detects the outer diameter of the winding roll 50. This makes it possible to reverse the driving motor 100 when it is detected that the outer diameter of the winding roll 50 observed when the pre-filter 6 has been wound up around the winding roll 50 is larger than a predetermined outer diameter. It is also possible to stop the driving motor 100 when it is detected that the outer diameter of the winding roll 50 is smaller than a predetermined outer diameter.
- [0081] After completion of the cleaning operation by the cleaning device 30, the user can remove the dust collector 90 from the cover 21 and clear the dust collected in the container 92.
- [0082] When the pre-filter 6 is replaced, the supply roll 40, to which one end of the pre-filter 6 has been fitted, is fitted to the cover 21. Then, the bottom end of the pre-filter 6 is fitted to the winding roll 50.
- [0083] Here, the pre-filter 6 between the supply roll 40 and the winding roll 50 may be loose. In this case, if the user turns the handle 73 of the biasing member 70 in the counter-clockwise direction as seen from the right side surface of the handle 73 (as seen from the direction indicated by arrow A), then the rotary members 71 and 72 rotate in the counter-clockwise direction as seen from their respective right side surfaces. This winds up the pre-filter 6 around the supply roll 40, and thereby eliminates the loosening of the pre-filter 6. Thus, when the fan 10 is driven, air sucked in through the suction port 3 can reliably pass through the pre-filter 6.
- [0084] According to this embodiment, a biasing member 70 in a cleaning device 30 includes a spiral spring 75 which biases, when a pre-filter 6 is wound up around a

winding roll 50, the rotary shaft of a supply roll 40 in the direction opposite to the winding direction. Thus, after completion of the winding around the winding roll 50, when a driving motor 100 is reversed, by the restoring force of the spiral spring 75, the pre-filter 6 is wound up around the supply roll 40. Thus, there is no need to separately provide another motor, in addition to the driving motor 100, for rotating the supply roll 40 in the direction opposite to the winding direction W of the winding roll 50. This helps reduce the manufacturing cost of the air purifier 1. With the spiral spring 75, it is possible to wind up the pre-filter 6, while applying a biasing force to it, around the winding roll 50 over a long distance. Thus, it is possible to enhance flexibility in design as to the size of the pre-filter 6.

[0085] The biasing member 70 further includes a rotary member 71 (first rotary member) which engages with the shaft of the supply roll 40 and which is fitted with one end of the spiral spring 75, a rotary member 72 (second rotary member) which is fitted with the other end of the spiral spring 75 and of which the rotation in a direction in which the biasing force of the spiral spring 75 decreases is restricted, and a handle 73 with which the rotary member 72 is operated to rotate. Thus, when the handle 73 is operated with the supply roll 40 fitted to a cover 21, the pre-filter 6 is wound up in the direction opposite to the winding direction W. This helps reduce the loosening of the pre-filter 6, and thus permits air containing dust to reliably pass through the pre-filter 6.

[0086] The biasing member 70 further includes a coupling member 74 which is arranged between the handle 73 and the rotary member 72 and which restricts the rotation of the handle 73 in the direction in which the biasing force of the spiral spring 75 decreases. The coupling member 74 rotates together with the rotary member 72. This makes it possible to reliably prevent the rotary member 72 from rotating in the direction in which the biasing force of the spiral spring 75 decreases.

[0087] The shaft 41 of the supply roll 40 has a core 41a which has a groove 41b in it and a sleeve 41d which is fitted outside the core 41a and which is formed of an elastic material with a C-shaped section. The sleeve 41d and the groove 41b hold a bar 6a of the pre-filter 6 between them with elasticity. Thus, with an opening 41e in the sleeve 41d widened, the bar 6a can be removed from the shaft 41 easily. Also with the sleeve 41d, it is possible to prevent the bar 6a from falling off from the shaft 41. The winding

roll 50 is structured similarly.

[0088] The core 41a of the supply roll 40 is formed of metal, and the sleeve 41d is formed of a molding of resin. The winding roll 50 is formed similarly. Thus, it is possible to easily fit and remove the bar 6a to and from the shafts 41 and 51 while ensuring sufficient strength of the shafts 41 and 51.

[0089] The driving motor 100 is arranged in a body 20 of a housing 2, and the supply roll 40 and the winding roll 50 are arranged in the cover 21. This makes it possible to remove the cover 21 from the body 20 and then replace the pre-filter 6 easily. Although the air purifier 1 is provided with the cleaning device 30, dust may still clog the pre-filter 6 depending on the place where the air purifier 1 is placed (for example, in a place like a kitchen where contamination with oil is more likely). Even in this case, it is possible to easily remove the pre-filter 6 and clean it thoroughly.

[0090] A brush 80 is coupled to the driving motor 100 which drives the winding roll 50 to rotate; as the winding roll 50 rotates, the brush 80 rotates while sliding on the pre-filter 6 (filter) on the winding roll 50. This eliminates the need to separately provide, in addition to the driving motor 100, a motor dedicated to rotating the brush 80 as in the conventional example. Thus, it is possible to further reduce the manufacturing cost of the air purifier 1.

[0091] The rotation direction of the winding roll 50 and the rotation direction of the brush 80 are the same. Thus, the brush 80 slides on the pre-filter 6 from the direction opposite to the forward direction of the pre-filter 6. Thus, the brush 80 can reliably remove dust on the pre-filter 6.

[0092] The peripheral velocity of the brush 80 is preferably higher than the peripheral velocity of the winding roll 50. Then the length of contact of brush bristle bundles 82 on the pre-filter 6 in the circumferential direction is larger than the length of one cycle at which the brush bristle bundles 82 make contact with the pre-filter 6, and the brush bristle bundles 82 can make contact with the pre-filter 6 with no gap left in between. Thus, it is possible to remove dust on the pre-filter 6 more reliably.

[0093] There are also provided a bevel gear 61 (first intersecting-axis gear) having a fitting hole 61a in which the rotary shaft of the driving motor 100 is fitted, a bevel gear 62 (second intersecting-axis gear) which meshes with the bevel gear 61, a spur gear 63 (first parallel-axis gear) which rotates together with the bevel gear 62 and

which is coupled to the winding roll 50, and a spur gear 64 (second parallel-axis gear) which meshes with the spur gear 63 and which is coupled to the brush 80. This makes it possible to easily rotate the winding roll 50 and the brush 80 with a single driving motor 100.

[0094] The spur gear 63, which is coupled to the winding roll 50, is arranged closer to the driving motor 100 than the spur gear 64 is, which is coupled to the brush 80, and this helps reduce a drop in the driving force transmitted to the winding roll 50. Thus, the driving motor 100 can reliably drive the winding roll 50, to which a biasing force is applied via the pre-filter 6 by the biasing member 70, to rotate against the biasing force.

[0095] Between the brush 80 and the spur gear 64, there are provided an internal gear 65, which is provided integrally with the spur gear 64, and a spur gear 66 (third parallel-axis gear), which meshes with the internal gear 65. The axis of rotation of the brush 80 is arranged between the axis of rotation of the spur gear 63 and the axis of rotation of the spur gear 64. This makes it possible to easily arrange the brush 80, which slides on the pre-filter 6 on the winding roll 50, close to the winding roll 50.

[0096] The pre-filter 6 has a ventilation portion 6b which is arranged to face the suction port 3 when the cleaning device 30 is out of operation and a housed portion 6c which is fed out from the supply roll 40 when the cleaning device 30 is in operation. The housed portion 6c has a pattern 6g on it which can be visually recognized through the suction port 3 for distinction from the ventilation portion 6b. This permits the user to visually recognize the movement of the pre-filter 6 easily, and thus to easily understand that the pre-filter 6 is being cleaned by the cleaning device 30.

[0097] When the cleaning device 30 is driven, the fan 10 stops. This can prevent dust immediately after being removed from the pre-filter 6 from being sucked in toward the downstream side of the pre-filter 6. Also the pattern 6g can prevent the user from misunderstanding that the fan 10 has stopped due to failure.

[0098] <Second Embodiment>

Next, a second embodiment of the present invention will be described. Fig. 9 is a side view of a supporting member on a cover of an air purifier according to this embodiment. For the sake of convenience of description, such parts as find their counterparts in the first embodiment shown in Figs. 1 to 8 referred to thus far are

identified by common reference signs. In this embodiment, the structure of the supporting member 49 on the cover 21 differs from that in the first embodiment. Otherwise, the second embodiment is similar to the first embodiment.

[0099] In a front end part of the supporting member 49 (see Fig. 3) on the right side of the supply roll 40 on the cover 21, there is provided a resin swing plate 400 which swings in the up-down direction. A shaft 401 of the swing plate 400 is arranged lopsided rearward relative to the middle of the swing plate 400 in the front-rear direction. Thus, as shown in Fig. 9, when the supply roll 40 is not fitted to the supporting member 49, a front end part of the swing plate 400 protrudes frontward beyond the supporting member 49. Thus, when the user tries to fit the cover 21 to the body 20 without the supply roll 40 fitted to the cover 21, the front end part of the swing plate 400 interferes with the body 20. It is thus possible to easily prevent the user from forgetting to fit the supply roll 40 to the cover 21.

[0100] On the other hand, as shown in Fig. 10, when the supply roll 40 is fitted to the supporting member 49, the supply roll 40 collides with a rear end part of the swing plate 400, and the swing plate 400 swings upward. Thus, the front end part of the swing plate 400 retracts rearward; this prevents the interference of the swing plate 400 with the body 20 when the cover 21 is fitted to the body 20.

[0101] This embodiment provides effects similar to those obtained with the first embodiment.

[0102] <Third Embodiment>

Next, a third embodiment of the present invention will be described. Fig. 11 is a side view of a supporting member on a cover of an air purifier according to this embodiment. For the sake of convenience of description, such parts as find their counterparts in the first embodiment shown in Figs. 1 to 8 referred to thus far are identified by common reference signs. In this embodiment, the structure of the supporting member 49 on the cover 21 differs from that in the first embodiment. Otherwise, the third embodiment is similar to the first embodiment.

[0103] The supporting member 49 has a fixed member 49a and a moving member 49b. In a rear end part of the moving member 49b, a spring 49c is provided, and one end of the spring 49c is fitted to the front face of the cover 21. Here, a design is adopted where, with the spring 49c stretched, a front end part of the moving member 49b

protrudes frontward beyond the fixed member 49a. Thus, as shown in Fig. 11, when the supply roll 40 is not fitted to the supporting member 49, the front end part of the moving member 49b protrudes frontward beyond the fixed member 49a. Thus, when the user tries to fit the cover 21 to the body 20 without the supply roll 40 fitted to the cover 21, the front end part of the moving member 49b interferes with the body 20. It is thus possible to easily prevent the user from forgetting to fit the supply roll 40 to the cover 21.

[0104] On the other hand, as shown in Fig. 12, when the supply roll 40 is fitted to the supporting member 49, the supply roll 40 in contact with the fixed member 49a moves the moving member 49b rearward. Thus, the front end part of the moving member 49b retracts rearward; this prevents the interference of the moving member 49b with the body 20 when the cover 21 is fitted to the body 20.

[0105] This embodiment provides effects similar to those obtained with the first embodiment.

[0106] In the second and third embodiments, a photointerrupter (unillustrated) may be provided instead of the magnet 23 and the Hall effect sensor in the first embodiment. The photointerrupter includes a light-emitting element and a light-receiving element which face each other. When the light-receiving element detects the light traveling from the light-emitting element to the light-receiving element being intercepted by the swing plate 400 in the second embodiment, which protrudes frontward beyond the supporting member 49, or by the moving member 49b in the third embodiment, the driving of the fan 10 is prohibited. This makes it possible to prevent the blowing operation of the air purifier 1 when the cover 21 is not fitted to the body 20.

[0107] <Fourth Embodiment>

Next, a fourth embodiment of the present invention will be described. Fig. 13 is a plan view of a pre-filter of an air purifier according to this embodiment. For the sake of convenience of description, such parts as find their counterparts in the first embodiment shown in Figs. 1 to 8 referred to thus far are identified by common reference signs. In this embodiment, the structure of the pre-filter 6 differs from that in the first embodiment. Otherwise, the fourth embodiment is similar to the first embodiment.

[0108] The sheet-form pre-filter 6 is composed of a first region A1, a second region A2, a

third region A3, and a fourth region A4 which are arrayed in the winding direction W. The first region A1 is a region with a low mesh density, the second region A2 is a region with a high mesh density, the third region A3 is a region where activated carbon is attached to the mesh, and the fourth region A4 is a region where a deodorant is attached to the mesh.

[0109] The air purifier 1 includes a dust sensor (unillustrated) and an odor sensor (unillustrated). The dust sensor detects the dust concentration in air in a room. The odor sensor detects the concentration of odor components in air in a room.

[0110] In the air purifier 1 structured as described above, for example, if, according to the result of detection by the dust sensor, it is determined that the dust concentration in air is low, the driving motor 100 is driven to rotate the winding roll 50 so that the first region A1 is located to face the suction port 3. This helps improve the blowing efficiency of the air purifier 1. For another example, if, according to the result of detection by the dust sensor, it is determined that the dust concentration in air is high, the driving motor 100 is driven to rotate the winding roll 50 so that the second region A2 is located to face the suction port 3. Here, based on the length of the first to fourth regions A1 to A4 in the winding direction W and the rotation amount of the driving motor 100, it is possible to determine which of the regions is to be located to face the suction port 3.

[0111] If, according to the result of detection by the odor sensor, it is determined that the concentration of odor components in air is high, the driving motor 100 is driven to rotate the winding roll 50 so that the third region A3 or the fourth region A4 is located to face the suction port 3.

[0112] As described above, a region of the pre-filter 6 suitable for the air condition in a room is located to face the suction port 3; it is thus possible to improve the usability of the air purifier 1.

[0113] This embodiment provides effects similar to those obtained with the first embodiment. Moreover, the pre-filter 6 is composed of the first to fourth regions A1 to A4 which are arrayed in the winding direction W. Thus, a region of the pre-filter 6 suitable for the air condition in a room is located to face the suction port 3; this makes it possible to improve the usability of the air purifier 1.

[0114] The user can be allowed to select from among the first to fourth regions A1 to A4

through operation on the operation panel 19.

[0115] <Fifth Embodiment>

Next, a fifth embodiment of the present invention will be described. Fig. 14 is a perspective view of a presser for a pre-filter of an air purifier according to this embodiment. For the sake of convenience of description, such parts as find their counterparts in the first embodiment shown in Figs. 1 to 8 referred to thus far are identified by common reference signs. In this embodiment, the structure of the presser 22 differs from that in the first embodiment. Otherwise, the fifth embodiment is similar to the first embodiment.

[0116] In this embodiment, the presser 22 only has the rib 22b which extends in the winding direction W of the pre-filter 6 (in the up-down direction in this embodiment), and thus has no ribs which extend in the direction orthogonal to the winding direction W (in the left-right direction in this embodiment). It is thus possible to prevent dust from falling off as a result of ribs, which extend in the direction orthogonal to the winding direction W, sliding on the pre-filter 6.

[0117] This embodiment provides effects similar to those obtained with the first embodiment.

[0118] Although, in the first to fifth embodiments, the supply roll 40 and the winding roll 50 are arranged in the cover 21, instead, they may be arranged in the body 20.

[0119] In the cleaning operation of the air purifier 1 in the first to fifth embodiments, the winding speed of the winding roll 50 and the rewinding speed of the supply roll 40 can be the same or different. For example, when the winding speed of the winding roll 50 is set lower than the rewinding speed of the supply roll 40, it is possible, while removing dust on the pre-filter 6, to increase the rewinding speed of the supply roll 40 and thereby reduce the time required for the cleaning operation.

Industrial Applicability

[0120] The present invention finds applications in air purifiers provided with a cleaning device that cleans a filter.

List of Reference Signs

[0121] 1 air purifier

2	housing
3	suction port
4, 5	blowout port
6	pre-filter (filter)
6a	bar
6b	ventilation portion
6c	housed portion
6g	pattern
7	deodorant filter
8	air passage
8a	first branch passage
8b	second branch passage
9	dust-collecting filter
10	fan
11	ion generating device
12	damper
14, 15	wind deflector
20	body
21	cover
22	presser
23	magnet
30	cleaning device
40	supply roll
41	shaft
41a	core
41d	sleeve
50	winding roll
60	gear unit
61	bevel gear (first intersecting-axis gear)
62	bevel gear (second intersecting-axis gear)
63	spur gear (first parallel-axis gear)
64	spur gear (second parallel-axis gear)

65	internal gear
66	spur gear (third parallel-axis gear)
69	housing
70	biasing member
71	rotary member (first rotary member)
71a	holding member
72	rotary member (second rotary member)
72a	claw
73	handle
74	coupling member
75	spiral spring
76	compression spring
77	stopper
77a	twist coil spring
78, 79	housing
80	brush
81	shaft
82	brush bristle bundle
90	dust collector
91	lid
91a	opening
92	container
93	comb
100	driving motor
200	humidifier
201	tray
202	humidification filter
300	tape-form member
400	swing plate
401	shaft
SP	space

CLAIMS

[Claim 1] An air purifier including: a housing in which a suction port and a blowout port are open; an air passage through which the suction port and the blowout port are coupled together; a fan arranged inside the air passage; a filter arranged to face the suction port; and a cleaning device which cleans the filter, wherein

the cleaning device includes:

a supply roll around which the filter, which is in a sheet form, is wound;

a winding roll which winds up the filter around the winding roll;

a driving motor which drives the winding roll to rotate;

a biasing member having a spiral spring which biases, during winding of the winding roll, a rotary shaft of the supply roll in a direction opposite to a winding direction; and

a brush which slides on the filter as the winding roll rotates.

[Claim 2] The air purifier of claim 1, wherein
the supply roll is removably arranged on the housing, and
the biasing member includes:

a first rotary member which engages with the shaft of the supply roll and which is fitted with one end of the spiral spring;

a second rotary member which is fitted with another end of the spiral spring and of which rotation in a direction in which a biasing force of the spiral spring decreases is restricted; and

a handle with which the second rotary member is operated to rotate.

[Claim 3] The air purifier of claim 2, wherein
the biasing member includes:

a coupling member arranged between the handle and the second rotary member, the coupling member restricting rotation of the handle in the direction in which the biasing force of the spiral spring decreases, and

the coupling member rotates together with the second rotary member.

- [Claim 4] The air purifier of any one of claims 1 to 3, wherein
 the filter has, in opposite end parts thereof in the winding direction, bars which
 extend in an axial direction,
 a shaft of the supply roll and a shaft of the winding roll are each a shaft that
 includes a core which extends in the axial direction and which has therein a groove
 of which opposite inner wall surfaces incline, and a sleeve which is fitted outside
 the core and which is formed of an elastic material with a C-shaped section, and
 the bars are each held between the sleeve and the groove with elasticity.
- [Claim 5] The air purifier of claim 4, wherein
 the core is made of metal, and
 the sleeve is made of a molding of resin.
- [Claim 6] The air purifier of any one of claims 1 to 5, wherein
 the housing includes:
 a body in which the fan is arranged;
 a cover which is removably fitted to the body and in which the suction
port is open,
 the driving motor is arranged in the body, and
 the supply roll and the winding roll are arranged in the cover.