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

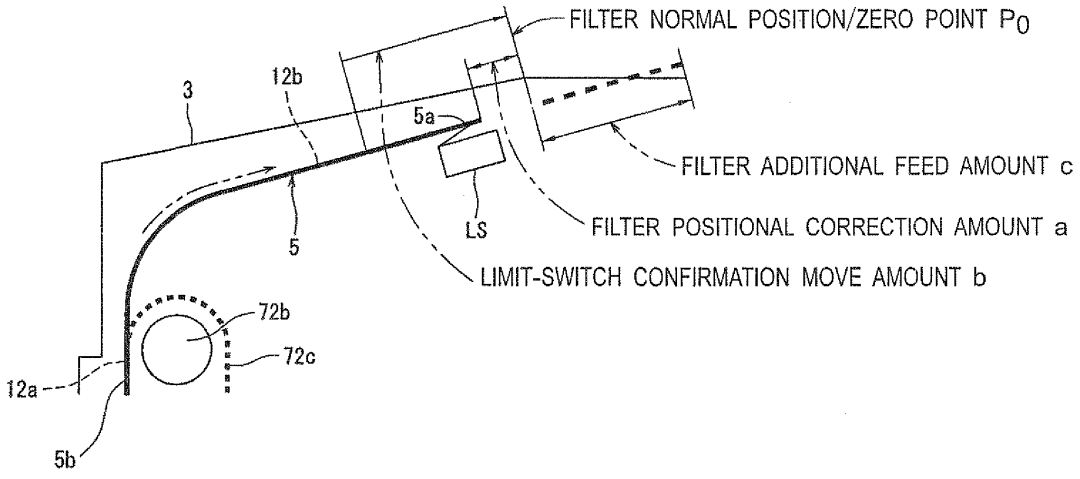
(72) Inventor: **MATSUBARA, Atsushi**
Kusatsu-shi
Shiga 5250044 (JP)

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

(54) AIR CONDITIONER WITH FILTER CLEANING UNIT

(57) The air conditioner with a filter cleaning unit of the invention includes: a body casing 3; a heat exchanger 4 provided in mid-course of an air passage in the body casing 3; a filter 5 placed in correspondence to a primary side of air intake surfaces of the heat exchanger 4; a filter driving section 72 to which the filter 5 is fitted and which moves the filter 5 along the air intake surfaces of the heat exchanger 4; a filter detecting section LS provided at a specified position on a terminal-end side of filter movement paths 12a, 12b; a filter cleaning unit 6 for performing cleaning of a filter surface of the filter 5 in mid-course of the filter movement paths; and a fan 70 provided on a position of a secondary side of the heat exchanger 4. The filter detecting section LS is provided at a position which is corrected in correspondence to a deviation amount of a fitting position of the filter 5 that can occur due to a way of fitting of the filter 5 to the filter driving section 72, the position correction being done to an extent of the deviation amount in a direction from a terminal end P_0 of the filter movement paths toward inside of the filter movement paths.

Fig.12



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Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner equipped with a filter cleaning unit in which the filter is moved.

BACKGROUND ART

[0002] A filter of an indoor unit for use in air conditioners, generally called prefilter, is liable to clogging with contaminants, dust and the like, requiring frequent maintenance basically. However, filter cleaning process, which includes the steps of releasing and removing the filter from the indoor unit main body, sucking up contaminants of its mesh part with a cleaner, or other steps, is quite troublesome so as to often fail to be done practically.

[0003] Therefore, it has also been practiced to accumulate operating time or the like so as to find a timing for cleaning and, upon reaching a cleaning-required timing, to issue a maintenance instruction (e.g., lighting of LED) so as to urge the user to conduct the filter cleaning.

[0004] Nevertheless, even with such a maintenance instruction issued, it is often the case that the cleaning is not conducted practically. In the case continuing the operation with the filter clogged would cause pressure loss to increase, incurring increases in power consumption due to increased load on the fan motor. Air intake noise would increase as well.

[0005] Thus, it has recently been becoming the case to provide an air conditioner equipped with a filter cleaning unit in which a filter cleaning unit is incorporated into the indoor unit itself so that dust or the like deposited on the filter is automatically scraped off in response to an operation stop or to a remote control operation or the like during an operation halt and then discharged outdoors through a suction nozzle and an exhaust pipe or collected into a dust box.

[0006] Such filter cleaning units are provided in various types including one in which a scrape-and-suction nozzle part for scraping off dust of the filter and moreover sucking up the scraped dust moves rightward and leftward along the filter surface, and another in which a dust box having a brush for scraping off dust or the like is attached in lower portion of the filter, the dust box being moved up and down along the filter so that dust is scraped down into the dust box with the brush (the former is known by Patent Literature 1 (JP 2006-112699 A, Specification pp. 1-6, Figs. 1-11), and the latter is known as a commercial product).

[0007] Other than those in which such a scrape-and-suction nozzle unit for dust or the like or a dust box unit as described above is moved along the filter surface, there has also been proposed a filter cleaning unit in which, for example, the filter itself is provided as a flat-and-bendable flexible structure, the filter being supported so as to be reciprocatively movable along an air intake surfaces of heat-exchanger ranging from front to top surfaces of the air conditioner main body by a filter driving means and a filter support means while a dust box having a dust-scraping brush is placed at some point of the filter movement, so that dust or the like of the filter can be removed and collected into the dust box without moving the dust box or the like (see Patent Literature 2 (JP 2001-99479 A, Specification pp. 1-4, Figs. 1-2) as a known literature).

DISCLOSURE OF INVENTION

TECHNICAL PROBLEM

[0008] The inventor of this patent application, prior to this application, has proposed a filter cleaning unit in which the filter is made movable as in the above case but further in which the filter is supported so as to be reciprocatively movable along the entirety of the air intake surfaces extending from front face to top face side of the heat exchanger while the filter cleaning unit further includes a filter roll-up/back mechanism for rolling up the generally entire filter from its lower end side in a conveyor-like fashion and rolling back the filter into a one-sheet state, and moreover in which a dust box having a scrape-down brush for contaminants, dust and the like is provided in correspondence to a roll-up position of the filter roll-up/back mechanism so as to allow the filter to be rolled up and moved so that dust or the like of the filter can be automatically removed and collected into the dust box without moving the brush and the dust box (see Patent Literature 3 (JP 2006-25942, Specification pp. 1-6, Figs. 1-7) as an unknown prior-art literature).

[0009] In the case of an air conditioner having such a filter-driven type automatic cleaning function as described above, there is a need for structurally providing some extent of margin (dimensional margin) in a filter fitting state for the sake of fitting easiness (a degree of roughness of mutual engaging portions between the filter and the driving means), type and structural restraints (drive-amount accuracy) of the drive mechanism of the driving means, and other reasons, when the filter is fitted to the filter driving means (when it is set for the first time after once removed). In such a case, user inevitably cause a some amount of deviation from a filter fitting position (a deviation from a designed structural destination position). Due to this, in the case where a filter detecting means (e.g., limit switch) is provided in correspondence to a normal proper destination position, a fitting state of the filter may be mis-detected by the filter detecting means (e.g., limit switch) depending on the way of fitting of the filter to the driving means by user.

[0010] As a result, the prior art would involve executing a filter detection control logic for detecting the presence or absence of the filter necessarily after each filter fitting, posing a problem that extra time is taken until actual cleaning is started.

[0011] The present invention having been accom-

plished with a view to solving these and other problems, an object of the invention is to provide an air conditioner with a filter cleaning unit having specified filter movement paths provided in correspondence to air intake surfaces of the heat exchanger or the like, in which a filter detecting section is provided at a position corrected in correspondence to a deviation amount of the fitting position that can occur due to the above-mentioned way of fitting by the user from structural reasons, by which the above problems of the prior art have been solved.

SOLUTION TO PROBLEM

[0012] In order to achieve the above object, the present invention provides an air conditioner with a filter cleaning unit having solutions to the problems as shown below.

[0013] An air conditioner with a filter cleaning unit according to the present invention, comprises:

a body casing having an air intake port and an air blow-off port;
a heat exchanger provided in mid-course of an air passage ranging from the air intake port to the air blow-off port in the body casing;
a filter placed in correspondence to a primary side of air intake surfaces of the heat exchanger;
a filter driving section to which the filter is fitted and which moves the filter through filter movement paths extending along the air intake surfaces of the heat exchanger;
a filter detecting section provided at a specified position on a terminal-end side of the filter movement paths;
a filter cleaning unit for performing cleaning of a filter surface of the filter in mid-course of the filter movement paths; and
a fan provided on a position of a secondary side of the heat exchanger, wherein
in correspondence to a deviation amount of a fitting position of the filter that can occur due to a way of fitting of the filter to the filter driving section, the filter detecting section is provided at a position which is corrected to an extent of the deviation amount in a direction from a terminal end of the filter movement paths toward inside of the filter movement paths.

[0014] According to the air conditioner with a filter cleaning unit of this invention, the filter detecting section for detecting whether or not the filter is set at a preset proper position, in correspondence to a deviation amount of a fitting position of the filter that can occur due to a way of fitting of the filter to the filter driving section, is provided at a position which is corrected to an extent of the deviation amount in a direction from a terminal end of the filter movement paths toward inside of the filter movement paths. That is, for such structural reasons as achievement of fitting easiness, the filter detecting section is placed at a position which is shifted in such a direction as to cancel out a deviation amount by a length corresponding to the deviation amount due to the way of fitting by user. As a result of this, the deviation amount caused by the way of fitting of the filter by user is canceled out, so that the filter can securely be detected in the fitting of the filter.

[0015] Accordingly, there is no occurrence of misdetection of filter setting state depending on the way of filter fitting by user as could occur in the prior art, so that the filter detection logic after the filter setting can be simplified.

[0016] Since the filter detection logic can be simplified as shown above, the time taken until the cleaning start is shortened.

[0017] In one embodiment of the air conditioner with a filter cleaning unit, wherein a moving state of the filter during its movement by the filter driving section is also detected by the filter detecting section.

[0018] With such an arrangement, it also becomes possible to accurately detect the moving state of the filter also by the filter detecting section.

[0019] In one embodiment of the air conditioner with a filter cleaning unit, wherein in the movement of the filter by the filter driving section, permission for the movement of the filter is decided depending on presence or absence of a filter detection signal by the filter detecting section until the filter arrives at a position where the filter detecting section is placed, and the permission is decided depending on a drive amount of the filter driving section after the filter detection at the placement position of the filter detecting section.

[0020] With such an arrangement, misdetections of the filter setting state due to the way of filter fitting by user are eliminated as described above, so that the detection logic after the filter fitting can be simplified and moreover the time until the cleaning start can be shortened. Furthermore, since filter detection by the filter detecting section until arrival at the detection position and filter detection during movement after that on are fulfilled by two different means, respectively, it becomes possible to accurately and securely detect faults of the filter detecting section and abnormalities of the filter including filter movement obstacles.

[0021] In one embodiment of the air conditioner with a filter cleaning unit, wherein in checking of filter setting state of the filter upon a start of filter cleaning operation by the filter cleaning unit, after the fitting of the filter, only abnormality detection of the filter detecting section and zero point correction control are performed if a filter detection signal by the filter detecting section is present, while detection of presence or absence of filter setting in addition to the abnormality detection of the filter detecting section and the zero point correction control are performed if no filter fitting detection signal of the filter by the filter detecting section is present.

[0022] With such an arrangement, even if no signal of fitting of the prefilter 5 by the filter detecting section LS is present, it becomes possible to detect the presence or

absence of filter setting in addition to the abnormality detection of the filter detecting section LS and the zero point correction control.

ADVANTAGEOUS EFFECTS OF INVENTION

[0023] As described above, according to the invention of this application, misdetections of the filter setting state due to the way of filter fitting by user as would be involved in the prior art are eliminated, so that the filter detection logic after the filter fitting can be simplified. Moreover, since the detection logic can be simplified, the time until the cleaning start of the filter can be shortened accordingly.

BRIEF DESCRIPTION OF DRAWINGS

[0024]

Fig. 1 is a sectional view showing an overall construction of an air conditioner with a filter cleaning unit according to one of the most preferred embodiments of the invention;
Fig. 2 is a perspective view of the air conditioner in a state that its exterior parts such as an overall cover and a top-face side air intake grille are removed;
Fig. 3 is an enlarged perspective view of a main part showing a mutual relationship between a prefilter and a prefilter roll-up/back mechanism of the air conditioner;
Fig. 4 is an enlarged sectional view of the air conditioner in a prefilter inserted/removed state, showing mutual relationships and structures among the prefilter, a prefilter support member, a filter presser, a seal plate, the prefilter roll-up/back mechanism, a contaminant etc. scrape-down brush, and a dust box;
Fig. 5 is an enlarged sectional view of the air conditioner in a prefilter developed-and-extended state, showing mutual relationships and structures among the prefilter, the prefilter support member, the filter presser, the seal plate, the prefilter roll-up/back mechanism, the contaminant etc. scrape-down brush and the dust box;
Fig. 6 is an enlarged sectional view of the air conditioner in a prefilter rolled-up state, showing mutual relationships and structures among the prefilter, the prefilter support member, the filter presser, the prefilter roll-up/back mechanism, the contaminant etc. scrape-down brush and the dust box;
Fig. 7 is an enlarged sectional view of a main part of the air conditioner, showing relationships among the prefilter support member, the heat exchanger and the seal plate as viewed sideways;
Fig. 8 is an enlarged sectional view of a main part of the air conditioner, showing mutual relationships among the prefilter support member, the prefilter and the prefilter presser;
Fig. 9 is a block diagram showing a construction of a control circuit of the air conditioner;
Fig. 10 is an explanatory view showing a relationship between prefilter drive position and 'cleaning operation' in the air conditioner;
Fig. 11 is an explanatory view showing a relationship between normal position and maximum position of the prefilter in the air conditioner;
Fig. 12 is an explanatory view showing a construction of a prefilter detection system in the air conditioner;
Fig. 13 is a time chart corresponding to a zero point correction control operation of the air conditioner;
Fig. 14 is a time chart showing contents of outward movement operation in the 'cleaning operation' control of the air conditioner; and
Fig. 15 is a time chart showing contents of homeward movement operation in the 'cleaning operation' control of the air conditioner.

DESCRIPTION OF EMBODIMENTS

[0025] Figs. 1 to 15 show construction and function of an air conditioner A with a filter cleaning unit according to one of the most preferred embodiments, as well as contents of filter cleaning control by the filter cleaning unit.

(1) Overall construction and function of the air conditioner A

[0026] This air conditioner A includes: a body casing 3 having an air intake port 1 on a top face side and an air blow-off port 2 on a lower-face side front portion; a cross-fin type heat exchanger (evaporator or condenser) 4 provided within the body casing 3; a meshed prefilter 5 provided in correspondence to a primary side of air intake surfaces of the heat exchanger 4; a filter support member 7 for supporting the prefilter 5 so as to allow the prefilter 5 to move in up-and-down direction and from the up-and-down to back-and-forth horizontal direction along the air intake surfaces of the heat exchanger 4; a filter cleaning unit 6 for driving and rolling up the prefilter 5 in a conveyor belt-like fashion to perform cleaning (scrape-down of contaminants and the like by brushing) of a filter surface (meshed surface); and a cross-flow type multiblade fan 70 provided on a position of a secondary side of the heat exchanger 4.

[0027] The body casing 3 is composed of a housing section 3a for attachment or support of the heat exchanger 4, the prefilter 5, the filter support member 7, the multiblade fan 70 or the like, an air intake grille 3b for covering the air blow-off port 2, a front cover 3c for openably and closably covering a front-side air intake space 1a of the heat exchanger 4, and the like.

[0028] The heat exchanger 4, which is formed as a so-called lambda-type heat exchanger, is composed of a front-side heat exchanger section 4a extending vertically in a dogleg shape, and a rear-side heat exchanger section 4b which is bent rearward and downward from an upper end portion of the front-side heat exchanger sec-

tion 4a and which is positioned upward on the rear side of the body casing 3. With this arrangement, enough amount of air flow is allowed to efficiently pass via a wide-area air intake passage formed from the top-face side air intake port 1 portion to the front-face side air intake space 1a portion of the body casing 3.

[0029] In addition, reference sign 8a denotes a first drain pan for receiving a drain from the front-side heat exchanger section 4a, 8b denotes a second drain pan for receiving a drain from the rear-side heat exchanger section 4b, 9 denotes a scroll-structured air blow-off passage by which an air flow blown off from an impeller part 70a of the multiblade fan 70 is guided toward the air blow-off port 2, 10 denotes a tongue part for preventing back-flow of the air flow blown off from the impeller part 70a of the multiblade fan 70, and 11 denotes a wind direction adjustment mechanism made up of vertical blades, horizontal blades or the like provided in the upstream of the air blow-off port 2.

[0030] The front cover 3c is supported on both sides of the body casing 3 via a specified movable guide mechanism. For example, as shown in Fig. 1, the front cover 3c is openable and closable between two states, a closed state in which the front cover 3c approaches the front face of the front-side heat exchanger section 4a to blind a front part of the front-side heat exchanger section 4a and a forward-inclined open state in which the front cover 3c has moved downward from the closed state with its upper end side protruded forward. The front cover 3c is so formed as to open the front face of the front-side heat exchanger section 4a in the open state.

[0031] Then, in the open state of the front cover 3c, the air flow taken in through the top-face side air intake port 1 and the front-face side air intake space 1a of the body casing 3 is cooled or heated during its passing through the heat exchanger 4 (heat exchanger sections 4a, 4b) so as to be a conditioned air of desired temperature and humidity. The air flow further flows through the impeller part 70a of the multiblade fan 70 so as to perpendicularly cross a rotating shaft 70b of the multiblade fan 70, and passes through the scroll-structured air blow-off passage 9, thus being blown off from the air blow-off port 2 into the room.

[0032] The impeller part 70a of the multiblade fan 70 is so formed that on outer peripheral edge portions of a plurality of circular-shaped support plates provided in parallel at a specified interval along the rotating shaft 70b direction, a multiplicity of blades are provided with a certain blade angle so as to be parallel to the rotating shaft 70b.

(2) Construction of prefilter 5 as a contaminant etc. collecting section

[0033] The prefilter 5, for example as shown in Fig. 3, is so formed that mesh members 52, 52, ... of a specified mesh diameter are stretched over square window portions between individual flat frame members 51a, 51a, ... of a flat-grille-like frame body 51 made of synthetic resin which is freely bendable in a circular-arc shape and highly flexible (a rectangular-shaped frame body a little longer in the vertical direction as a whole). Outer frames 51A, 51A on left-and-right both sides in the flat rectangular-shaped frame body 51 are formed wider in width than the grille-like frame members 51a, 51a, ... provided therebetween, and protruding members (engaging pins) 53, 53, ... of a specified length are provided on the rear side of the outer frame so as to protrude perpendicularly at a constant longitudinal interval.

[0034] Then, as shown in Figs. 4 and 5, the prefilter 5, in a normal state, is supported so as to be reciprocatively movable along the entire air intake surfaces of the lambda-type heat exchanger 4 from front to top face side. When cleaning of filter surface is practiced, the generally entire filter surface of the prefilter 5, as shown in Figs. 5-6, is rolled up, starting with its lower end 5b side, in a conveyor belt-like fashion into filter roll-up/back mechanism 72, 72 of the later-described filter cleaning unit 6. On the way of rolling-up of the filter surface, the entire filter surface is cleaned by brushing with a contaminant etc. scrape-down brush 16 as described later.

(3) Construction of the filter support member 7 that supports the prefilter 5 so that the prefilter 5 is moveable in the up/down and roll-up directions

[0035] A filter support member 7 for support of the prefilter, as shown in detail in Fig. 8 as an example, is provided on the body casing 3 side. This filter support member 7 is composed of: a left-and-right pair of frame plates 71, 71 which are located on left-and-right both sides of the prefilter 5, and which are so formed from synthetic resin with a hook-like cross section as to have relatively high rigidity and to extend along the entire configuration ranging from a top-side rear plate position to a front-side lower end position of the lambda-type heat exchanger 4; a filter presser 73 which has a frame body structure provided in correspondence to front portions in lower side portions of side walls 71a, 71a extending up and down between the left-and-right pair of frame plates 71, 71; and filter guide members 74a, 74a, 75a, 75a provided at both upper and lower spatial plane positions of corner surface portions where a position-shift occurs from a front-face side portion extending in the up/down direction to a top-face side portion extending in the back-and-forth (horizontal) direction between the frame plates 71, 71. The filter guide members 74a, 74a, 75a, 75a are supported in parallel to each other with their plate surfaces set perpendicular between each two parallel support members 74, 74, 75, 75 bridged between side wall portions 71a, 71a of the left-and-right pair of frame plates 71, 71. As a result of this, the filter guide members 74a, 74a, 75a, 75a smoothly guide the prefilter 5 in the up-and-down and back-and-forth directions by supporting the prefilter 5 without causing flexure of intermediate portion of the prefilter 5, while end faces of their plate portions

having rounded surfaces at their upper-and-lower both ends, respectively, are used as guide surfaces extending in the filter movement direction.

[0036] These filter guide members 74a, 74a, 75a, 75a, as apparent from Fig. 8 as an example, support and guide the prefilter 5 just in correspondence to the intermediate frame members 51a, 51a of the prefilter 5 extending in the up-and-down direction.

[0037] The filter presser 73 can be opened and closed in correspondence to the front portion of the filter support member 7 corresponding to the front-side heat exchanger section 4a of the heat exchanger 4. An upper-end-side frame plate 73b portion of the filter presser 73 is pivotally supported via latch mechanisms 76, 76 interposed at front-portion upper ends of left-and-right both frame plates 71, 71 of the filter support member 7, respectively, so that the lower-end side of the filter presser 73 is made turnable in the up-and-down direction.

[0038] Then, frame plate 73a, 73a portions on left-and-right both sides of the filter presser 73 serve also as front-side frame wall portions (71a) out of front-and-rear frame wall portions that form prefilter 5 guide grooves of the left-and-right both-side frame plates 71, 71 of the filter support member 7. As a result of this, the frame plate 73a, 73a portions form first filter guide grooves (filter movement spaces in the up-and-down direction) 12a that extend in the up-and-down direction against toothed belts 72c of the filter roll-up/back mechanisms 72, 72 working as main operative mechanisms of the filter cleaning unit 6 as described below.

[0039] Also, between the left-and-right both-side frame plates 73a, 73a are provided presser members 73c, 73c for slidably pressing the up-and-down extending frame members 51a, 51a of the prefilter 5 in correspondence to the above-described filter guide members 75a, 75a on the filter support member 7 side.

(4) Construction of the filter cleaning unit 6 for brushing the filter surface of the prefilter 5

[0040] On the other hand, the filter cleaning unit 6 is composed of: a left-and-right pair of filter roll-up/back mechanisms 72, 72 provided on both sides of the front portion of the heat exchanger 4 (front portion of the front-side heat exchanger section 4a); a contaminant etc. scrape-down brush 16 of a rotor structure provided in correspondence (facing) to a proximity to a prefilter roll-up start position of the filter roll-up/back mechanisms 72, 72; and a dust box 17. The filter roll-up/back mechanisms 72, 72 roll up the prefilter 5 from such an original setting state (develaped-and-extended state) as shown in Fig. 5 into such an annular state as shown in Fig. 6, and roll back the prefilter 5 from the state of Fig. 6 into the original developed-and-extended state of Fig. 5 again. The contaminant etc. scrape-down brush 16 scrapes down contaminants, dust and the like deposited on the mesh members 52, 52, ... of the prefilter 5 by brushing. The dust box 17 collects contaminants and the like scraped down by the contaminant etc. scrape-down brush 16.

[0041] The contaminant etc. scrape-down brush 16 and the dust box 17 are provided so as to stretch between left-and-right both ends of the heat exchanger 4.

[0042] The left-and-right pair of filter roll-up/back mechanisms 72, 72 are each composed of: a lower-side, larger-diameter driving-side first toothed pulley 72a; a driven-side second toothed pulley 72b which is provided so as to be upward spaced by a specified distance from the first toothed pulley 72a and which is smaller in diameter than the first toothed pulley 72a; and a toothed belt 72c stretched in an engaged state between these first and second toothed pulleys 72a, 72b. In these toothed belts 72c, for example as shown in Fig. 3, engaging holes (elongate holes) 13, 13, ... for insertion and engagement of the protruding members (engaging pins) 53, 53, ..., 53, 53, ... provided on the rear face side of the outer frames 51A, 51A located on left-and-right both sides of the prefilter 5 are provided so as to be spaced from one another with longitudinally corresponding equal intervals.

[0043] Each of the toothed belts 72c is rotationally driven (stepping driven) accurately in both forward and reverse directions by drive of the first toothed pulley 72a with a pulse motor M1 (M2) of Fig. 8 as an example. For example, when the toothed belt 72c is driven in the normal direction (rightward rotation), the prefilter 5 is set properly up to a final setting position (on the upper end side) that is required to develop and extend the prefilter 5 via the first and second guide grooves 12a, 12b. On the other hand, when the toothed belt 72c is driven in the reverse direction (leftward rotation), the prefilter 5 is generally entirely rolled up onto the outer peripheral surface of the toothed belt 72c from the developed-and-extended state of Fig. 5 as shown in the cleaning state of Fig. 6. This reverse driving is fulfilled by making use of guide actions exerted by: a first guide plate 14a and a second guide plate 14b which are located on a lower end side of the first guide groove 12a and which is provided along a pulley surface of the first toothed pulley 72a at a specified rotational angle width so as to keep a clearance against the toothed belt 72c necessary to allow the outer frames 51A, 51A of the prefilter 5 to pass therethrough; a third guide plate 14c which is provided longer in the rear-side up-and-down direction from the pulley surface along the toothed belt 72c in the pulley direction of the second toothed pulley 72b; and a fourth guide plate 15a (rotation pivotal shaft 15c) which is located on the second toothed pulley 72b to press the prefilter curved surface part rolled up by the part's own dead weight, and the like.

[0044] Then, in the rolling-up of the prefilter 5 from the state of Fig. 5 to the state of Fig. 6, contaminants, dust and the like deposited on the mesh member 52, 52, ... portions of the prefilter 5 are scraped down enough by the contaminant etc. scrape-down brush 16 provided under the first toothed pulley 72a (between the first guide plate 14a and the second guide plate 14b rearward from the first guide plate by a specified rotational angle) in a contact state therebetween (state of Fig. 6). This con-

taminant etc. scrape-down brush 16 is provided at a position within the dust box 17 in a coaxial direction. Scraped-down contaminants, dust and the like are collected into the dust box 17 without fail. The dust box 17, which is removably attached to the housing section 3a of the body casing 3, can be detached periodically (or every elapse of a specified operating time) for disposal of contaminants and dust as well as for cleaning of the brush part.

[0045] When the lower end side of the filter presser 73 is disengaged from the filter support member 7, and the lower end side is turned forward to a specified angle as shown in Fig. 4 as an example, the lower end 5b side of the prefilter 5 is released from the pressing state against the toothed belt 72c. Withdrawing the protruding members 53, 53, ... on the rear face side of the prefilter 5 from the engaging holes 13, 13, ... of the toothed belt 72c (protruding members 53, 53, ... are not shown in Fig. 4) allows the prefilter 5 to be removed from the filter support member 7 (see a direction of arrow 'a').

[0046] In this case, since the filter presser 73 is pivotally supported on the filter support member 7 via the latch mechanisms 76, 76, the filter presser 73 can be kept in such an open state at a desired angle as shown in Fig. 4. Thus, not only the removal of the prefilter 5 but also its reverse insertion-and-setting work are facilitated.

[0047] The setting of the prefilter 5 into the filter support member 7 is carried out in the following manner. For example, as shown by an arrow 'b' in Fig. 4, the upper end 5a side of the prefilter 5 is inserted from the lower-side first guide groove 12a toward the upper-end side second guide groove 12b. In this case, at a terminal-end-side upper portion of the fourth guide plate 15a, a filter guide 15b shaped into a circular-arc surface is further formed to guide the inserted prefilter 5 upward. Thereafter, protruding member 53, 53, ... portions of the rear surfaces of the prefilter 5 ranging from its intermediate portion side to lower end 5b side (rear surfaces of the outer frames 51A, 51A) are inserted into and engaged with the engaging holes 13, 13, ..., respectively, on the front side portions of the toothed belts 72c (72c, 72c) stretched between the first and second toothed pulleys 72a, 72b (left-and-right pair), as shown by imaginary line in Fig. 3 as an example. Then, in this engaging state, the filter presser 73 is closed into the original state. In this way, the setting-up process is carried out.

[0048] Thereafter, the front cover 3c is engaged with the front-side movable guide mechanism portion of the body casing 3, and a desired filter actuating switch is turned on. Then, the lower end 5b side of the prefilter 5 is once turned reverse to a specified extent so as to be rolled up to between the first and second guide plates 14a, 14b on the first toothed pulley 72a side, and thereafter turned forward so that the upper end 5a side is rolled out upward to a proper extent, coming to a stop at a proper setting position finally. An arrival at this setting position is detected by the filter detecting section LS implemented by a limit switch provided at a specified position on a terminal-end side of the filter movement paths, as well as when later-described 'cleaning operation' is stopped.

[0049] As a result, the prefilter 5 is set up into the original developed-and-extended state as shown in Fig. 5.

[0050] In addition, for example as shown in Fig. 2, the filter roll-up/back mechanisms 72, 72 composed of the first and second toothed pulleys 72a, 72b and the toothed belt 72c are provided by one left-and-right pair for each of the left-and-right pair of filter support members 7, 7 and the left-and-right pair of prefilters 5, 5 corresponding to the left-and-right pair of filter support members 7, 7, which are divided into left and right sides. Then, between the left-and-right respective pairs of first toothed pulleys 72a, 72a; 72a, 72a of the left-and-right respective pairs of filter roll-up/back mechanisms 72, 72; 72, 72, elastic rolls 77, 77 for backup use being generally equal in diameter to the first toothed pulleys 72a, 72a; 72a, 72a are provided in a mutually coaxial continuing state.

[0051] Also in this embodiment, for example as shown in Figs. 2 and 8, in a lower portion under an upper-end-side specified width portion, which is extending back-and-forth between the frame plates 71, 71 of the filter support member 7, a seal plate 20 for sealing of the heat-exchanger-section top face is provided integrally over a range from the upper end side to near the front-side corner portion, the seal plate 20 having a V-shaped cross section (side face) corresponding to the configuration of a V-shaped-in-cross-section air passage section (trough section) 4c provided at the bent portion of the lambda-type heat exchanger 4. As a result of this, together with the fitting of the filter support member 7 to the body casing 3, sealing of the V-shaped air passage section (trough section) 4c at the bent portion of the lambda-type heat exchanger 4 is fulfilled by the seal plate 20 (seal portion 20a, support frame portion 20b, fitting-and-integrating portion 20c).

(5) Construction of control circuit section

[0052] In the housing section 3a of the body casing 3, for example as shown in Fig. 2, an electrical box 18 is placed so as to be positioned beside the heat exchanger 4. Various types of control sections as shown in Fig. 9, typified by a microcomputer control unit, are included in the electrical box 18.

[0053] The control sections can be divided roughly into an indoor unit control section 80 and an outdoor unit control section 83 connected to each other. The indoor unit control section 80 is additionally provided with an air-conditioning mechanism control section 81 and a cleaning-mechanism control section 82, and the outdoor unit control section 83 is additionally provided with a humidification-and-ventilation control section 84.

[0054] The air-conditioning mechanism control section 81 is composed of a front panel driving section 81a, a horizontal flap driving section 82a, a vertical flap driving section 81c, and a fan driving section 81d. Also, the cleaning-mechanism control section 82 is composed of

a rotary brush driving section 82a, a filter driving section 82b, a filter detecting section 82c, and a dust box detecting section 82d.

[0055] The indoor unit control section 80 includes an air-conditioner operation control section 80a, a cleaning-mechanism deciding section 80b, a cleaning-mechanism control section 80c, a cleaning-mechanism initialization processing section 80d, a filter-cleaning-timing deciding section 80e, and the like. With this arrangement, the indoor unit control section 80 performs control over the air-conditioning mechanism control section 81 and the cleaning-mechanism control section 82 as well as the outdoor unit control section 83 and the like.

[0056] The indoor unit control section 80 is further provided with a main unit-side operation switch 85, a display section 86, a light receiving section 87b of a remote control 87a, and the like.

[0057] The filter detecting section 82c of the cleaning-mechanism control section 82 is implemented, for example, by a filter detecting section LS which is a limit switch, for example, as described below. With this arrangement, it is properly detected and decided whether a setting state of the prefilter 5 by user is proper or not as well as whether the filter setting state in the filter rolling-back by the filter roll-up/back mechanisms 72, 72 is proper or not.

(6) Cleaning operation control

[0058] In the air conditioner A of this embodiment constructed as described above, rotation drive for the filter roll-up/back mechanisms 72, 72 and the contaminant etc. scrape-down brush 16 is started in the developed-and-extended state of the prefilter 5 (normal position corresponding to the state of Fig. 5), for example, as shown in Fig. 10(a). Then, as shown in Fig. 10(b), the prefilter 5 goes rolled up onto the toothed belts 72c, 72c of the filter roll-up/back mechanisms 72, 72, where the cleaning of the prefilter 5 is started. In addition, in the following description of 'cleaning operation control,' movement of the prefilter 5 in the roll-up direction is defined as outward movement and its movement in the roll-back direction reverse thereto is defined as homeward movement.

[0059] Finally, the cleaning of the prefilter 5 is ended in the state that the entirety of the prefilter 5 (entirety from lower end 5b side to upper end 5a side) has been rolled up (at a maximum movement position P_4 in the outward movement direction of the prefilter 5), as shown in Fig. 10(c). Subsequent movement of the prefilter 5 toward the developing-and-extending direction shown in Fig. 10 (a) is of the homeward movement.

[0060] The filter detecting section LS, which is a limit switch as described above, is provided at a specified position on a terminal-end (upper end) side of the prefilter movement paths 12a, 12b. Therefore, when the upper end 5a of the prefilter 5 is detected by the filter detecting section LS, it is discriminated that the prefilter 5 has returned to the original position (zero point position), from the state of Fig. 10(c) to the state of Fig. 10(a). At this point, driving of the filter roll-up/back mechanisms 72, 72 and the contaminant etc. scrape-down brush 16 is stopped.

(7) Problem in the setting of the prefilter 5 to the filter roll-up/back mechanisms 72, 72 and the toothed belts 72c, 72c

[0061] In the case where the prefilter 5 is driven by using the filter roll-up/back mechanisms 72, 72 as described above, some extent of structural margin (dimensional margin) in the fitted state of the prefilter 5 needs to be provided during the work of filter fitting to the toothed belts 72c, 72c of the filter roll-up/back mechanisms 72, 72 (first-time fitting after the filter is once removed; see Fig. 3) in view of easiness in filter fitting work, differences in driving accuracy as driving means, and the like. For example, in a case where the engaging holes 13, 13, ...; 13, 13, ... on the toothed belt 72c, 72c side are formed into elongate holes to facilitate the engagement between the protruding members 53, 53, ... of the prefilter 5 and the toothed belts 72c, 72c as shown in Fig. 3, it may be required to ensure a degree of roughness of engagement portions between the protruding members 53, 53, ...; 53, 53, ... on the prefilter 5 side and the engaging holes 13, 13, ... of the toothed belts 72c, 72c. In such a case, the filter fitting position by the user inevitably incurs a specified amount of deviation (a deviation amount from a designed structural contact destination position) in the filter movement path direction. In an extreme case, in Fig. 3, there arises a difference between a proper engagement starting with the lowermost-end belt side engaging holes 13, 13 and another engagement starting with one-step upper engaging holes 13, 13 as illustrated in the figure.

[0062] Therefore, given that the filter detecting section (limit switch) LS is provided in correspondence to a normal proper arrival position (structural contact position) P_0 shown in Fig. 11(a) as conventional, there may be a case where the filter detecting section (limit switch) LS mis-detects a fitting state of the prefilter 5 due to the way of fitting by user.

[0063] As a result of this, with the construction of a filter cleaning unit of the conventional filter-driving method as described before, it would be required to execute the filter detection control logic for detecting the presence or absence of the filter necessarily after filter fitting and additionally execute the filter cleaning control with the filter cleaning unit driven, which would cause a problem that an extra time should be taken until an actual start of the cleaning.

[0064] Thus, in this embodiment, with a view of solving such a problem, for example as shown in Fig. 11(a), (b) and Fig. 12, in correspondence to a deviation amount of the filter fitting position that can structurally occur due to the way of fitting by user as described above, the filter detecting section LS is provided at a position corrected to an extent of the deviation amount in a direction from a terminal end of the filter movement paths shown by the

first and second guide grooves 12a, 12b toward the inside of the filter movement paths (filter fitting position of Fig. 2). That is, the filter detecting section LS is provided at a position shifted (offset) by the deviation amount from the structural filter contact position (normal arrival position, i.e., zero point position) P_0 in a deviation-canceling direction. As a result, the deviation amount caused by the way of fitting of the prefilter 5 by user is canceled out, so that the prefilter 5 can securely be detected in the fitting of the prefilter 5. In Fig. 2, a filter-position correction amount 'a' denotes an offset amount from the structural filter contact position. Also, a limit-switch confirmation move amount 'b' denotes a move amount which causes the limit switch for the normal position to securely turn from 'set' to 'non-set.' A filter additional feed amount 'c' denotes a maximum move amount correction for homeward movement.

[0065] Accordingly, with this arrangement, misdetections of the prefilter setting state due to the way of prefilter fitting by user as would be involved in the prior art are eliminated, so that the filter detection logic after the prefilter fitting can be simplified.

[0066] Thus, since the filter detection logic can be simplified as shown above, the time taken until the cleaning start is shortened.

[0067] In addition, the positional deviation in the filter setting is corrected by zero point correction in terms of control, for example, by such zero point correction control as shown by the time chart of Fig. 13, thereby it becomes possible to set to a correct normal position (zero point position) P_0. Besides, any fault of the filter detecting section LS is also detected at the same time by the same zero point correction operation.

[0068] Accordingly, by this control, the prefilter 5 is moved not from the normal position (zero point position) P_0 shown in Fig. 10(a), but from a position P_1 immediately after an actual setting toward the outward movement direction (maximum position P_4 direction) shown in Fig. 10 (b) beyond a placement position (detection position) P_2 of the prefilter 5 by a distance 'b' that allows a non-setting of the prefilter 5 to be perfectly detected, where the prefilter 5 is stopped (non-setting stop position P_3).

[0069] In this case, if the filter detecting section LS is not in the non-setting detection operation (no detection signal), it can be assumed that the filter detecting section LS is faulty or that the prefilter 5 is involved in a movement obstacle. Hence, it is decided that there has occurred a filter abnormality.

[0070] Further, the prefilter 5 is reversed to the homeward movement direction and moved to the zero point position P_0, during which given a change of detection by the filter detecting section LS from a 'non-set' state to a 'set' state, the prefilter 5 is further operated by a number of pulses corresponding to the above-mentioned filter offset distance 'a' and then stopped. Thus, if the prefilter 5 is other than the 'set' state even after being moved along the homeward movement path by the non-setting confirmation move amount 'b,' then it is decided that there has occurred a filter abnormality due to a movement obstacle of the prefilter 5 or a fault of the filter detecting section LS.

[0071] In addition, reference sign FT (time) in Fig. 13 denotes a two-phase excitation time for securely stopping or reversing a stepping motor M_1 (M_2).

[0072] Fig. 14 is a time chart of the outward movement drive (filter cleaning) for movement from the state of Fig. 10(a), in which the upper end of the prefilter 5 is at the normal position (zero point position) P_0, to the maximum movement position P_4 of Fig. 10(b). Conversely, Fig. 15 is a time chart of the homeward movement drive for returning the above-described prefilter 5 from the maximum movement position P_4 of Fig. 10(b) to the zero point return position P_0 of Fig. 10(a). If driving the prefilter 5 by the distance 'b' in Fig. 14 does not cause a turn to the 'non-set' state of the prefilter 5 or if driving the prefilter 5 by a distance 'a + c + d' in Fig. 15 does not cause a detection of the prefilter 5 by the filter detecting section LS, then an abnormality of the prefilter 5 is detected in each case. Also, if separately provided detection means of the detecting section 82d for the dust box 17 detects a filter 'non-set' state on the way of movement in each of Figs. 14 and 15, then an abnormality of the dust box 17 is detected. Thus, abnormality detection is enabled.

[0073] As described above, with the construction of this embodiment, the moving state of the prefilter 5 during its movement by the filter roll-up/back mechanisms 72, 72 is also detected by the filter detecting section LS.

[0074] With such an arrangement, it also becomes possible to accurately detect the moving state of the prefilter 5 itself by the filter detecting section LS.

[0075] In such a case, with that arrangement, during the movement of the prefilter 5 by the filter roll-up/back mechanisms 72, 72, permission for the movement of the prefilter 5 is decided depending on the presence or absence of a filter detection signal by the filter detecting section LS until the prefilter 5 arrives at the placement position of the filter detecting section LS, and the permission is decided depending on the detection of a drive amount of the filter roll-up/back mechanisms 72, 72 (number of drive pulses by the stepping motor M_1 (M_2)) after the filter detection at the placement position of the filter detecting section LS.

[0076] With such an arrangement, misdetections of the filter setting due to the way of filter fitting by user are eliminated as described above, so that the detection logic after the filter fitting can be simplified and moreover the time until the cleaning start can be shortened. Furthermore, since filter detection until arrival at the detection position by the filter detecting section LS and filter detection during movement after that are fulfilled by two different means, respectively, it becomes possible to accurately and securely detect abnormalities of the prefilter 5 including faults of the filter detecting section and filter movement obstacles.

[0077] Furthermore, in this embodiment, as shown above, it may also be arranged that in checking of filter setting upon a start of filter cleaning operation by the filter

cleaning unit 6, after the fitting of the prefilter 5, only the abnormality detection of the filter detecting section LS and the zero point correction control are performed if a filter detection signal by the filter detecting section LS is present, while detection of presence or absence of filter setting in addition to the abnormality detection of the filter detecting section LS and the zero point correction control are performed if no filter fitting detection signal by the filter detecting section LS is present.

[0078] With such an arrangement, even if no fitting signal of the prefilter 5 by the filter detecting section LS is present, it becomes possible to detect the presence or absence of filter setting in addition to the abnormality detection of the filter detecting section LS and the zero point correction control.

Claims

1. An air conditioner with a filter cleaning unit, comprising:

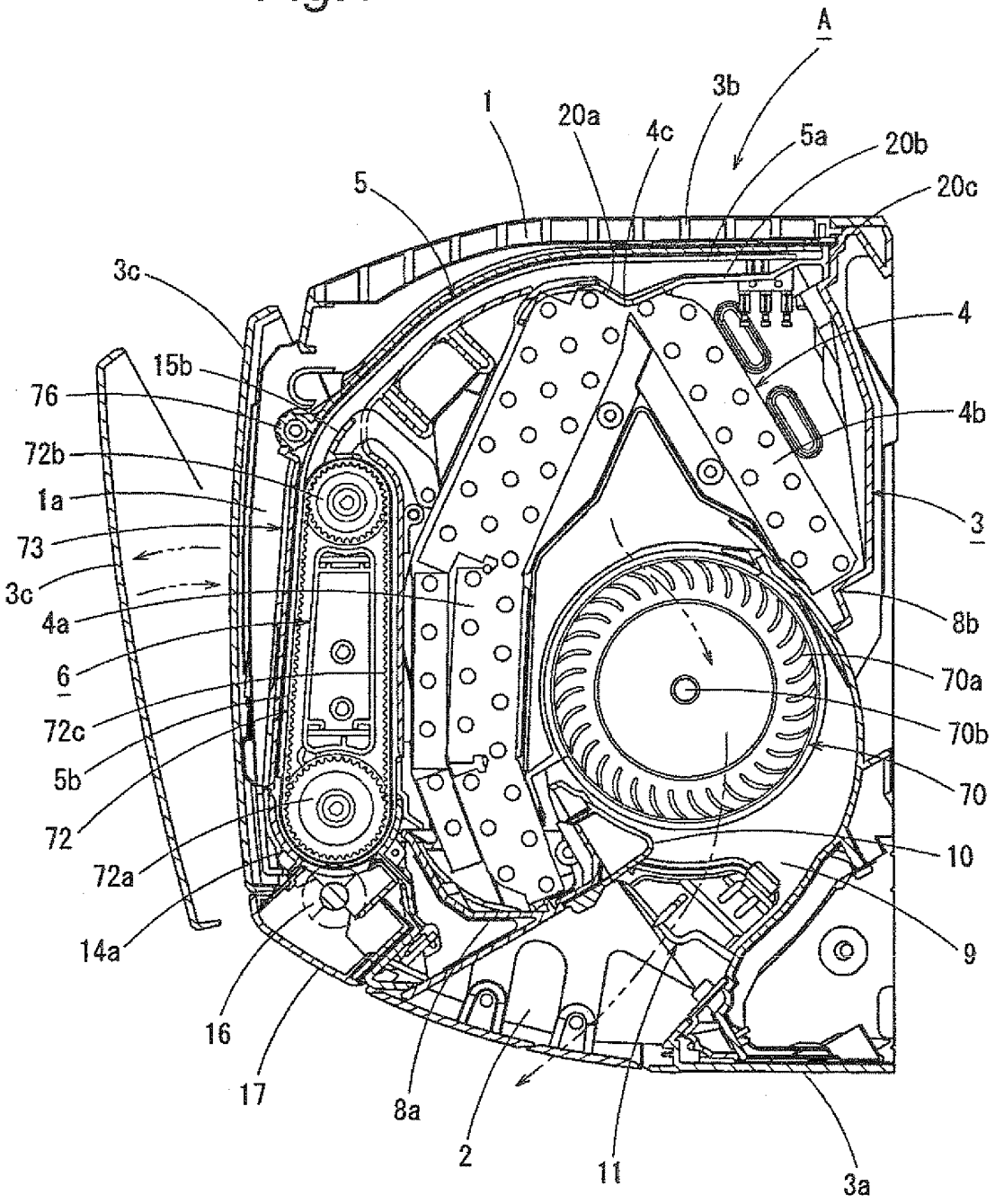
a body casing (3) having an air intake port (1) and an air blow-off port (2);
a heat exchanger (4) provided in mid-course of an air passage ranging from the air intake port (1) to the air blow-off port (2) in the body casing (3);
a filter (5) placed in correspondence to a primary side of air intake surfaces of the heat exchanger (4);
a filter driving section (72) to which the filter (5) is fitted and which moves the filter (5) through filter movement paths (12a, 12b) extending along the air intake surfaces of the heat exchanger (4);
a filter detecting section (LS) provided at a specified position on a terminal-end side of the filter movement paths (12a, 12b);
a filter cleaning unit (6) for performing cleaning of a filter surface of the filter (5) in mid-course of the filter movement paths (12a, 12b); and
a fan (70) provided on a position of a secondary side of the heat exchanger (4), wherein
in correspondence to a deviation amount of a fitting position of the filter (5) that can occur due to a way of fitting of the filter (5) to the filter driving section (72), the filter detecting section (LS) is provided at a position which is corrected to an extent of the deviation amount in a direction from a terminal end (P_0) of the filter movement paths (12a, 12b) toward inside of the filter movement paths.

2. The air conditioner with a filter cleaning unit as claimed in Claim 1, wherein a moving state of the filter (5) during its movement by the filter driving section (72) is also detected by the filter detecting section (LS).

3. The air conditioner with a filter cleaning unit as claimed in Claim 1 or 2, wherein in the movement of the filter (5) by the filter driving section (72), permission for the movement of the filter (5) is decided depending on presence or absence of a filter detection signal by the filter detecting section (LS) until the filter (5) arrives at a position where the filter detecting section (LS) is placed, and the permission is decided depending on a drive amount of the filter driving section (72) after the filter detection at the placement position of the filter detecting section (LS).

4. The air conditioner with a filter cleaning unit as claimed in Claim 1, 2 or 3, wherein in checking of filter setting state of the filter (5) upon a start of filter cleaning operation by the filter cleaning unit (6), after the fitting of the filter (5), only abnormality detection of the filter detecting section (LS) and zero point correction control are performed if a filter detection signal by the filter detecting section (LS) is present, while detection of presence or absence of filter setting in addition to the abnormality detection of the filter detecting section (LS) and the zero point correction control are performed if no filter fitting detection signal of the filter by the filter detecting section (LS) is present.

Fig.1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1
20a
4c
3b
5a
20b
20c
5
3c
15b
76
72b
1a
73
3c
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6
72c
5b
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72a
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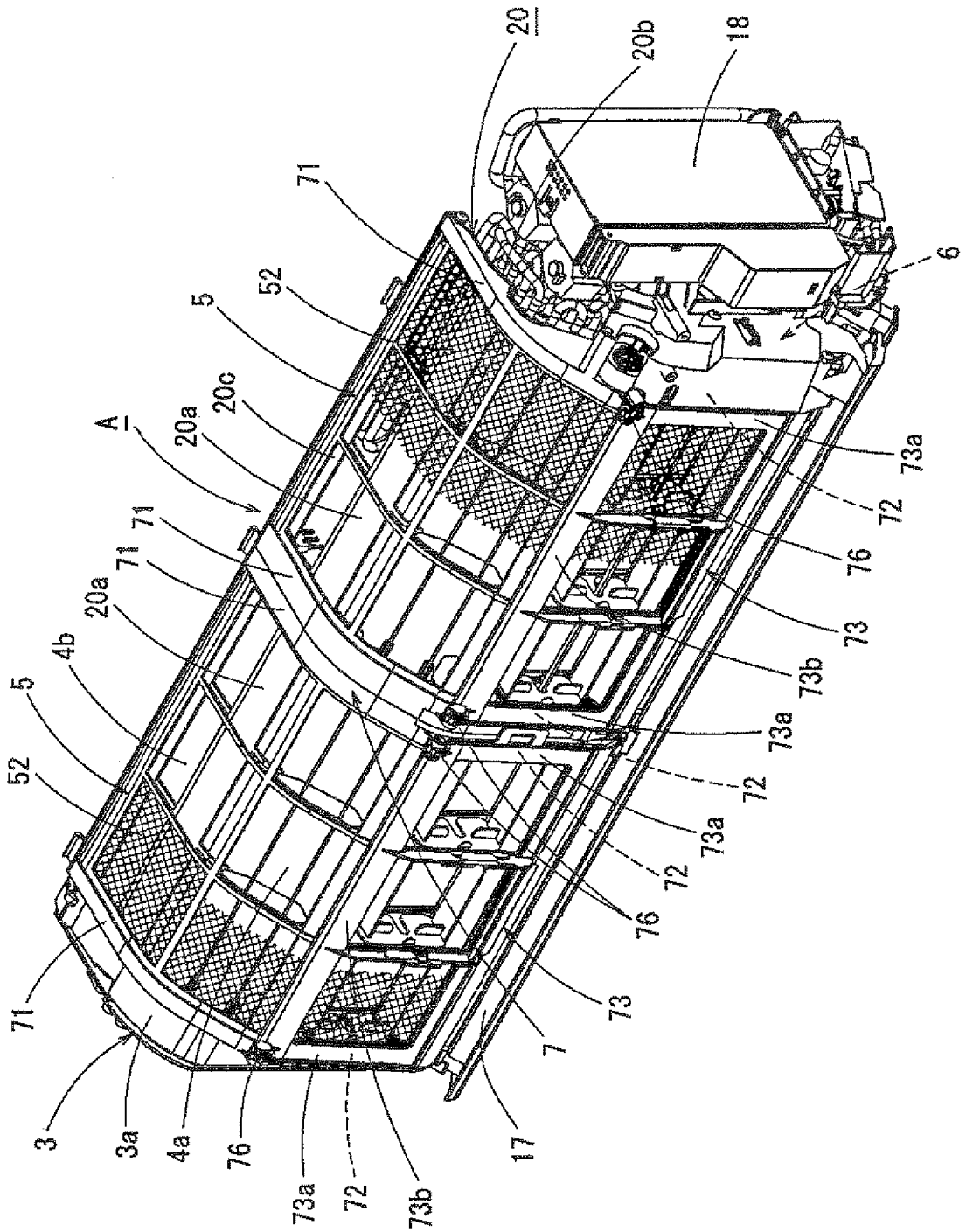
4b
3
8b
70a
70b
70
10
9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20b
18
71
6
52
5
20c
A
20a
73a
72
71
76
71
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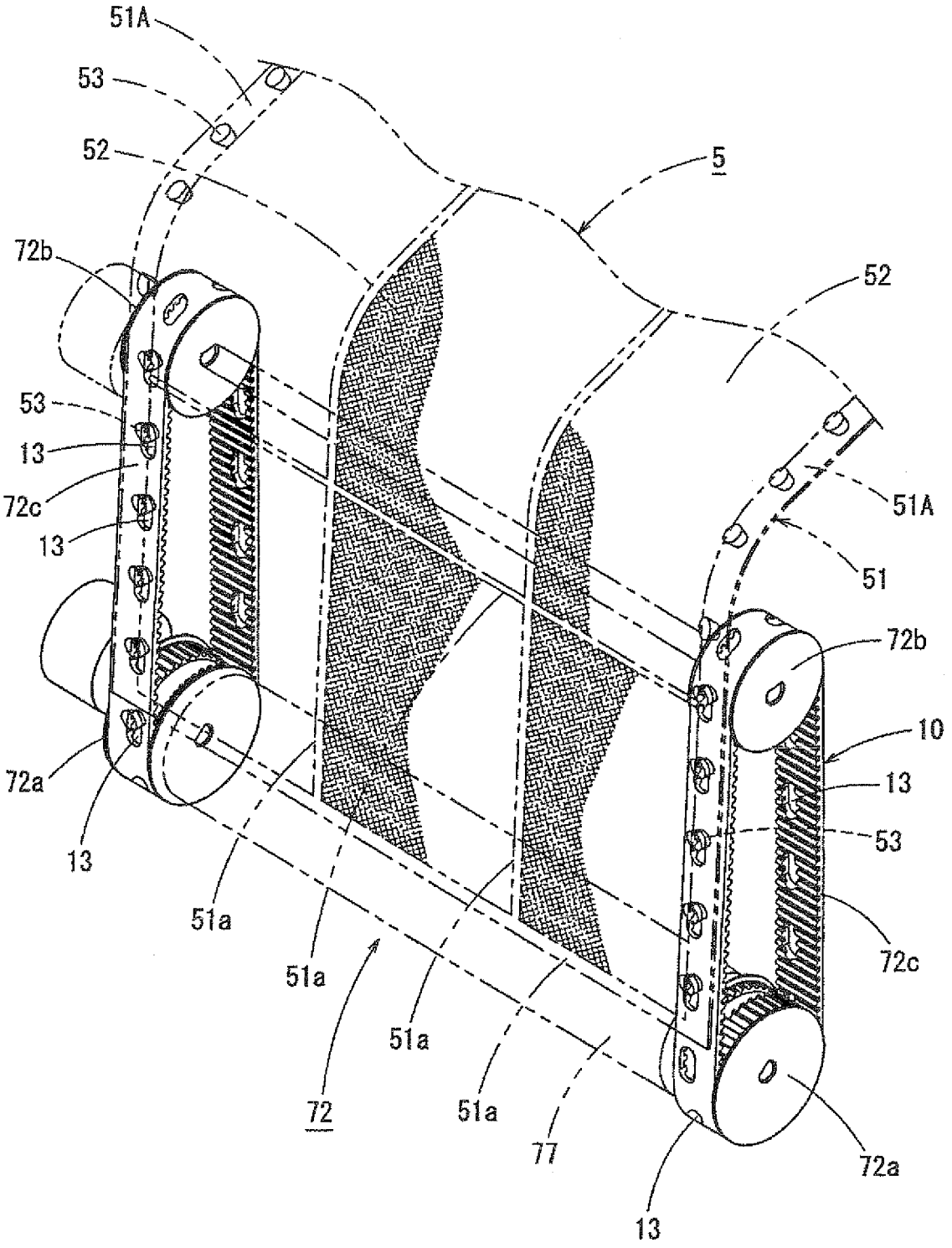
20a
73b
4b
5
73a
52
72
73a
72
76
71
73
7
3
3a
4a
76
73a
72
73b
17

Fig. 2

Fig.3


51A
53
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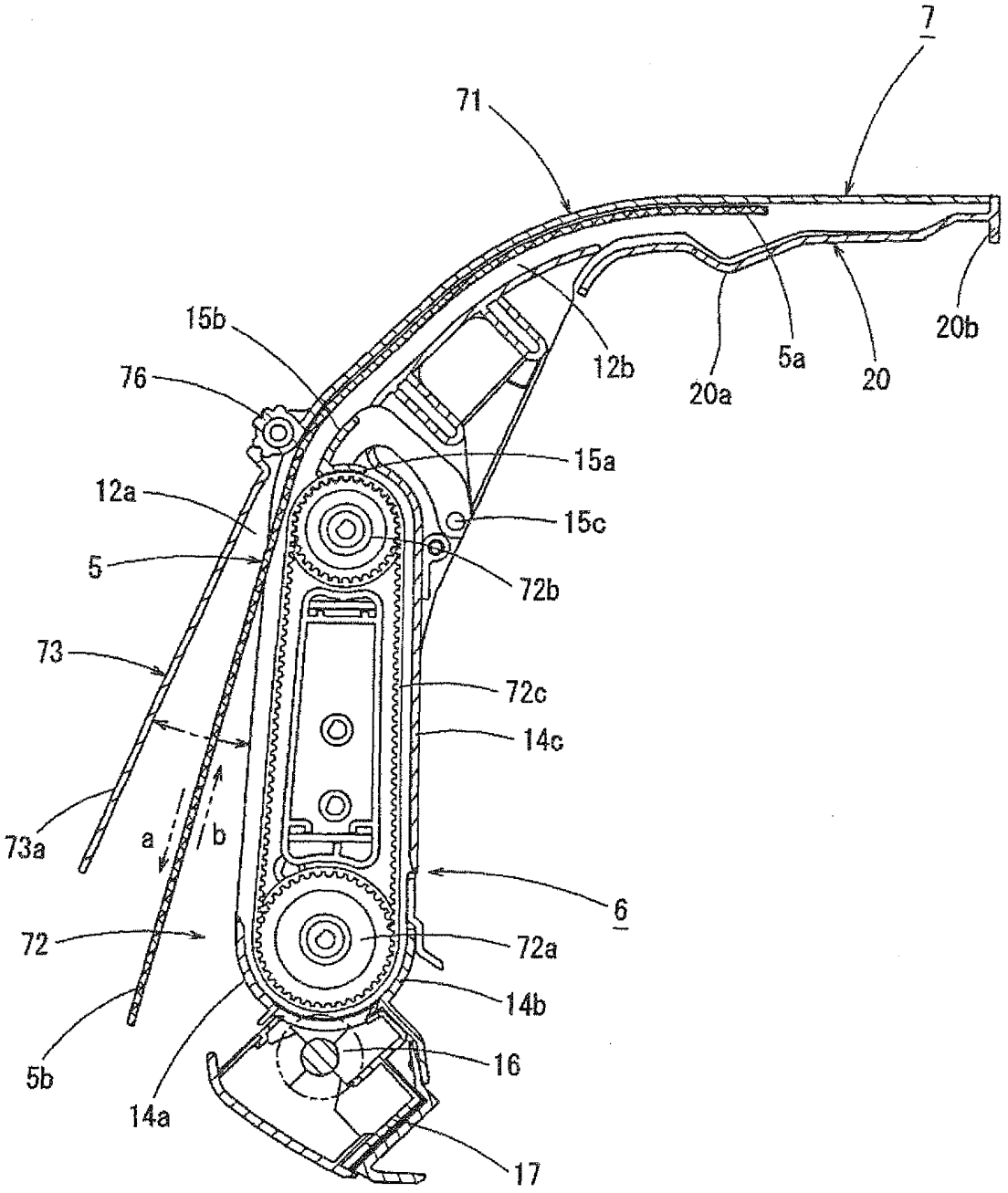
5
72b
52
53
13
72c
13
51A
51
72b
10
72a
13
53
13
51a
72c
51a
51a
72
51a
77
72a
13

Fig.4


7
71
20b
5a
20
20a
12b
15b
76
15a
12a
15c
5
72b
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72c
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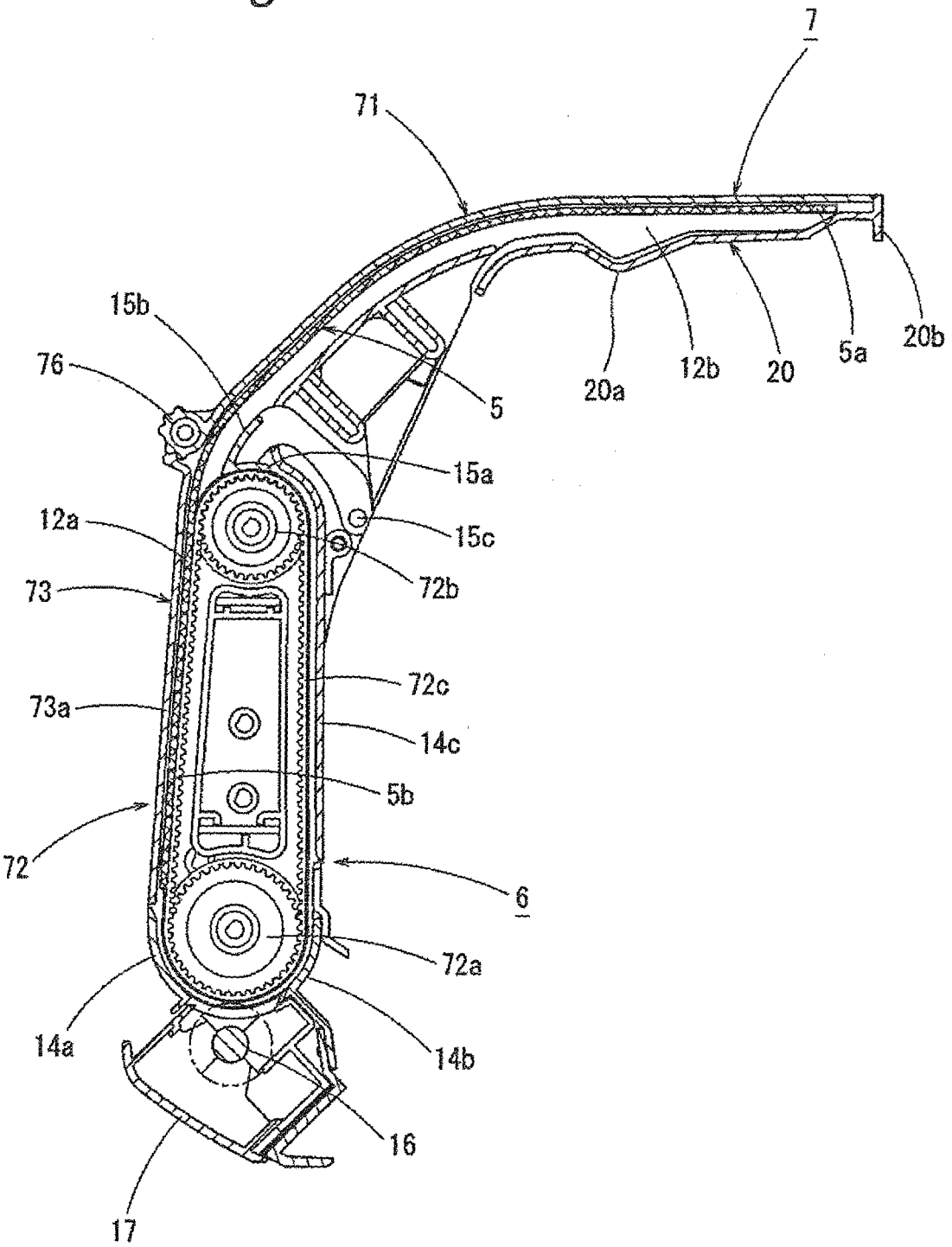
72
72a
14b
5b
16
14a
17

Fig.5


7
71
15b
76
5
20a
12b
20
5a
20b
15a
12a
15c
72b
73
72c
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5b
72
6
72a
14a
14b
16
17

Fig.6

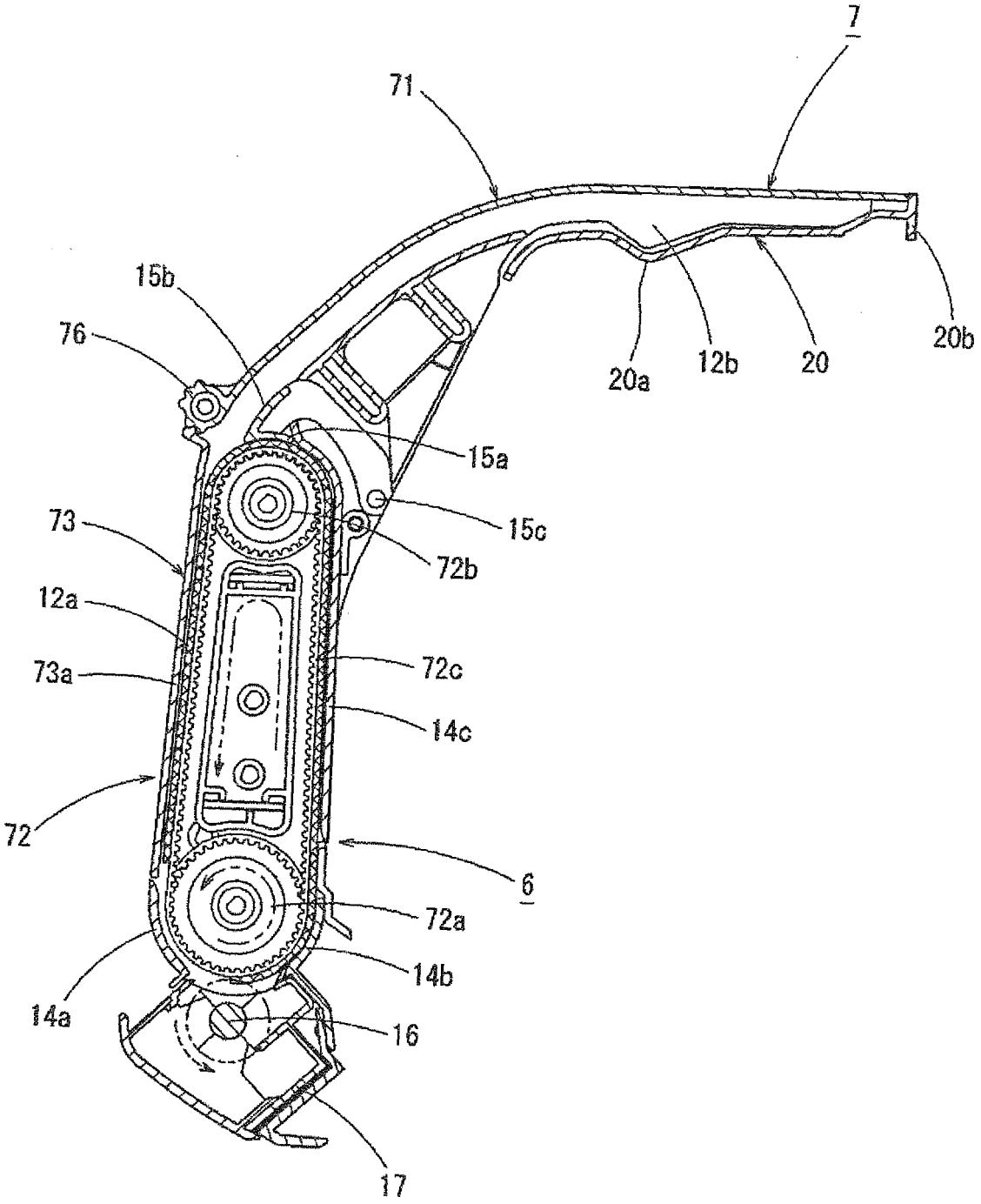

7
71
15b
76
20a
12b
20
20b
15a
15c
73
72b
12a
73a
72c
14c
72
6
72a
14b
14a
16
17

Fig. 7

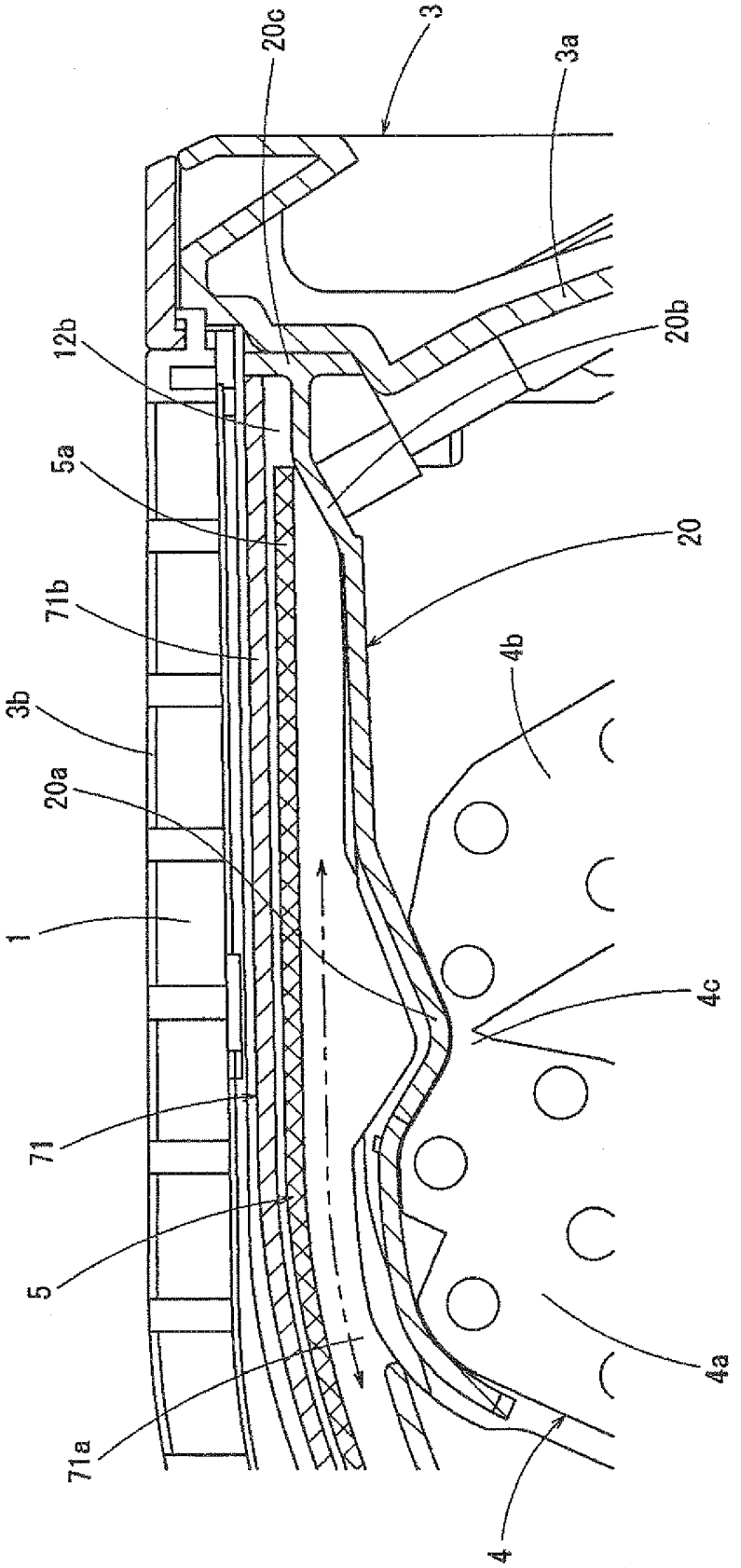
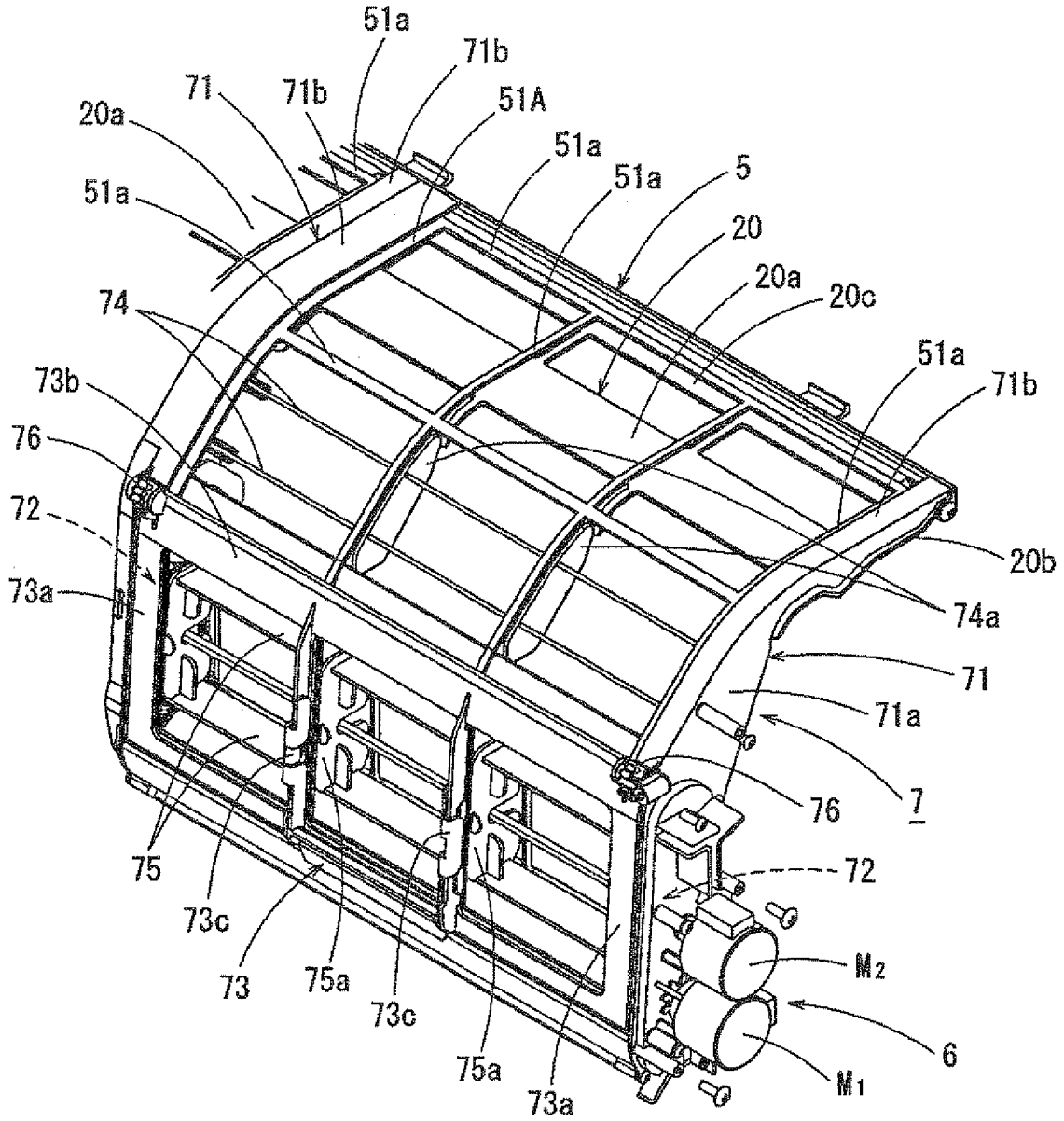


Fig.8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71b
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51a
5
20
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20c
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76
72
20b
73a
74a
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73c
M2
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75a
73c
6
75a
M1
73a

Fig.9

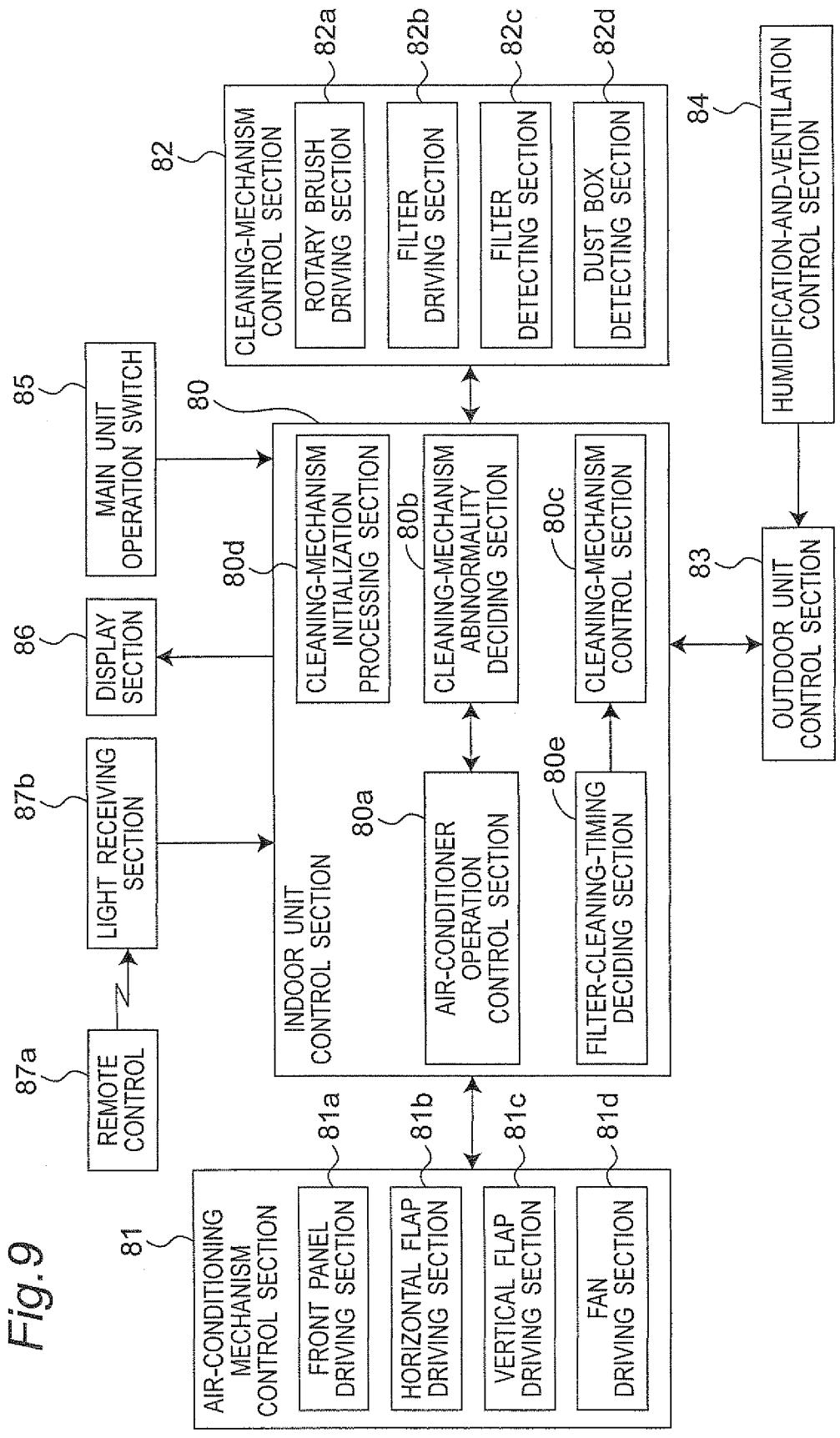

81
AIR-CONDITIONING MECHANISM CONTROL SECTION
81a
FRONT PANEL DRIVING SECTION
81b
HORIZONTAL FLAP DRIVING SECTION
81c
VERTICAL FLAP DRIVING SECTION
81d
FAN DRIVING SECTION
87a
REMOTE CONTROL
87b
LIGHT RECEIVING SECTION
80
INDOOR UNIT CONTROL SECTION
80a
AIR-CONDITIONER OPERATION CONTROL SECTION
80b
CLEANING-MECHANISM ABNORMALITY DECIDING SECTION
80c
CLEANING-MECHANISM CONTROL SECTION
80d
CLEANING-MECHANISM INITIALIZATION PROCESSING SECTION
80e
FILTER-CLEANING-TIMING DECIDING SECTION
82
CLEANING-MECHANISM CONTROL SECTION
82a
ROTARY BRUSH DRIVING SECTION
82b
FILTER DRIVING SECTION
82c
FILTER DETECTING SECTION
82d
DUST BOX DETECTING SECTION
83
OUTDOOR UNIT CONTROL SECTION
84
HUMIDIFICATION-AND-VENTILATION CONTROL SECTION
85
MAIN UNIT OPERATION SWITCH
86
DISPLAY SECTION

Fig.10

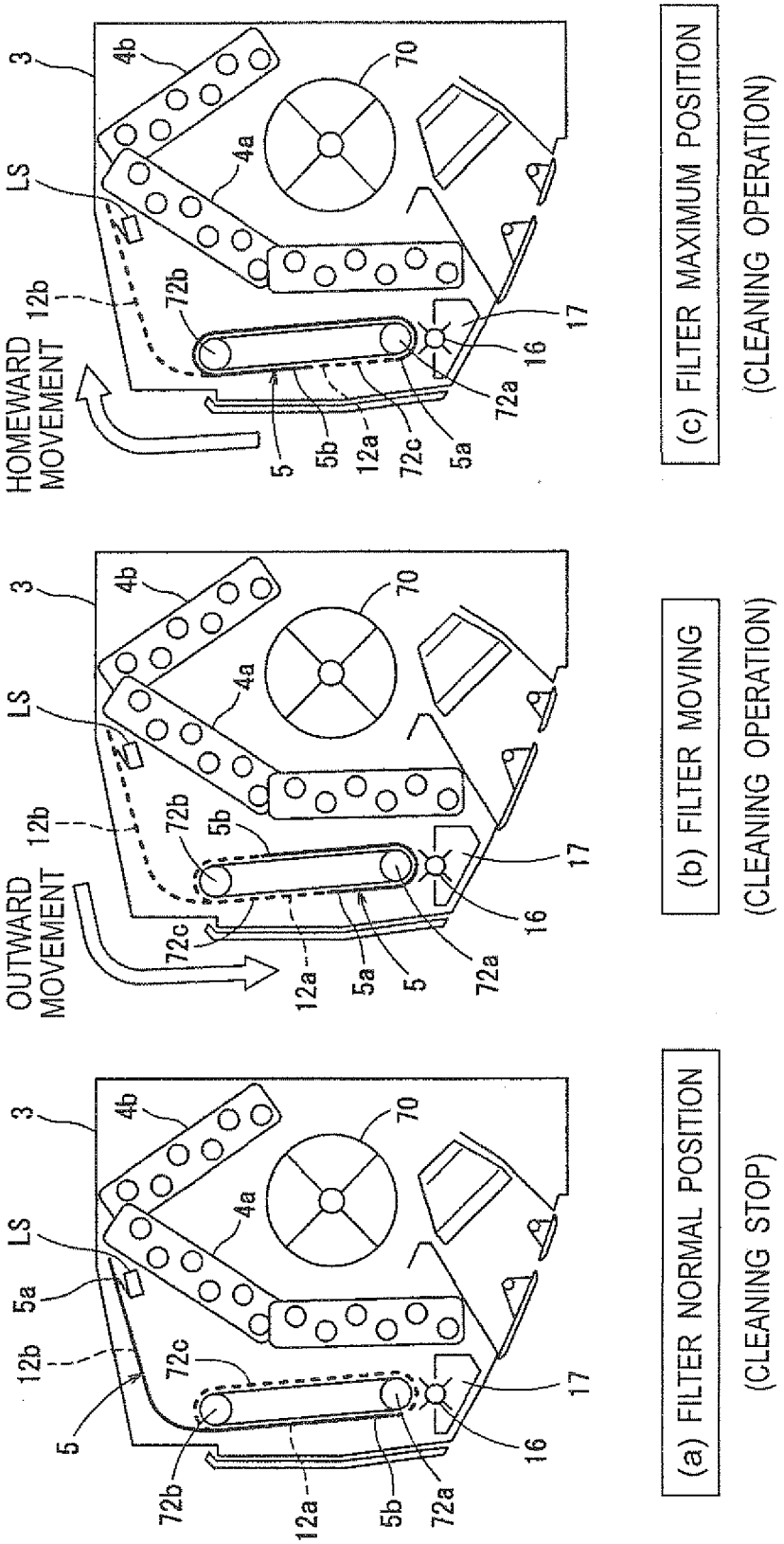

3
4b
70
4a
LS
5a
12b
72c
5
72b
12a
5b
72a
16
17
(a) FILTER NORMAL POSITION
(CLEANING STOP)
OUTWARD MOVEMENT
(b) FILTER MOVING
(CLEANING OPERATION)
HOMEWARD MOVEMENT
(c) FILTER MAXIMUM POSITION
(CLEANING OPERATION)

Fig.11

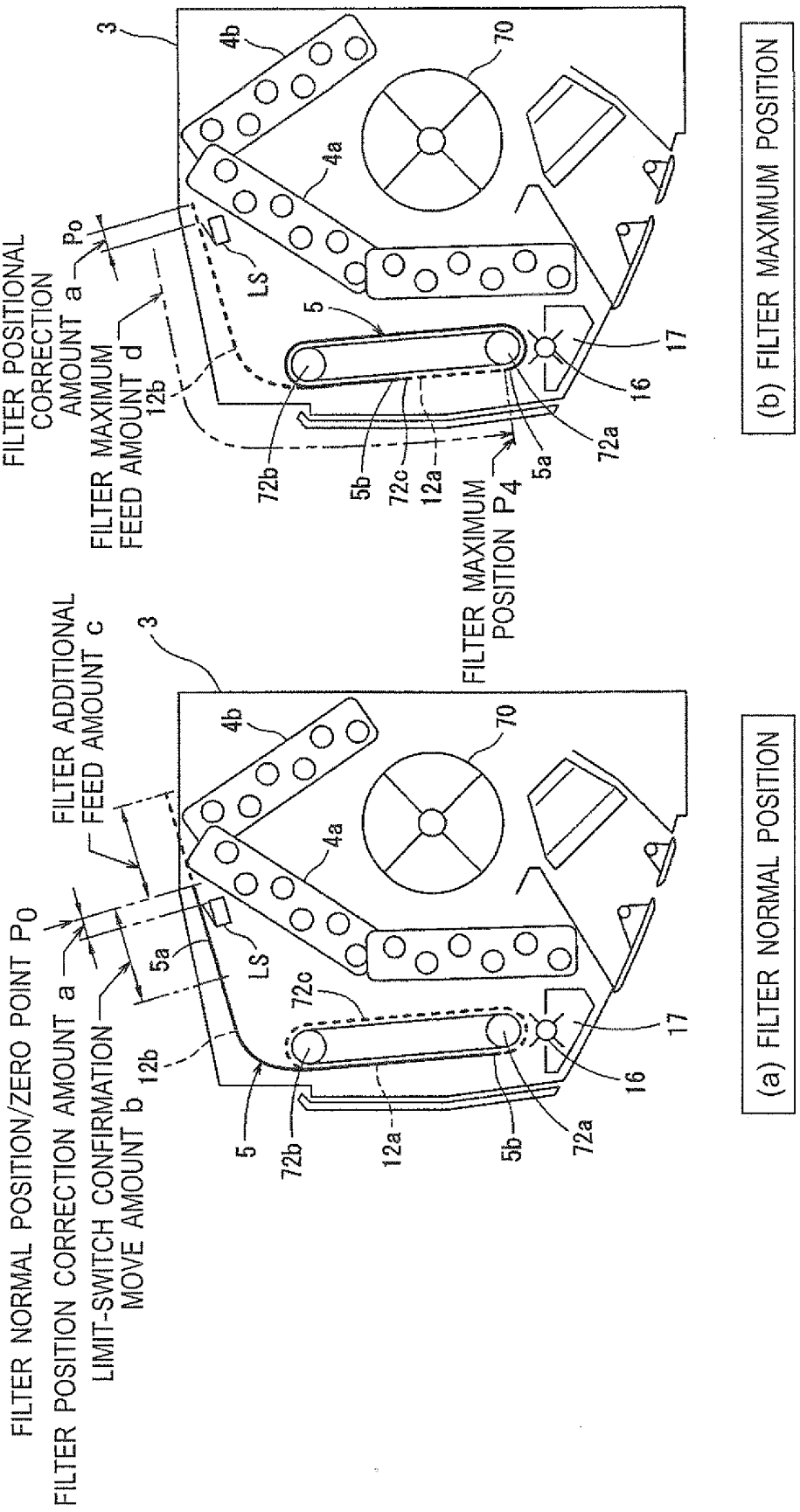

FILTER NORMAL POSITION/ZERO POINT P0
FILTER POSITION CORRECTION AMOUNT a
LIMIT-SWITCH CONFIRMATION MOVE AMOUNT b
FILTER ADDITIONAL FEED AMOUNT c
FILTER POSITIONAL CORRECTION AMOUNT a
FILTER MAXIMUM FEED AMOUNT d
FILTER MAXIMUM POSITION P4
3
4b
4a
70
LS
5
5a
12b
72c
72b
12a
5b
72a
16
17
(a) FILTER NORMAL POSITION
(b) FILTER MAXIMUM POSITION

Fig.12

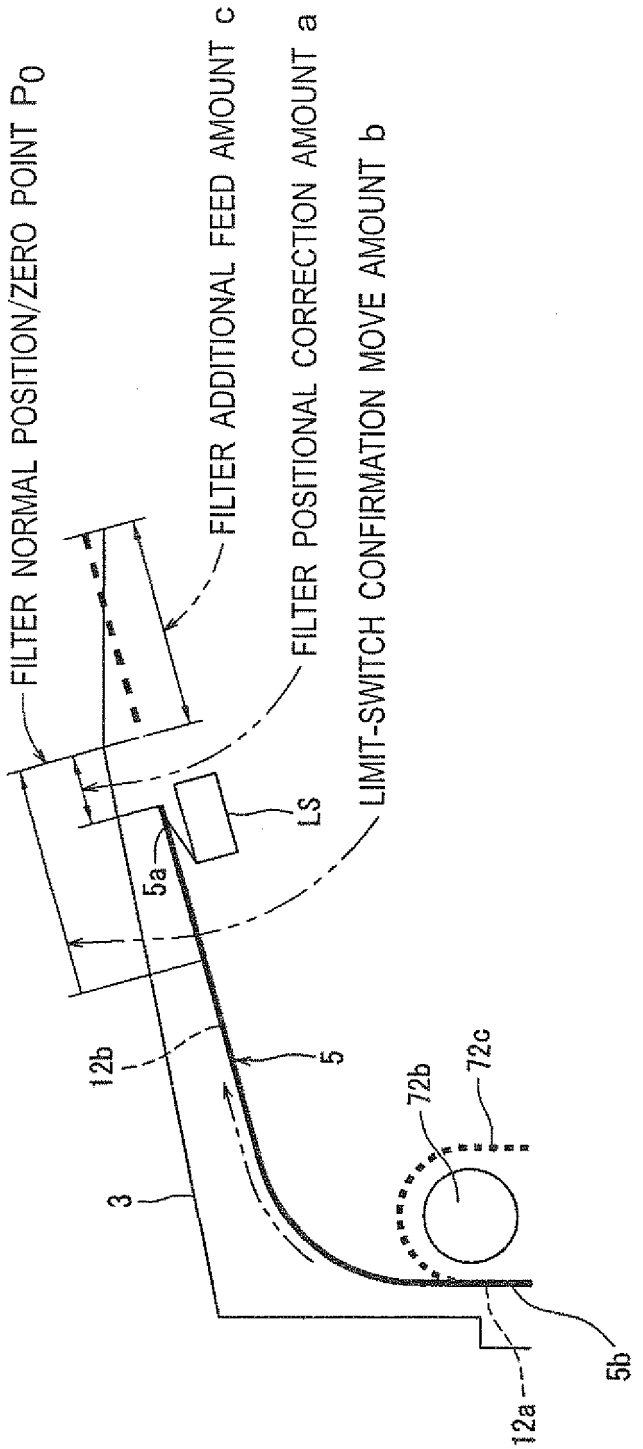

FILTER NORMAL POSITION/ZERO POINT P0
FILTER ADDITIONAL FEED AMOUNT c
FILTER POSITIONAL CORRECTION AMOUNT a
LIMIT-SWITCH CONFIRMATION MOVE AMOUNT b
LS
5a
12b
5
3
72b
72c
5b
12a

Fig.13

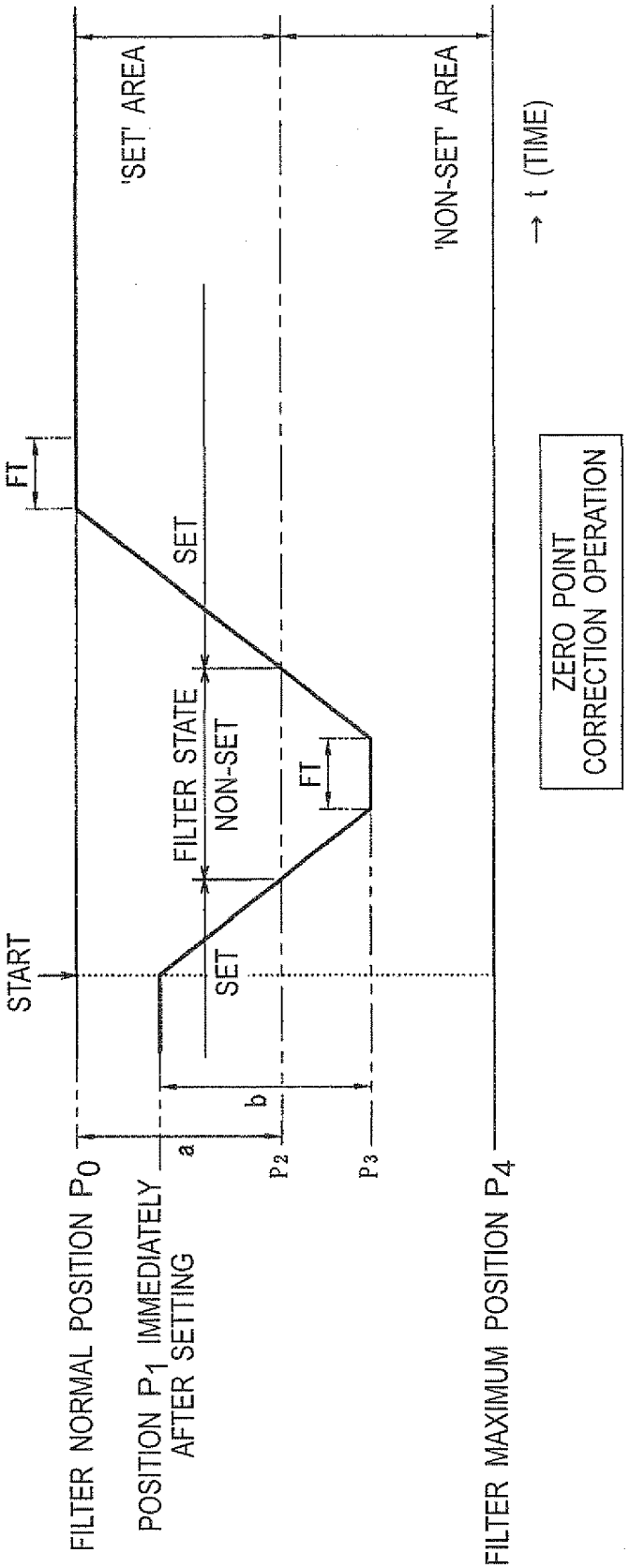

FILTER NORMAL POSITION P0
POSITION P1 IMMEDIATELY AFTER SETTING
FILTER MAXIMUM POSITION P4
START
FT
SET
FILTER STATE
NON-SET
SET
FT
a
b
P2
P3
'SET' AREA
'NON-SET' AREA
→ t (TIME)
ZERO POINT CORRECTION OPERATION

Fig.14

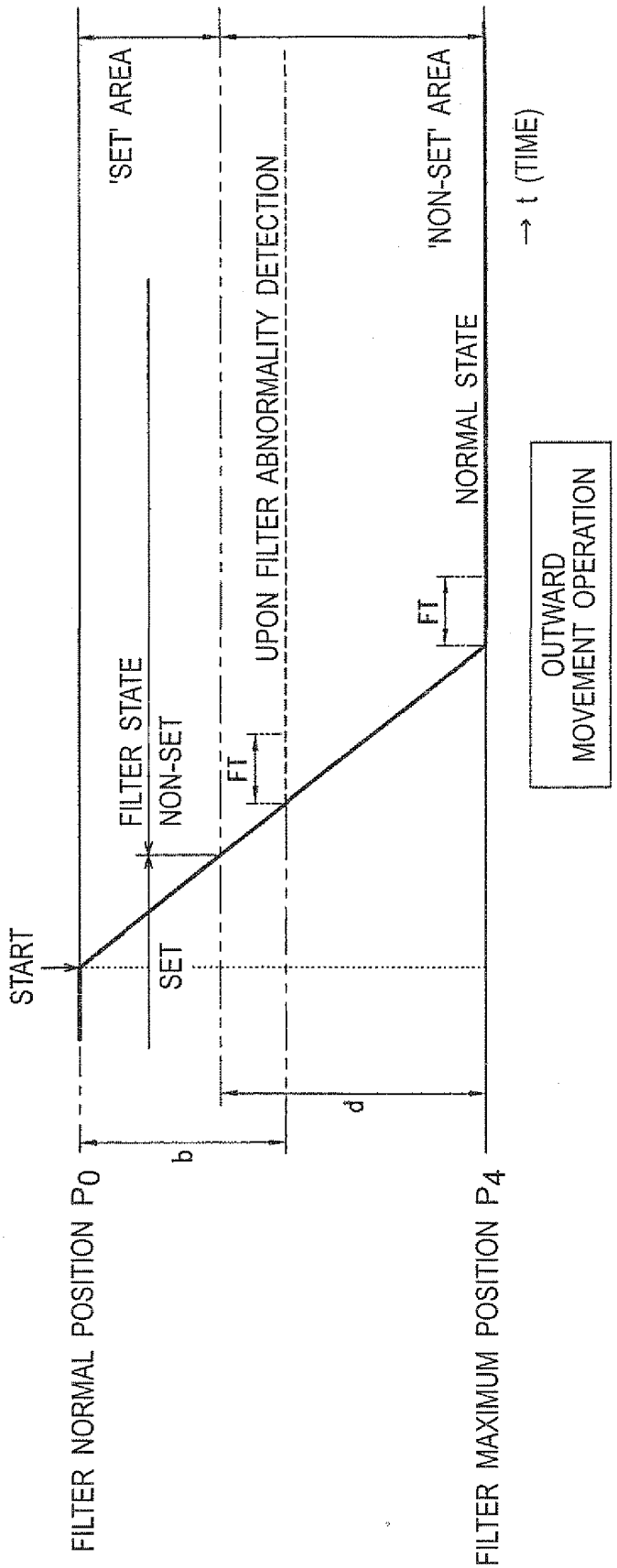
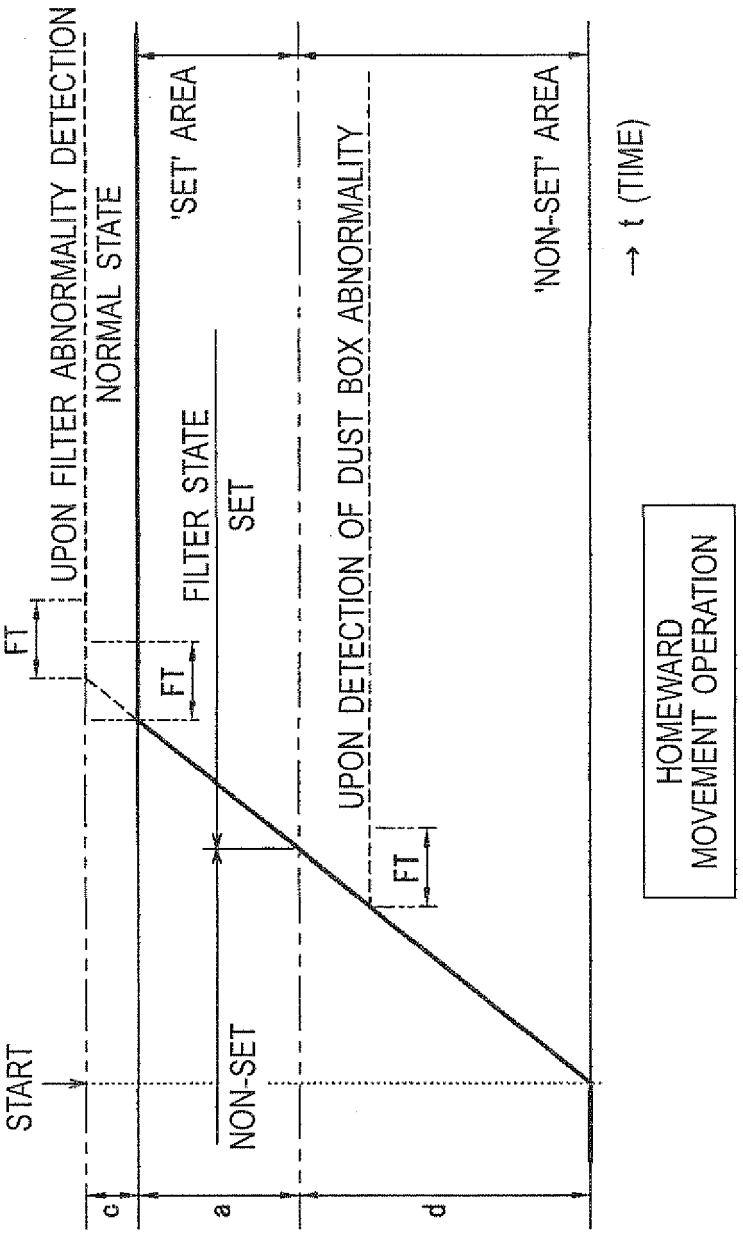

'SET' AREA
'NON-SET' AREA
FILTER STATE
NON-SET
SET
START
UPON FILTER ABNORMALITY DETECTION
FT
FT
NORMAL STATE
OUTWARD
MOVEMENT OPERATION
→ t (TIME)
FILTER NORMAL POSITION P0
FILTER MAXIMUM POSITION P4
b
d

Fig.15


START
NON-SET
FILTER STATE
SET
FT
FT
FT
FT
UPON FILTER ABNORMALITY DETECTION
NORMAL STATE
'SET' AREA
UPON DETECTION OF DUST BOX ABNORMALITY
'NON-SET' AREA
→ t (TIME)
HOMEWARD
MOVEMENT OPERATION
c
a
d

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/069819

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 1996-2007
Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

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 2006-71206 A (Fujitsu General Ltd.), 16 March, 2006 (16.03.06), Par. Nos. [0026] to [0040], [0076]; Figs. 1, 2 & US 2006-70358 A1 & EP 1632728 A2	1-4
Y	JP 11-151453 A (Toshiba Corp.), 08 June, 1999 (08.06.99), Par. No. [0066]; Fig. 11 (Family: none)	1-4
A	JP 2002-81711 A (Sanyo Electric Co., Ltd.), 22 March, 2002 (22.03.02), Par. No. [0023]; Fig. 1 (Family: none)	1-4

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

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 December, 2007 (27.12.07)	15 January, 2008 (15.01.08)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/069819

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 5-106859 A (Fujitsu General Ltd.), 27 April, 1993 (27.04.93), Par. Nos. [0012], [0013]; Fig. 3 (Family: none)	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006112699 A **[0006]**
- JP 2001099479 A **[0007]**
- JP 2006025942 A **[0008]**