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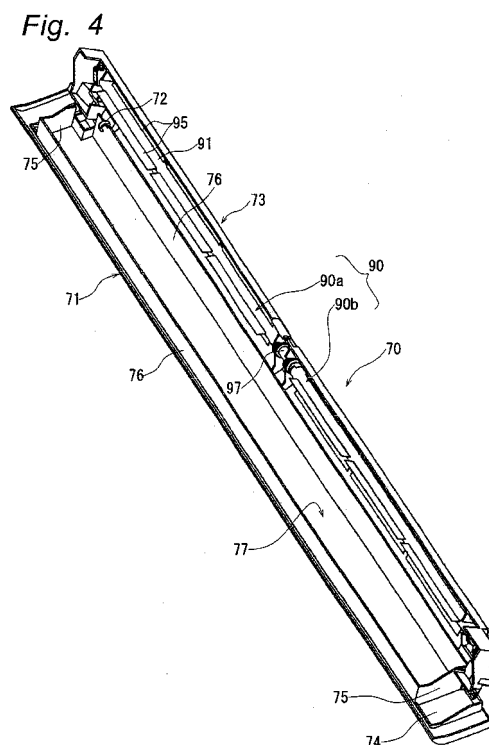
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(54) **AIR CONDITIONER**

(57) In an air conditioner having an automatic air filter cleaning function, a dust box (70) is removably attached to a body unit. The dust box (70) is comprised of a box body (71) and a lid (73) provided on the box body (71) to be opened and closed freely. A cleaning brush (90) is rotatably provided on the lid (73).



Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner and in particular to an air conditioner having an automatic air filter cleaning function.

BACKGROUND ART

[0002] An air conditioner typically sucks room air with a blow fan, cools or heats the room air by forcing it to pass through a heat exchanger, and then returns it to the room. The air conditioner is provided with an air filter on the front side of the heat exchanger to prevent dust suspended in the room from polluting the heat exchanger. When dust adheres to the filter to cause clogging and thereby the draft resistance increases, the air conditioning ability of the air conditioner decreases and the power consumption of it increases. In order to resolve such a disadvantage, various air conditioners having an automatic filter cleaning device have been proposed.

[0003] An automatic filter cleaning method is disclosed in JP62-145019U. In this method, a belt filter shaped like a loop is supported by a pair of rollers and moved by rotating the rollers by a motor, and in this process, the filter is cleaned by a rotating cleaning brush. Filter moving methods include a method of rolling up a belt filter wound around one roller to the other roller, and cleaning, in this process, the belt filter by a cleaning brush, as shown in JP2001-99479A. In this case, after cleaning, the filter is wound back from the other roller to the one roller.

[0004] In the case of JP62-145019U, dust removed from the filter is accumulated in a dust box (dust reservoir) located before or under the cleaning brush, and the dust box is cleaned by a way such as suction by a cleaner when the dust box is filled to capacity or on a regular basis. Furthermore, in the case of JP62-145019U, the dust box is designed to be removably attached to the air conditioner body, and be able to be cleaned and washed after detached from the air conditioner body. However, the cleaning brush is coupled with a driving motor and thereby cannot be detached from the air conditioner body.

[0005] The air conditioner of JP62-145019U has a problem that dust accumulated in the dust box flies easily when the dust box is detached from the air conditioner body.

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0006] The present invention has been developed to solve the problem of the conventional air conditioner, and aims to provide an air conditioner which has an automatic air filter cleaning function and is capable of simply disposing of dust removed from a filter in such a way as not

to cause the dust to fly to the surroundings.

SOLUTION TO PROBLEM

[0007] In order not to cause dust removed from the filter to fly to the surroundings, it is conceivable to modify the air conditioner of JP62-145019U such that it has, for example, a lid with which an opening section of the dust box is covered and which can be opened and closed freely. However, it is difficult to locate such a lid and open and close it while avoiding interference with the cleaning brush.

[0008] On the other hand, it is also conceivable that the cleaning brush is rotatably installed in the dust box which is configured to be able to be attached to and detached from the air conditioner body together with the cleaning brush. In this case, the cleaning brush functions as a lid and dust in the dust box does not fly easily. However, the cleaning brush becomes obstructive when dust in the dust box is thrown away or sucked by a cleaner. Even if the cleaning brush is removably attached to the dust box, its configuration becomes complex and its attaching/detaching operation is troublesome.

[0009] Thus, an air conditioner according to the present invention comprises a cleaning brush for removing dust adhered to a filter, and a dust box for storing removed dust. The dust box is removably attached to a body unit of the air conditioner, and includes a box body and a lid provided on the box body to be opened and closed freely. Also, the cleaning brush is rotatably provided on the lid.

[0010] According to the above configuration, the dust box can be detached from the air conditioner body in the state that the box body is covered with the lid. For this reason, dust accumulated in the dust box does not fly. Disposal of the dust can be done easily by opening the lid of the dust box detached from the air conditioner body and sucking the dust in the box body by a cleaner. Since the cleaning brush is installed on the lid, the box body is cleaned easily.

[0011] In one embodiment, the lid is rotatably coupled with the box body by a hinge. Therefore, the lid opening and closing operations are easy and the lid is prevented from missing.

[0012] In one embodiment, slidably mounted to the lid is a bearing supporting the cleaning brush in such a manner as to allow the cleaning brush to rotate freely. The bearing is fixed by a claw piece provided on the lid.

BRIEF DESCRIPTION OF DRAWINGS

[0013] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not intended to limit the present invention, and wherein:

Fig. 1 shows an embodiment of an air conditioner

according to the present invention and is an exploded perspective view of the whole of the air conditioner;

Fig. 2 is a cross-sectional view showing the state that the air conditioner has been assembled;

Fig. 3 is an enlarged view of the surroundings of a dust box in Fig. 2;

Fig. 4 is a perspective view of the dust box showing the state that the lid of the dust box is opened;

Fig. 5 is an enlarged view of an installation section of a cleaning brush in Fig. 4;

Fig. 6A is an enlarged view showing an installation state of the cleaning brush;

Fig. 6B is a cross-sectional view showing an installation state of the cleaning brush;

Fig. 7 is a perspective view showing the state that the lid of the dust box is closed;

Fig. 8 shows a variation of a supporting structure for supporting the cleaning brush on the lid of the dust box and is a perspective view of the box body, the cleaning brush, and the lid;

Fig. 9 is a plan view of the above variation;

Fig. 10 is a cross-sectional view taken along the line X-X in Fig. 9 showing a supporting structure near a gear;

Fig. 11 is a cross-sectional view taken along the line XI-XI in Fig. 9 showing a supporting structure at the midsection of the cleaning brush; and

Fig. 12 is a cross-sectional view taken along the line XII-XII in Fig. 9 showing a supporting structure at the side opposite to the gear.

DESCRIPTION OF EMBODIMENTS

[0014] Next, embodiments of an air conditioner according to the present invention will be specifically described in detail with reference to the drawings. Fig. 1 is an exploded perspective view of the whole of an air conditioner, Fig. 2 is a cross-sectional view showing the state that the air conditioner has been assembled, Fig. 3 is an enlarged view of the surroundings of a dust box in Fig. 2, Fig. 4 is a perspective view showing the state that the lid of the dust box is opened, Fig. 5 is an enlarged view of the installation section of a cleaning brush in Fig. 4, Fig. 6A and Fig. 6B are an enlarged view and a cross-sectional view, respectively, showing the installation state of the cleaning brush, and Fig. 7 is a perspective view showing the state that the lid of the dust box is closed. The air conditioner shown in Fig. 1 has a body unit 10, a filter unit 20, a front grill 50, a front panel 60, and a dust box 70. The body unit 10 has a bottom frame which is a high-strength member hung on a wall or the like and to which an indoor heat exchanger 12, a blower fan (cross flow fan) (notation 13 in Fig. 2), and an electrical components box 14 are attached, and is designed to suck room air, cause it to pass through the indoor heat exchanger 12, and discharge it from a supply opening 15 to perform air conditioning operations such as cooling,

heating, and humidity control.

[0015] The filter unit 20 has right and left air filters 21 which are located on the top face of the indoor heat exchanger 12 to prevent dust suspended in air from polluting the indoor heat exchanger 12 when room air is sucked from the upper part. Furthermore, the filter unit 20 has a moving means for moving the filters 21 downward to perform cleaning to remove dust which has adhered to the filters 21. The moving means is a mechanism for moving the filters 21 extending from the top face to the front face of the body unit 10 to the bottom face and the back face of the body unit and further moving the filters upward while bending them in the shape of the letter U (see Fig. 2). The moving means may be a commonly known mechanism such as a loop type one or a winding (rolling up) type one as described in the "BACKGROUND ART". The specific configuration of the filters 21 will be described later. The dust box 70 has a function of cleaning the filters 21. Its specific configuration will be described later.

[0016] The filter unit 20 is fitted on the bottom frame 11 of the body unit 10, and a box-like front grill 50 is fitted on the filter unit 20 to cover the filter unit 20. A front panel 60 is fitted on a suction opening 51 of the front face of the front grill 50, the suction opening 51 being covered with the front panel 60 to be opened and closed freely. Furthermore, the dust box 70 is mounted on the lower part of the front grill 50. In other words, the dust box 70 is placed in a position above the supply opening 15 of the body unit 10 at the lower part of the front panel 60 in such a manner as to be exposed to the outside as shown in Figs. 2 and 3. The dust box 70 is removably attached to the body unit without interfering with the front panel 60 in the state that the front panel 60 is closed.

[0017] The dust box 70 includes, as shown in Fig. 4, a rectangular box body 71, a lid 73 coupled with the box body 71 by a hinge 72 in such a manner as to be opened and closed freely, and a cleaning brush 90 rotatably supported by the lid 73. In this embodiment, an arc-shaped hinge 72 is adopted. However, any other type of hinge such as a pin joint may be adopted. The box body 71 includes a bottomplate 74 serving also as an exterior panel of the air conditioner, and right and left side walls 75 and front and back walls 76 standing up from the inner surface of the bottom plate 74. The side walls 75 and the front and back walls 76 stand up from locations at a distance inwardly from the outer edge of the bottom plate 74. A space surrounded by the bottom plate 74 and the walls 75 and 76 is a dust storage section 77.

[0018] The lid 73 is shaped like a flat box with which the upper ends of the walls 75 and 76 are covered. The lid 73 closes the upper end openings of the walls 75 and 76, and supports the cleaning brush 90 in such a manner as to allow rotation of the cleaning brush 90. Ribs 78 are provided at four places of the inner surface of the lid 73, and bearings 92 mounted around rotating shafts 91 of the cleaning brush 90 are removably attached to the ribs 78, respectively. As shown in detail in Figs. 6A and 6B, a notch 80 shaped substantially like the letter U or a rec-

tangle is formed in each of the ribs 78, and fitting grooves 93 are formed on the periphery of each of the bearings 92 and engaged with opposite parallel inner edges of the corresponding notch 80. In addition, claw pieces 82 are provided in a protruding manner on each of the ribs 78. When mounting the bearings 92 to the corresponding ribs, the claw pieces 82 deform flexibly to receive the respective bearings 92, and once the bearings are mounted, each claw piece 82 engages with an engaging portion 94 of the corresponding bearing 92 to retain the bearing.

[0019] As shown in Fig. 3, the bottom plate 83 of the lid 73 has an angle section as a whole, and part of the bottom plate 83 is made concave so that the filter 21 is able to move along it while bending. Furthermore, as shown in Fig. 7, an opening section 84 is formed in the midsection of the bottom plate 83 so that part of the cleaning brush 90 is exposed.

[0020] As shown in Fig. 4, the cleaning brush 90 is divided into right and left short brushes 90a and 90b, each of which includes an aforementioned rotating shaft 91, aforementioned bearings 92 rotatably coupled with both ends of the corresponding rotating shaft 91, and four arrays of bristles 95 arranged radially on the periphery of the corresponding rotating shaft 91 (see Fig. 4). The bearings 92 are irremovably mounted on the rotating shafts 91, so that the short brushes 90a and 90b only have to be attached to the lid 73 together with the bearings 92. As shown in Fig. 7, an end portion located outside the rotating shaft 91 of the left short brush 90a protrudes from a side wall of the lid 73, and a gear 96 transmitting driving force of a driving means (not shown) such as a motor is installed on the end portion. The rotating shafts 91, 91 of the right and left short brushes 90a and 90b are removably coupled with each other by a joint 97 at the midsection to be able to transmit torque.

[0021] The dust box 70 configured as above is attached to the body unit 10 in the state that the dust storage section 77 is covered with the lid 73 as shown in Fig. 7. In this state, the gear 96 of the cleaning brush 90 engages with a driving gear provided in the body unit 10. In the cleaning mode of the filter 21, the filter 21 is moved downward, and the arrays of bristles 95 of the cleaning brush 90 rotating in a direction opposite to the moving direction of the filter collect dust which has adhered to the filter 21 and stores the dust in the dust storage section 77 of the box body 71. At that time, as shown in Fig. 3, the dust which has adhered to the cleaning brush 90 can be scraped off by a scraping rib 85 provided in the lid 73.

[0022] When the amount of dust in the dust storage section 77 exceeds a fixed value, a user detaches the dust box 70 from the body unit 10. At that time, as shown in Fig. 7, the dust storage section 77 is closed with the lid 73, so that the dust does not fly. After that, the user places the dust box 70 in a horizontal position and opens the lid 73. In this state, the cleaning brush 90 has been attached to the lid 73 as shown in Figs. 4 and 5, so that the operation of sucking dust from the box body 71 by a

cleaner is easy. When the cleaning of the dust box 70 has been completed, the user closes the lid 73 as shown in Fig. 7 and attaches the dust box 70 to the body unit 10.

[0023] In the above embodiment, the lid 73 is hinged to the box body 71, but may be removably attached to the box body 71. Furthermore, the cleaning brush 90 is divided into two in the above embodiment, but may be of a continuous (i.e., not divided) type.

[0024] Figs. 8 to 12 show a variation of the supporting structure for supporting a cleaning brush on a lid of a dust box. Fig. 8 is a perspective view of a box body 29, a cleaning brush 30, and a lid 31. The cleaning brush 30 has brush bristles 33 (arrays of bristles) implanted on the periphery of a hollow rotating shaft 32. In this case, the rotating shaft 32 is formed as a single one, and the brush bristles 33 are provided substantially throughout the length and circumference of the rotating shaft 32 other than the midsection and both ends of it. Furthermore, a gear 34 is mounted on one end of the rotating shaft 32, and an end member 35 is mounted on the other end.

[0025] In Fig. 8, the lid 31 is shown in the state that its box body 29 side is directed upward. The lid 31 has, as in the above embodiment, an opening section 36 for projecting the brush bristles 33 outward, and a scraping rib 37. In this case, the tip of the scraping rib 37 has fine projections and depressions.

[0026] The cleaning brush 30 is rotatably supported by the lid 31 at the midsection, a portion near the gear 34, and the end member 35 of the rotating shaft 32. Fig. 9 is a plan view of the lid 31 in the state that the cleaning brush is installed on the lid 31 (wherein the opening section of the lid 31 facing the box body is shown directed upward). Fig. 10 is a cross-sectional view of a supporting portion near the gear 34 (cross-sectional view taken along the line X-X in Fig. 9). As shown in Fig. 10, the rotating shaft 32 of the cleaning brush 30 is supported between a supporting rib 38 provided on the side wall opposite to the scraping rib 37 and an elastic claw piece 39 provided at a distance from the supporting rib 38. The supporting rib 38 and the elastic claw piece 39 extend toward the opening section. A retaining protrusion 40 protruding toward the supporting rib 38 is formed near a tip end of the elastic claw piece 39. That is, when the rotating shaft 32 is inserted between the supporting rib 38 and the elastic claw piece 39, the elastic claw piece 39 is elastically wide opened, the rotating shaft 32 gets over the retaining protrusion 40, and then the retaining protrusion 40 prevents the rotating shaft from slipping out in the state that the elastic claw piece 39 has been restored to its original position.

[0027] Fig. 11 is a cross-sectional view of a supporting portion at the midsection of the cleaning brush 30 (which is a cross-sectional view taken along the line XI-XI in Fig. 9). As shown in Fig. 11, two grasping claw pieces 41, 41 extending toward the opening section are provided. Furthermore, formed on the midsections of the grasping claw pieces 41, 41 are wrapping/holding sections 42, 42 for holding the rotating shaft 32 by wrapping it from its both

sides. The rotating shaft 32 is thus held between the wrapping/holding sections 42, 42. When the rotating shaft 32 is inserted between the grasping claw pieces 41, 41, they are elastically wide opened and then restored.

[0028] Fig. 12 is a cross-sectional view of a portion supporting the end member 35 of the cleaning brush 30 (which is a cross-sectional view taken along the line XII-XII in Fig. 9). The end member 35 is integrally molded with a fitting pin 43 and fitted to the rotating shaft 32 by elastically fitting the fitting pin 43 into the end portion of the hollow rotating shaft 32. Furthermore, a supporting tube 44 extending toward the cleaning brush 30 is formed on an end wall of the lid 31, and four supporting ribs 45 are formed on the inner periphery of the supporting tube 44. The supporting ribs 45 are provided at regular intervals in the circumferential direction of the supporting tube 44. The end member 35 of the rotating shaft 32 is inserted into the inside of the supporting ribs 45 and thereby the rotating shaft 32 is rotatably supported. In this variation, the cleaning brush 30 is rotatably supported by the lid 31 due to the above structures.

[0029] Embodiments of the invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

1. An air conditioner comprising a cleaning brush (90) for removing dust adhered to a filter (21), and a dust box (70) for storing removed dust, wherein the dust box (70) is removably attached to a body unit (10) of the air conditioner, and includes a box body (71) and a lid (73) provided on the box body to be opened and closed freely, and the cleaning brush (90) is rotatably provided on the lid (73).
2. The air conditioner as claimed in claim 1, wherein the lid (73) is rotatably coupled with the box body (73) by a hinge (72).
3. The air conditioner as claimed in claim 1 or 2, wherein a bearing (92) is slidably mounted to the lid (73) and fixed by a claw piece (82) provided on the lid (73), said bearing (92) supporting the cleaning brush (90) in such a manner as to allow the cleaning brush (90) to rotate freely.

Fig. 1

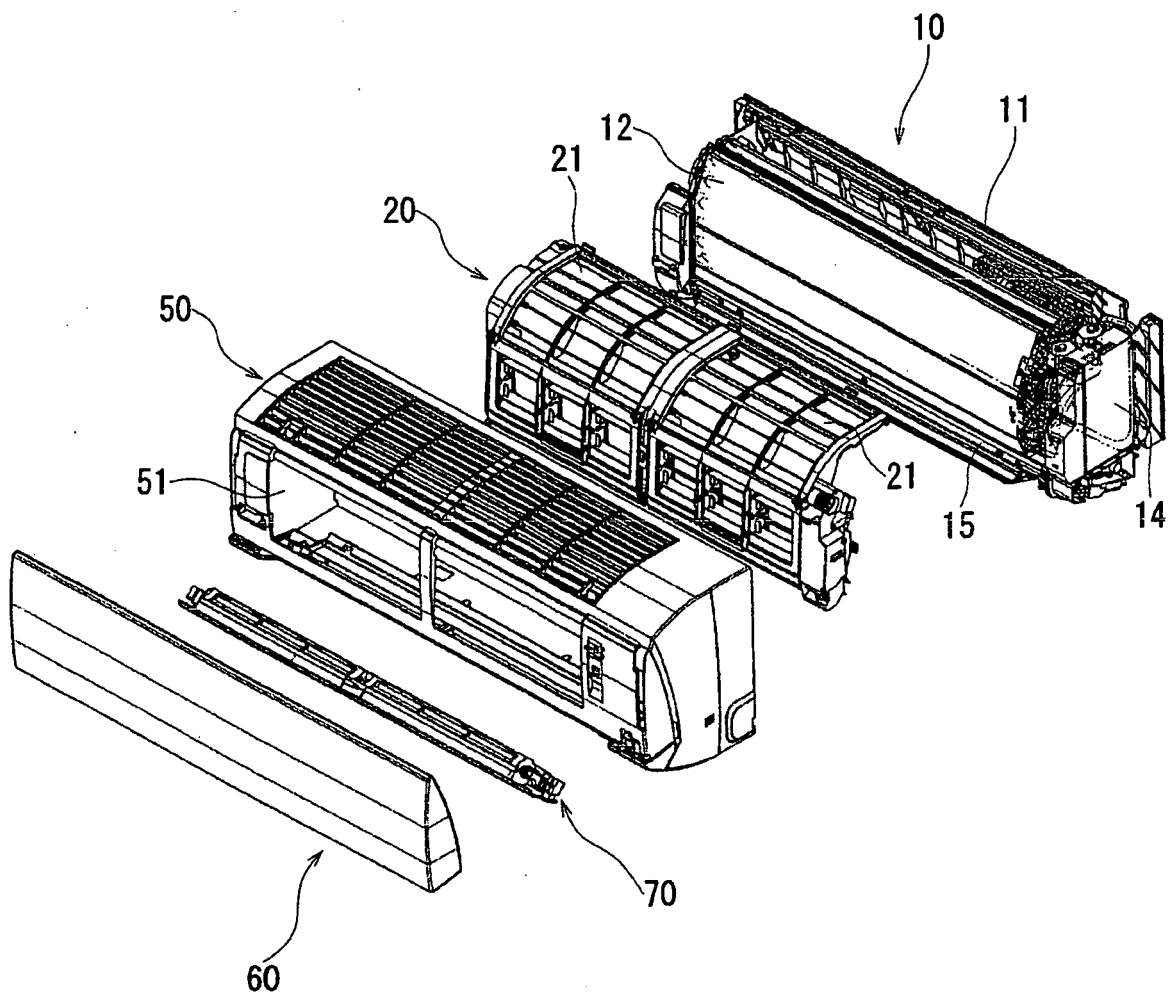


Fig. 2

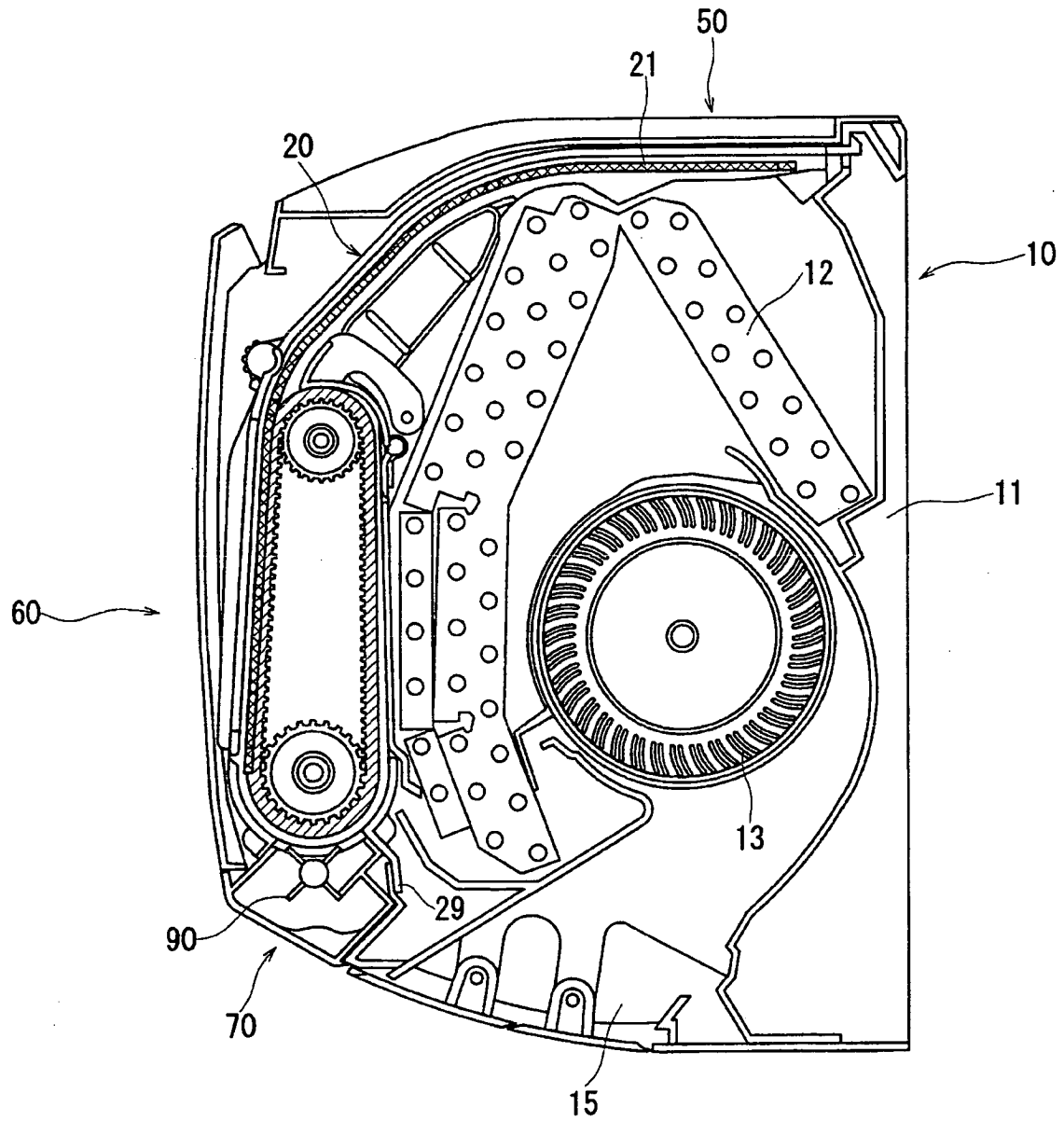


Fig. 3

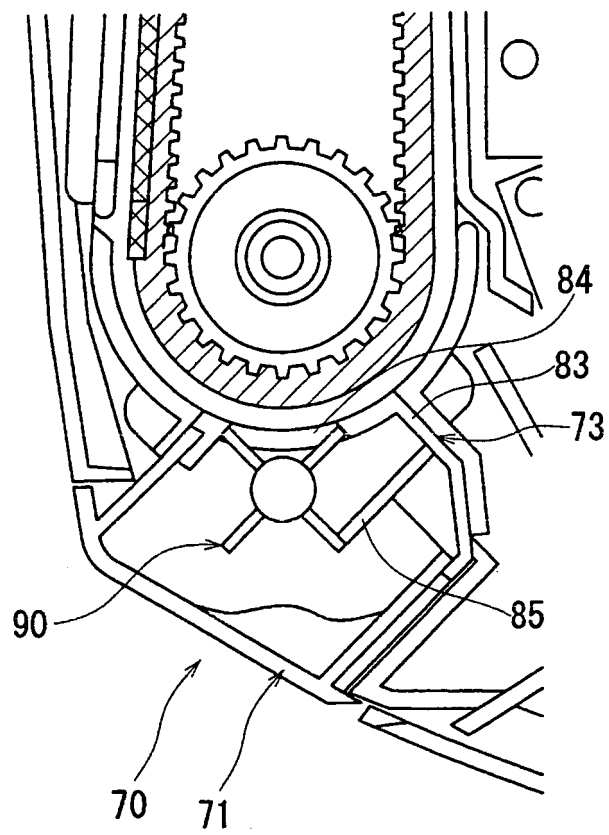


Fig. 4

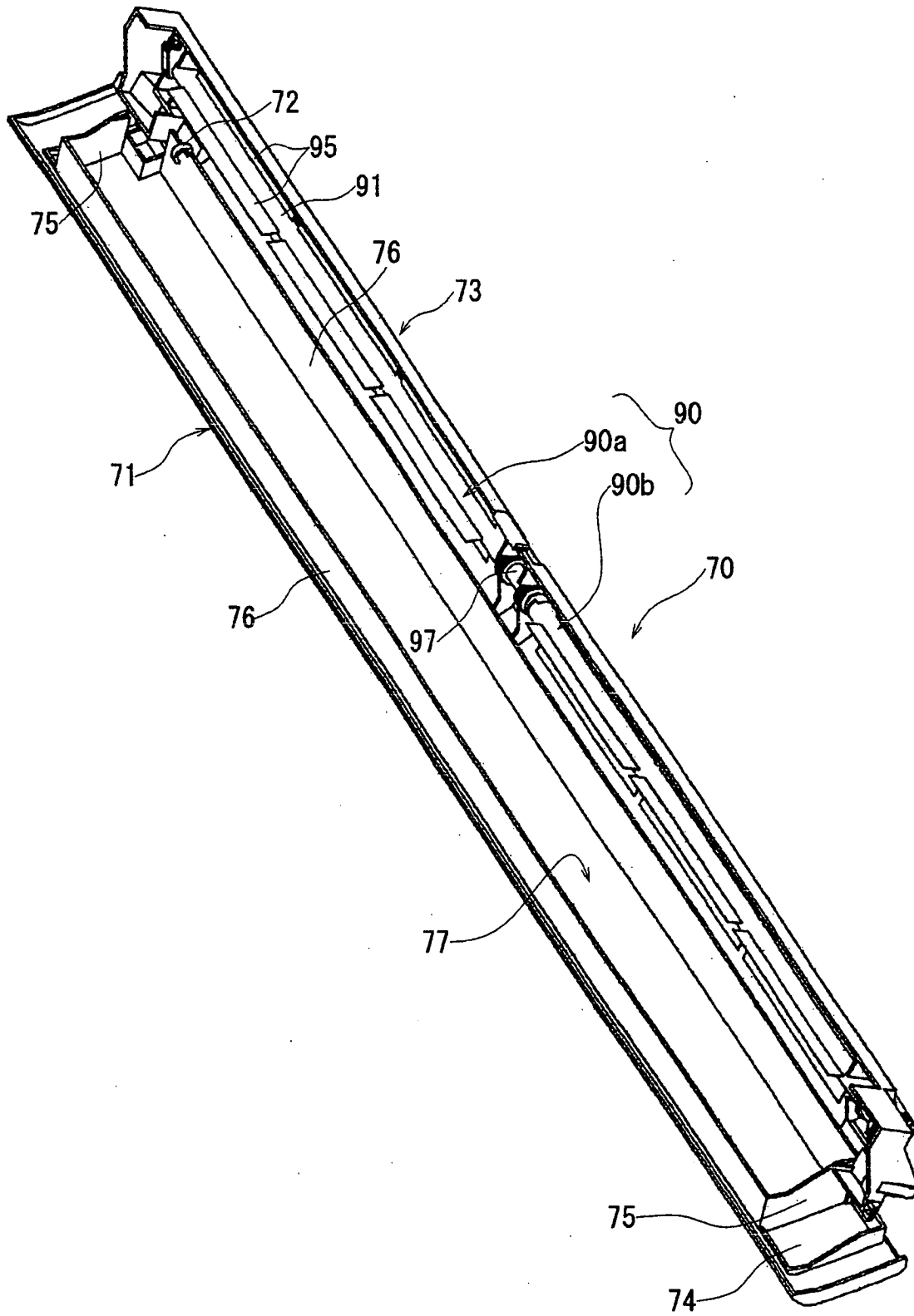


Fig. 5

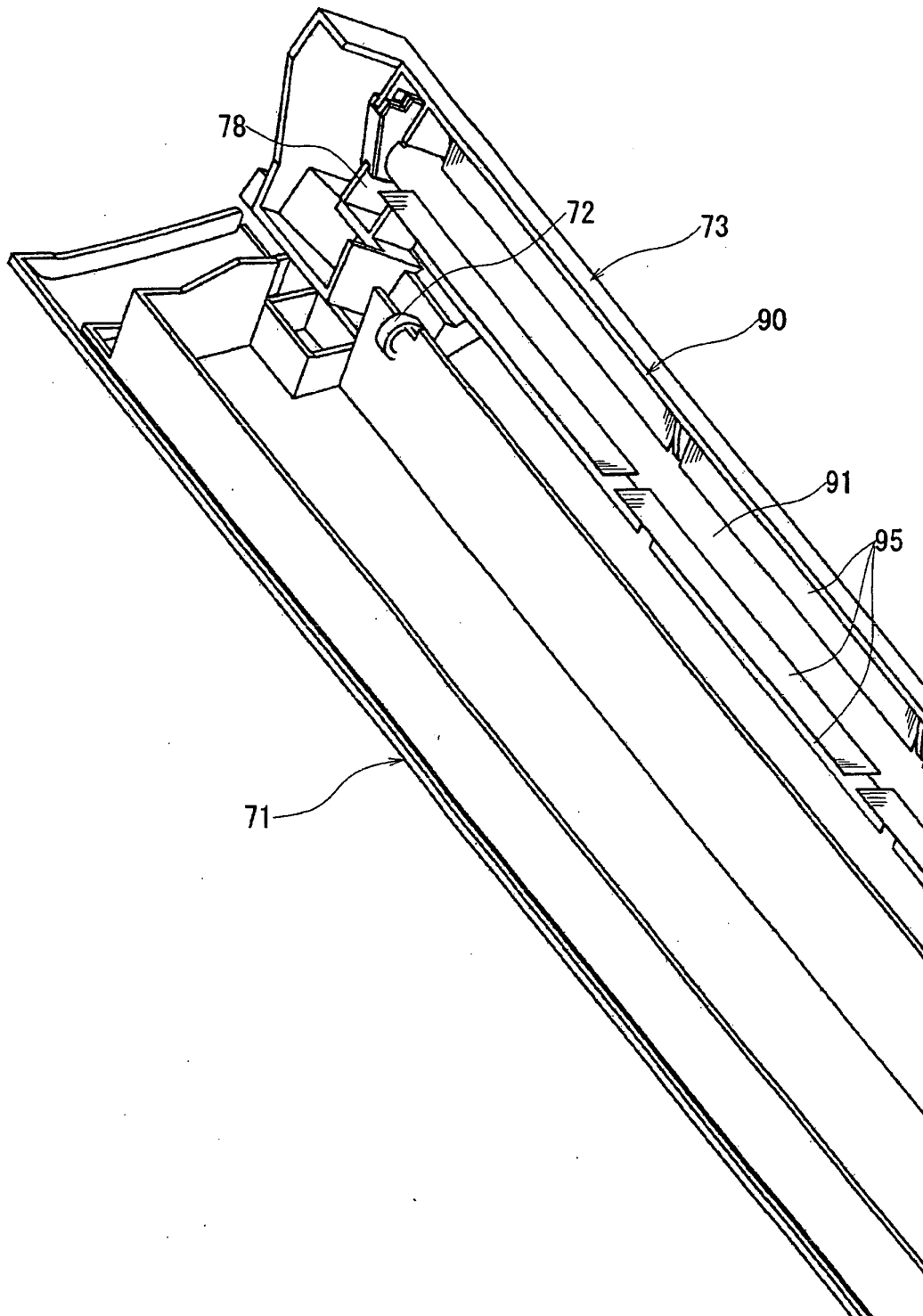


Fig. 6A

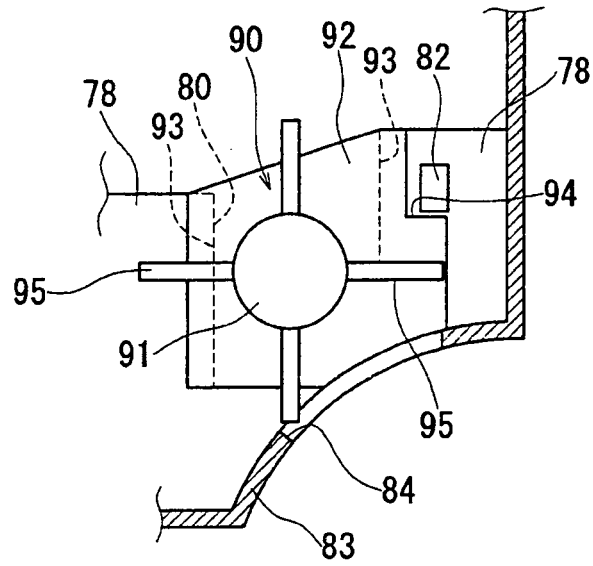


Fig. 6B

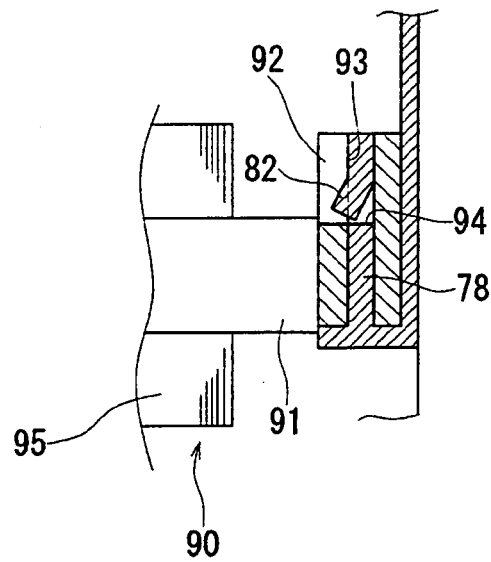


Fig. 7

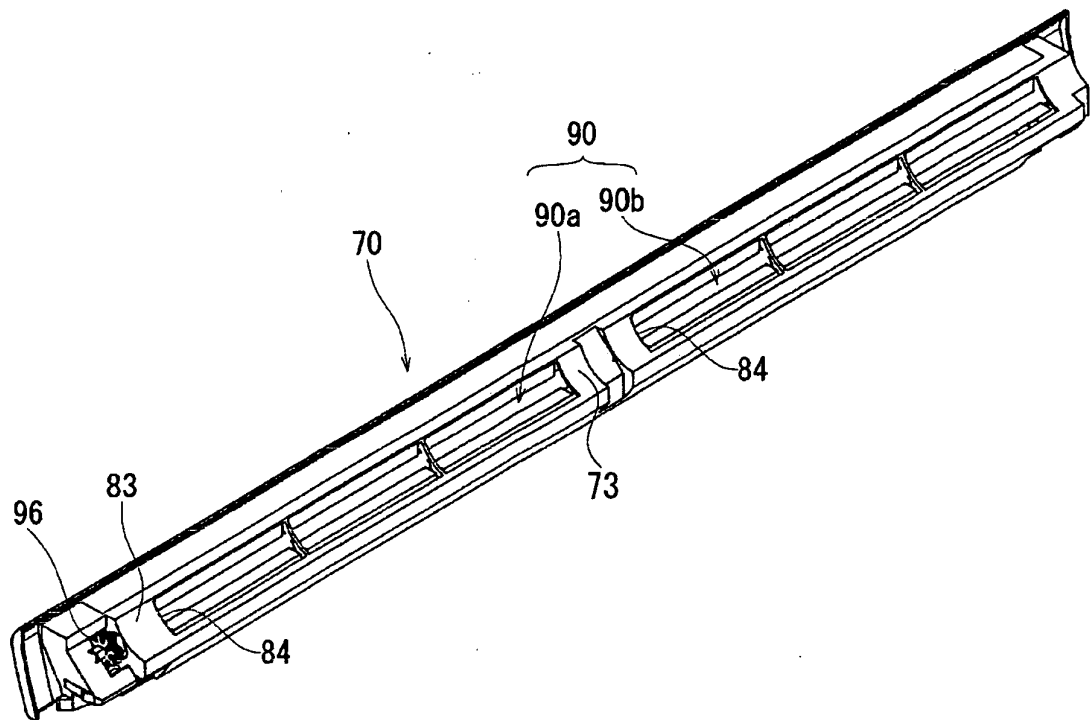


Fig. 8

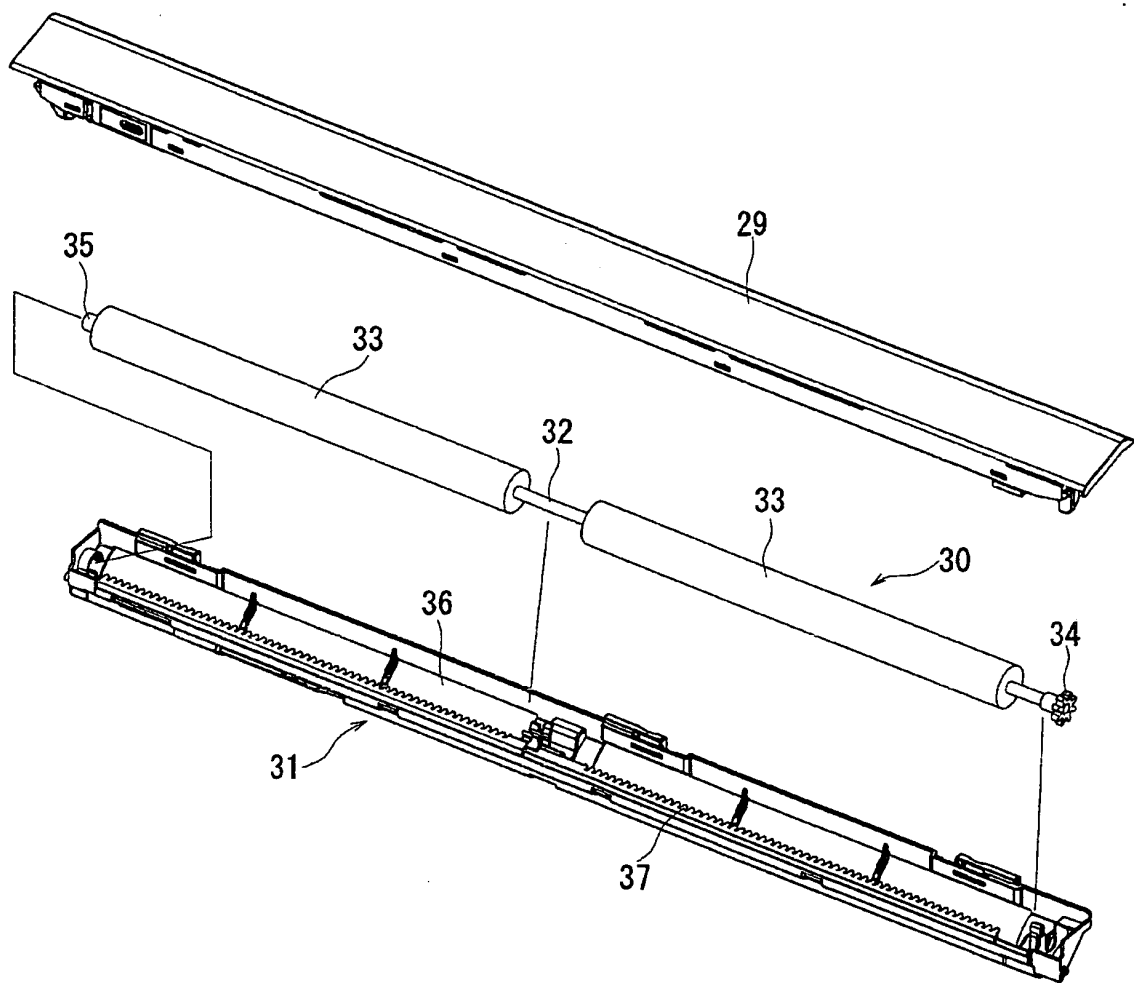


Fig. 9

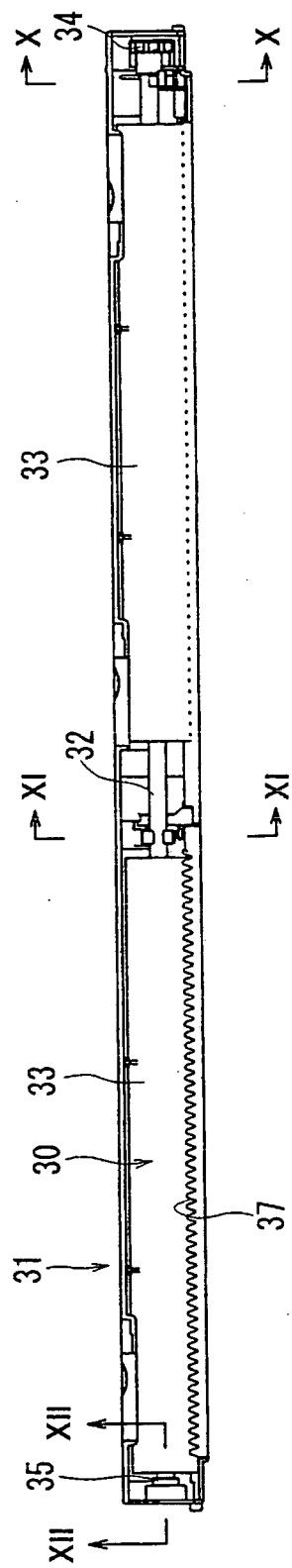


Fig. 10

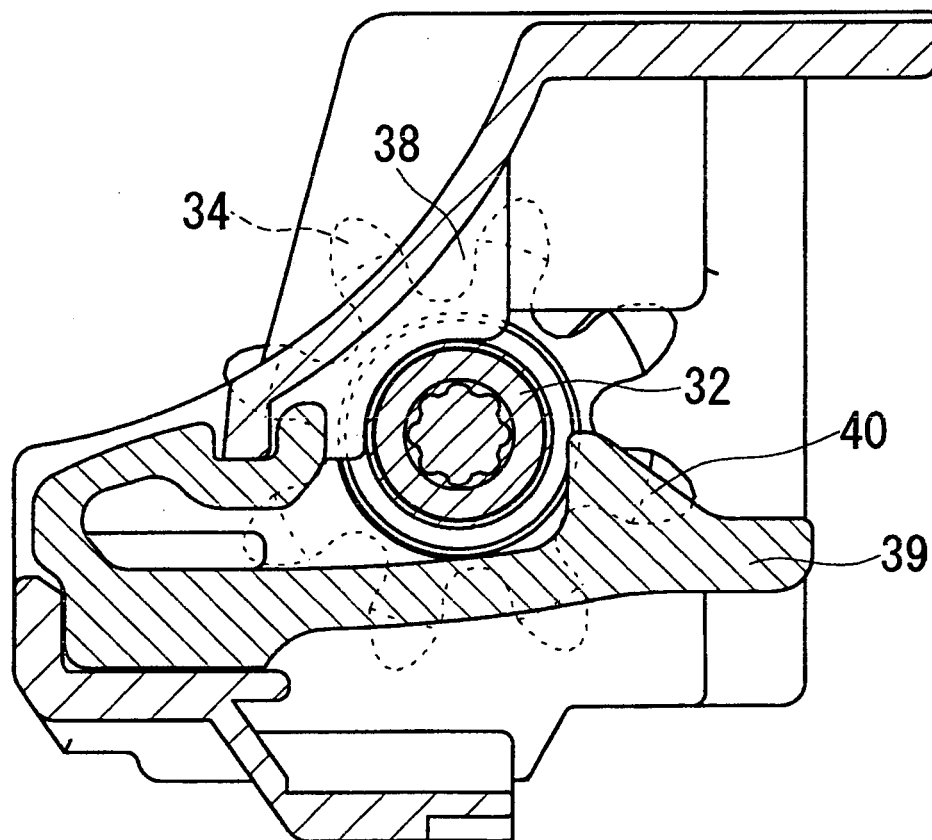


Fig. 11

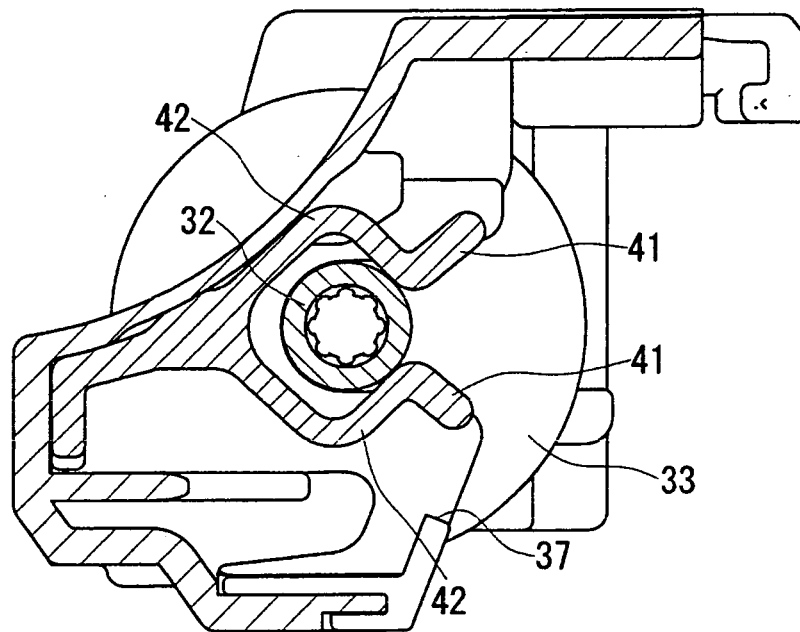
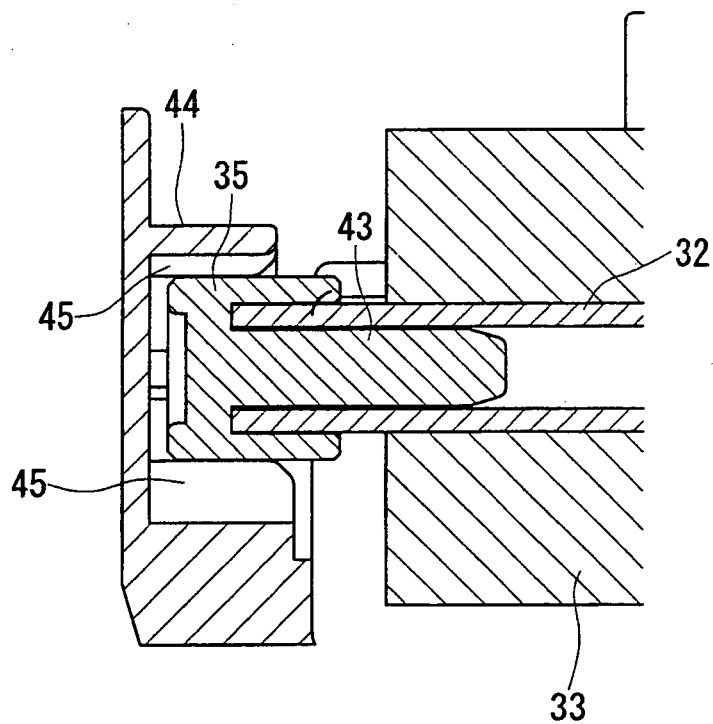


Fig. 12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/067000

A. CLASSIFICATION OF SUBJECT MATTER

F24F13/28(2006.01) i, B01D46/10(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, B01D46/10

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 2005-300154 A (Fujitsu General Ltd.), 27 October, 2005 (27.10.05), Claims; Par. Nos. [0001] to [0096]; Figs. 1 to 11 (Family: none)	1-3
Y	JP 10-9661 A (Sharp Corp.), 16 January, 1998 (16.01.98), Claims; Par. Nos. [0001] to [0038]; Figs. 1 to 4 (Family: none)	1-3
A	JP 62-145019 U (Mitsubishi Electric Corp.), 12 September, 1987 (12.09.87), Full text; all drawings (Family: none)	1-3



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

05 November, 2007 (05.11.07)

Date of mailing of the international search report

13 November, 2007 (13.11.07)

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/067000

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 2001-99479 A (Sanyo Electric Co., Ltd.), 13 April, 2001 (13.04.01), Full text; all drawings (Family: none)	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 62145019 U [0003] [0004] [0004] [0005] [0007]
- JP 2001099479 A [0003]