(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 071 252 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
17.06.2009 Bulletin 2009/25

(21) Application number: **07792963.6**

(22) Date of filing: **24.08.2007**

(51) Int Cl.:
F24F 13/20 *(2006.01)*

(86) International application number:
PCT/JP2007/066434

(87) International publication number:
WO 2008/023785 (28.02.2008 Gazette 2008/09)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(30) Priority: **25.08.2006 JP 2006229308**

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

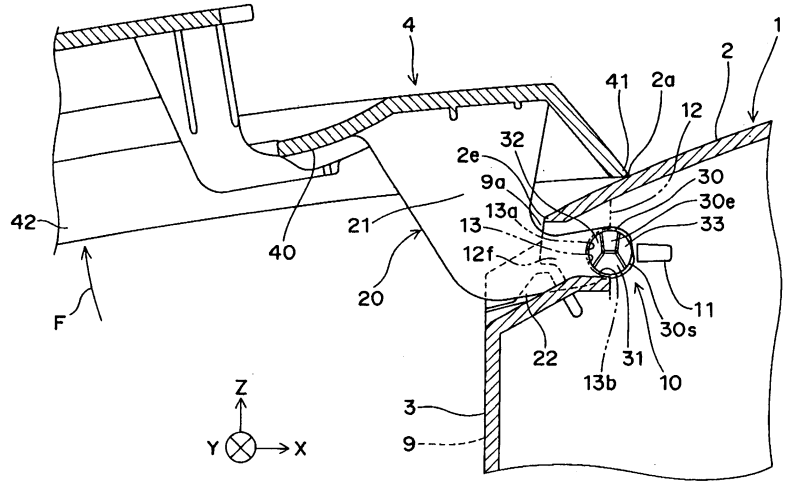
(72) Inventors:
- **YAMADA, Toshiaki**
  Kusatsu-shi, Shiga 5250044 (JP)
- **KURAMORI, Tetsutomo**
  Kusatsu-shi, Shiga 5250044 (JP)
- **WAKIHARA, Katsuhiro**
  Kusatsu-shi, Shiga 5250044 (JP)

(74) Representative: **Wiedemann, Peter**
Hoffmann - Eitle
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) AIR CONDITIONER

(57) A front panel 4 includes an arm 20 which is protrusively provided on a rear face 40 so as to be inserted into an indoor unit main body 1. A horizontally extending shaft 30 is provided in the arm 20. The indoor unit main body 1 includes a bearing portion 10 serving for rotatably supporting the shaft 30 and having at least a peripheral edge 13 curved so as to be recessed frontward. A first chamfer 31 is formed in a tip circumferential portion of the shaft 30 so that when the front panel 4 receives an external force F in such a direction as to be further opened beyond a fully opened state with respect to the indoor unit main body 1, the first chamfer 31 is brought into contact with a lower portion 13b of the peripheral edge 13, whereby the arm 20 is elastically deformed in such a direction that the shaft 30 is separated horizontally from the bearing portion 10.

Fig.1



EP 2 071 252 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner and, more particularly, to an air conditioner having a front panel which is to be attached to and removed from the indoor unit main body for conveniences of installation, relocation or the like.

BACKGROUND ART

[0002] As an air conditioner of this type, there has been known one in which, as shown in Fig. 12, an arm 66 to be inserted into an indoor unit main body is protrusively provided at an upper portion of the rear face of a front panel (not shown), with a shaft 65 provided on the arm so as to extend horizontally (see, e.g., JP H8-135994 A). In the indoor unit main body, on the other hand, is provided a bearing portion 63 for rotatably supporting the shaft 65. In this example, a round hole 64, a horizontal recess 81 adjoining the round hole 64, and a chamfered portion 82 adjoining the recess 81 are provided in the bearing portion 63. Also, at an end of the shaft 65, a chamfer 91 is formed at such a site as to just confront the recess 81 with the front panel opened to a certain angle with respect to the main body.

[0003] When the front panel is attached to the indoor unit main body, the operator, having the front panel in his/her hand, pushes the front panel horizontally with the shaft 65 of the arm 66 aligned with the chamfered portion 82. By this operation, the shaft 65 of the arm 66 is guided and inserted along the chamfered portion 82 and the recess 81 so as to be fitted into the round hole 64. After that, the front panel is turned around the shaft 65, thereby closed with respect to the indoor unit main body. On the other hand, when the front panel is removed from the indoor unit main body, the operator, holding a lower side portion of the front panel, lifts the front panel while pulling it frontward, and then turns the front panel around the shaft 65 to open the panel. With the front panel opened to a specified angle, the chamfer 91 of the shaft 65 just confronts the recess 81 while the arm 66 is elastically deformed in such a direction that the shaft 65 is horizontally disengaged from the round hole 64 by a protrusion 69. In this state, pulling the front panel frontward causes the chamfer 91 to ride on the recess 81 while, with the arm 66 elastically deformed, the shaft 65 is moved frontward along the recess 81, so that the front panel is removed from the indoor unit main body. In addition, a protrusion 68 is for holding the front panel at an angle halfway.

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] Generally, workers engaged in installation, relocation or the like of air conditioners treat with a wide variety of air conditioners. For this reason, the worker may, in some cases, try to remove the front panel from the indoor unit main body without grasping correct removal methods for individual machine types.

[0005] In this connection, with the prior-art air conditioner, removal of the front panel involves different kinds of operations such as turning the front panel around the shaft 65 and moving the front panel horizontally. Therefore, unless a correct removal method is grasped beforehand, the worker will encounter a difficulty in removing the front panel. As a result, there occurs a problem that the worker may exert excessive force on the front panel to damage the arm 66.

[0006] Accordingly, it is an object of the present invention to provide an air conditioner which allows the front panel to be easily removed without incurring damage thereon in removal of the front panel from the indoor unit main body.

SOLUTION TO PROBLEM

[0007] In order to achieve the object, an air conditioner according to the present invention comprises an indoor unit main body, and a front panel which is attached to and removed from the indoor unit main body (1), wherein the front panel includes an arm protrusively provided on a rear face so as to be inserted into the indoor unit main body, the arm having a horizontally extending shaft,

the indoor unit main body includes a bearing portion serving for rotatably supporting the shaft and having at least a peripheral edge curved so as to be recessed frontward, and

a first chamfer is formed at such a site of a tip circumferential portion of the shaft that when the front panel receives an external force in such a direction as to be further opened beyond a fully opened state of a certain opening angle with respect to the indoor unit main body, the first chamfer faces a lower portion of the peripheral edge, so that the first chamfer is brought into contact with the lower portion of the peripheral edge, whereby the arm is elastically deformed in such a direction that the shaft is separated horizontally from the bearing portion.

[0008] In the air conditioner of this invention, when the front panel is opened from a closed state to a fully opened state of a certain opening angle with respect to the indoor unit main body, the front panel is turned around the shaft while the shaft keeps supported on the bearing portion. When the front panel is further opened from the fully opened state with respect to the indoor unit main body, the first chamfer formed at the tip circumferential portion of the shaft is brought into contact with the lower portion of the peripheral edge, by which the arm is elastically deformed in such a direction that the shaft is disengaged horizontally from the bearing portion. Therefore, in the fully opened state of the front panel, when the worker applies a little excessive force to the front panel so as to remove the front panel, the shaft is easily disengaged

from the bearing portion. Thus, even if the worker does not know a correct removal method beforehand, the worker is enabled to easily remove the front panel from the indoor unit main body without causing any damage. As a result, the cost for servicing replacement can be cut down.

[0009] In the air conditioner of one embodiment, a second chamfer is formed at such a site of the tip circumferential portion of the shaft that when the front panel is opened further from the fully opened state with respect to the indoor unit main body, the second chamfer faces a center portion of the peripheral edge, so that the second chamfer is brought into contact with the center portion of the peripheral edge so as to make the arm elastically deformed, whereby the shaft is separated off the bearing portion.

[0010] In the air conditioner of this one embodiment, when the front panel is further opened from the fully opened state with respect to the indoor unit main body, the second chamfer formed at the tip circumferential portion of the shaft is brought into contact with the center portion of the peripheral edge so as to make the arm elastically deformed, by which the shaft is separated off the bearing portion. That is, in this air conditioner, only one kind of operation of turning the front panel in an opening direction with respect to the indoor unit main body is required to remove the front panel from the indoor unit main body. Therefore, removal of the front panel can be achieved even more easily.

[0011] In the air conditioner of one embodiment, a third chamfer is formed at such a rearward-facing site of the tip circumferential portion of the shaft that when the front panel, while keeping a posture to form the fully opened state, is pushed from frontward to rearward and attached to the indoor unit main body, the third chamfer keeps in contact with a portion of the bearing portion located frontward of the peripheral edge until the shaft reaches the peripheral edge, so that the arm is elastically deformed in one same direction as the shaft is separated off the bearing portion.

[0012] In the air conditioner of this one embodiment, when the front panel, while keeping a posture to form the fully opened state, is pushed from frontward to rearward and attached to the indoor unit main body, the third chamfer formed at the tip circumferential portion of the shaft keeps in contact with a portion of the bearing portion located frontward of the peripheral edge until the shaft reaches the peripheral edge, so that the arm is elastically deformed in one same direction as the shaft is disengaged from the bearing portion. Thus, the front panel can be easily attached to the indoor unit main body.

[0013] In the air conditioner of one embodiment, a length of the arm and a position of the peripheral edge within the indoor unit main body are so set that when the front panel is further opened beyond the fully opened state with respect to the indoor unit main body, an upper edge of the front panel is brought into contact with a portion of the indoor unit main body located upper than an edge of an opening, which is to be closed in a closed state, so that the upper edge serves as a fulcrum by which a force responsive to the external force is exerted on the shaft.

[0014] In the air conditioner of this one embodiment, when the front panel is further opened beyond the fully opened state with respect to the indoor unit main body, the upper edge of the front panel is brought into contact with a portion of the indoor unit main body located upper than the edge of the opening, which is to be closed in a closed state, so that the upper edge serves as a fulcrum on which a force responsive to the external force is exerted on the shaft. Accordingly, when the worker applies a little excessive force to the front panel in a front-panel opening direction to remove the front panel, a force larger than that force is applied to the shaft, so that the shaft is easily separated off the bearing portion. Thus, the front panel can be removed even more easily. Moreover, when the front panel is further opened beyond the fully opened state with respect to the indoor unit main body, there is no possibility that the upper edge of the front panel and the edge of the opening may collide with each other so as to be damaged.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

Fig. 1 is a sectional view showing a portion of an air conditioner according to an embodiment of the present invention in relation to attachment and removal between an indoor unit main body and a front panel;

Fig. 2 is a view showing the indoor unit (right half) as viewed from the front;

Fig. 3 is a view showing the indoor unit of Fig. 2 as viewed from the right side;

Fig. 4 is a view showing a shaft provided at an end of an arm extending from the front panel;

Fig. 5 is a view showing a shaft in which parts equivalent to the first and second chamfers are not formed, in contrast to Fig. 4;

Fig. 6 is a view showing a portion relating to attachment and removal between the indoor unit main body and the front panel, as viewed from the front, with the shaft fitted to the peripheral edge of the bearing portion;

Fig. 7 is a view showing a portion relating to attachment and removal between the indoor unit main body and the front panel, as viewed from the front, with the shaft removed from the peripheral edge of the bearing portion;

Fig. 8 is a view showing a state that a downward force responsive to an external force applied to the front panel is acting on the shaft, with an upper edge of the front panel serving as a fulcrum;

Fig. 9 is a view showing a state that a forward force responsive to an external force applied to the front

panel is acting on the shaft, with the upper edge of the front panel serving as a fulcrum;

Fig. 10 is a view of the state of Fig. 9, as viewed from diagonal upward;

Fig. 11 is a view for explaining an action in case that the shaft of Fig. 5 is provided in the arm; and

Fig. 12 is a view illustrating a portion relating to attachment and removal between the indoor unit main body and the front panel in a conventional air conditioner.

DESCRIPTION OF EMBODIMENTS

[0016] Hereinbelow, the present invention will be described in detail by way of embodiment thereof illustrated in the accompanying drawings.

[0017] Fig. 2 shows a wall type indoor unit (right half) of an air conditioner according to an embodiment, as viewed from the front (-X side). Fig. 3 shows the indoor unit of Fig. 2 as viewed from the right side (-Y side). As can be seen from Figs. 2 and 3, this air conditioner includes an indoor unit main body 1, and a front panel 4 to be attached to and removed from the indoor unit main body 1. In Figs. 2 and 3, the front panel 4 is opened at an opening angle of about 90° with respect to the indoor unit main body 1, being in a fully opened state of a generally horizontal posture. When the front panel 4 is closed and postured generally vertical to the indoor unit main body 1, an opening 9 of an indoor unit front 3 is closed by the front panel 4. A grille (not shown) for intake of the indoor air is formed in a top face 2 of the indoor unit main body 1.

[0018] As shown in Fig. 1, the front panel 4 has an arm 20 which is protrusively provided on a rear face 40 so as to be inserted into the indoor unit main body 1. It is noted that Fig. 1 corresponds to a sectional view taken along the line A-A of Fig. 2. This arm 20 is composed of a tapered first arm portion 21 extending generally vertical to the rear face 40 of the front panel 4, and a second arm portion 22 which is bent about 90° with respect to the first arm portion 21 and which extends up to a position generally corresponding to an upper edge 41 of the front panel 4. A horizontally extending shaft 30 is provided at an end of the second arm portion 22.

[0019] As shown under magnification in Fig. 4, the shaft 30 basically has an outer shape obtained by forming a first chamfer 31, a second chamfer 32 and a third chamfer 33 on a short cylinder defined by a circumferential surface 30s and an end face 30e, each of the chamfers being composed of a flat surface inclined with respect to a center axis. Rounds 35 are provided at boundaries between the end face 30e and the chamfers 31, 32, 33, respectively, rounds 36 are provided at boundaries between the circumferential surface 30s and the chamfers 31, 32, 33, respectively, and rounds 37 are provided at boundaries between each two of the chamfers 31, 32, 33.

[0020] The arm 20 and shaft 30 are provided in one pair in left-and-right symmetry at an upper portion of the rear face of the front panel 4. The front panel 4 and the one pair of arm 20 and shaft 30 are made of integrally molded resin.

[0021] As shown in Fig. 1, the indoor unit main body 1 has a bearing portion 10 for rotatably supporting the shaft 30. This bearing portion 10 includes a guide plate 12 having a semicircular peripheral edge 13 curved so as to be recessed frontward (-X direction), and a restraining member 11 (see Fig. 10) placed rearward of the guide plate 12 and extending horizontally (Y direction). As shown in Fig. 6 (corresponding to a sectional view taken along the line B-B in Fig. 3), the guide plate 12 has a sloped surface 12f sloped in such a direction as to approach the arm 20 toward the rearward (+X direction). The peripheral edge 13 is located rearward of the sloped surface 12f of the guide plate 12. As shown in Fig. 1, with the front panel 4 attached to the indoor unit main body 1, the peripheral edge 13 of the guide plate 12 rotatably supports the shaft 30. The restraining member 11 restrains a fore end of the second arm portion 22 from moving rearward (+X direction), thereby restraining the shaft 30 from separating off rearward (+X direction) from the position in which the shaft 30 is fitted to the peripheral edge 13 of the guide plate 12.

[0022] The bearing portion 10 is provided in one pair in left-and-right symmetry at an upper portion within the indoor unit main body 1, in correspondence to the one pair of arm 20 and shaft 30 of the front panel 4.

[0023] The first chamfer 31 of the shaft 30 is formed at such a site of the tip circumferential portion of the shaft 30 that the first chamfer 31 faces a lower portion 13b of the peripheral edge 13, while the front panel 4 is in the fully opened state as shown in Fig. 1. Also, the second chamfer 32 of the shaft 30 is formed at such a site of the tip circumferential portion of the shaft 30 that the second chamfer 32 faces a center portion 13a of the peripheral edge 13, while the front panel 4 is in the fully opened state. The third chamfer 33 of the shaft 30 is formed at such a site of the tip circumferential portion of the shaft 30 that the third chamfer 33 faces the rearward (+X direction), while the front panel 4 is in the fully opened state.

[0024] When the front panel 4 is attached to the indoor unit main body 1, the worker, holding the front panel 4 horizontally postured in his/her hand, pushes the front panel 4 horizontally from front to rear with the shaft 30 aligned with the sloped surface 12f of the guide plate 12 as shown in Fig. 7. By this operation, the third chamfer 33 of the shaft 30 (see Fig. 1) is guided and inserted along the sloped surface 12f of the guide plate 12 so as to be fitted to the peripheral edge 13 as shown in Fig. 6.

[0025] For a duration until the shaft 30 reaches the peripheral edge 13, the third chamfer 33 formed at the tip circumferential portion of the shaft 30 makes the arm 20 elastically deformed in the same direction as the shaft 30 is separated from the bearing portion 10. Thus, the front panel 4 can be easily attached to the indoor unit main body 1.

[0026] After that, with the shaft 30 supported on the

bearing portion 10, the front panel 4 is turned around the shaft 30, so that the front panel 4 is closed with respect to the indoor unit main body 1.

[0027] On the other hand, when the front panel 4 is removed from the indoor unit main body 1, the worker, holding the front panel 4 at its lower side portion 42, exerts an external force F so as to pull frontward and lift the front panel 4 as shown in Fig. 1, by which the front panel 4 is opened from a closed state to a fully opened state with respect to the indoor unit main body 1. In this operation, with the shaft 30 supported on the bearing portion 10, the front panel 4 is easily turned around the shaft 30.

[0028] In the fully opened state, the upper edge 41 of the front panel 4 is in contact with a portion 2a of the top face 2 of the indoor unit main body 1 located upper than the opening 9. This is because the length of the arm 20 and the position of the peripheral edge 13 within the indoor unit main body 1 are so set as to yield such a result. Between the arm 20 and an edge 2e that defines the opening 9 is a gap 9a to be left. Accordingly, there is no possibility of collision or resultant damage between the upper edge 41 or the arm 20 of the front panel 4 and the edge 2e defining the opening 9.

[0029] In this fully opened state, the front panel 4 is supported by an engaging portion formed of an unshown rib provided between the indoor unit main body 1 and the arm 20. Accordingly, even if the worker releases his/her hand off the front panel 4, the posture of the front panel 4 is maintained in the fully opened state.

[0030] When the worker attempts to open the front panel 4 further beyond the fully opened state with respect to the indoor unit main body 1, a downward force F1 responsive to an external force F applied to the front panel 4 acts on the shaft 30 while the upper edge 41 of the front panel 4 serves as a fulcrum, as shown in Fig. 8. Thus, the first chamfer 31 formed at the tip circumferential portion of the shaft 30 is brought into contact with the lower portion 13b of the peripheral edge 13. As a result of this, the arm 2C is elastically deformed in such a direction that the shaft 30 is horizontally separated from the bearing portion 10. To an extent that first chamfer 31 slightly crawls into the lower portion 13b of the peripheral edge 13, the front panel 4 is slightly opened from the fully opened state.

[0031] From this state, when the worker attempts to further open the front panel 4 with respect to the indoor unit main body 1, a frontward force F2 responsive to the external force F applied to the front panel 4 acts on the shaft 30 while the upper edge 41 of the front panel 4 serves as a fulcrum, as shown in Figs. 9 and 10 (equivalent to Fig. 9, as viewed from diagonal upward). Thus, the second chamfer 32 formed at the tip circumferential portion of the shaft 30 is brought into contact with the center portion 13a of the peripheral edge 13. As a result of this, the arm 20 is further elastically deformed in such a direction that the shaft 30 is horizontally separated from the bearing portion 10, with a result that the shaft 30 is separated off the bearing portion 10.

[0032] As shown above, in the fully opened state of the front panel 4, when the worker applies a little excessive force to the front panel 4 so as to remove the front panel 4, the shaft 30 is easily separated off the bearing portion 10. Also, since a force larger than the external force F is applied to the shaft 30 with the upper edge 41 of the front panel 4 serving as a fulcrum, the shaft 30 is even more easily removed from the bearing portion 10. Accordingly, it is easily achievable to remove the front panel 4 from the indoor unit main body 1. Yet, only one kind of operation to turn the front panel 4 in an opening direction with respect to the indoor unit main body 1 is enough to remove the front panel 4 from the indoor unit main body 1. Therefore, removal of the front panel 4 can be achieved even more easily. Still more, when the front panel 4 is further opened from the fully opened state with respect to the indoor unit main body 1, there is no possibility of collision or resultant damage between the upper edge 41 or the arm 20 of the front panel 4 and the edge 2e defining the opening 9.

[0033] Thus, according to this air conditioner, even if the worker does not know a correct removal method beforehand, the worker is enabled to easily remove the front panel 4 from the indoor unit main body 1 without incurring their damage. As a result, the cost for servicing replacement can be cut down.

[0034] In addition, in contrast to the shaft 30 shown in Fig. 4, Fig. 5 shows a shaft 130 having no parts corresponding to the first and second chamfers. This shaft 130 basically has an outer shape obtained by forming a chamfer 133 on a short cylinder defined by a circumferential surface 130s and an end face 130e. The chamfer 133 corresponds to the third chamfer 33 in the shaft 30 shown in Fig. 4. An round 135 is provided at a boundary between the end face 130e and the chamfer 133, and an round 136 is provided at a boundary between the a circumferential surface 130s and the chamfer 133. Without parts corresponding to the above-described first and second chamfers as shown in this shaft 130, if a frontward force F2 responsive to the external force F applied to the front panel 4 acts on the shaft 130 as shown in Fig. 11 as an example, the shaft 130 is never separated off the peripheral edge 13. Thus, preferable functional effects of the present invention cannot be obtained.

[0035] In the above-described embodiment, the first chamfer 31, the second chamfer 32 and the third chamfer 33 are flat surfaces each inclined with respect to a center axis, respectively, but of course, this is not limitative. The first chamfer 31 and the second chamfer 32, or the first chamfer 31 and the second chamfer 32 and the third chamfer 33, may be provided so as to form (part of) a conical surface that tapers as becoming apart from the arm 20 for example, the individual chamfers continuously adjoining one another over a certain angle range about the center axis.

Claims

1. An air conditioner comprising an indoor unit main body (1), and a front panel (4) which is attached to and removed from the indoor unit main body (1), wherein
the front panel (4) includes an arm (20) protrusively provided on a rear face (40) so as to be inserted into the indoor unit main body (1), the arm (20) having a horizontally extending shaft (30),
the indoor unit main body (1) includes a bearing portion (10) serving for rotatably supporting the shaft (30) and having at least a peripheral edge (13) curved so as to be recessed frontward, and
a first chamfer (31) is formed at such a site of a tip circumferential portion of the shaft (30) that when the front panel (4) receives an external force (F) in such a direction as to be further opened beyond a fully opened state of a certain opening angle with respect to the indoor unit main body (1), the first chamfer (31) faces a lower portion (13b) of the peripheral edge (13), so that the first chamfer (31) is brought into contact with the lower portion (13b) of the peripheral edge (13), whereby the arm (20) is elastically deformed in such a direction that the shaft (30) is separated horizontally from the bearing portion (10).

2. The air conditioner as claimed in Claim 1, wherein
a second chamfer (32) is formed at such a site of the tip circumferential portion of the shaft (30) that when the front panel (4) is opened further from the fully opened state with respect to the indoor unit main body (1), the second chamfer (32) faces a center portion (13a) of the peripheral edge (13), so that the second chamfer (32) is brought into contact with the center portion (13a) of the peripheral edge (13) so as to make the arm (20) elastically deformed, whereby the shaft (30) is separated off the bearing portion (10).

3. The air conditioner as claimed in Claim 1, wherein
a third chamfer (33) is formed at such a rearward-facing site of the tip circumferential portion of the shaft (30) that when the front panel (4), while keeping a posture to form the fully opened state, is pushed from frontward to rearward and attached to the indoor unit main body (1), the third chamfer (33) keeps in contact with a portion (12f) of the bearing portion (10) located frontward of the peripheral edge (13) until the shaft (30) reaches the peripheral edge (13), so that the arm (20) is elastically deformed in one same direction as the shaft (30) is separated off the bearing portion (10).

4. The air conditioner as claimed in Claim 1, wherein
a length of the arm (22) and a position of the peripheral edge (13) within the indoor unit main body (1) are so set that when the front panel (4) is further opened beyond the fully opened state with respect to the indoor unit main body (1), an upper edge (4) of the front panel (4) is brought into contact with a portion (2a) of the indoor unit main body (1) located upper than an edge (2e) of an opening (9), which is to be closed in a closed state, so that the upper edge (41) serves as a fulcrum by which a force (F1, F2) responsive to the external force (F) is exerted on the shaft (30).

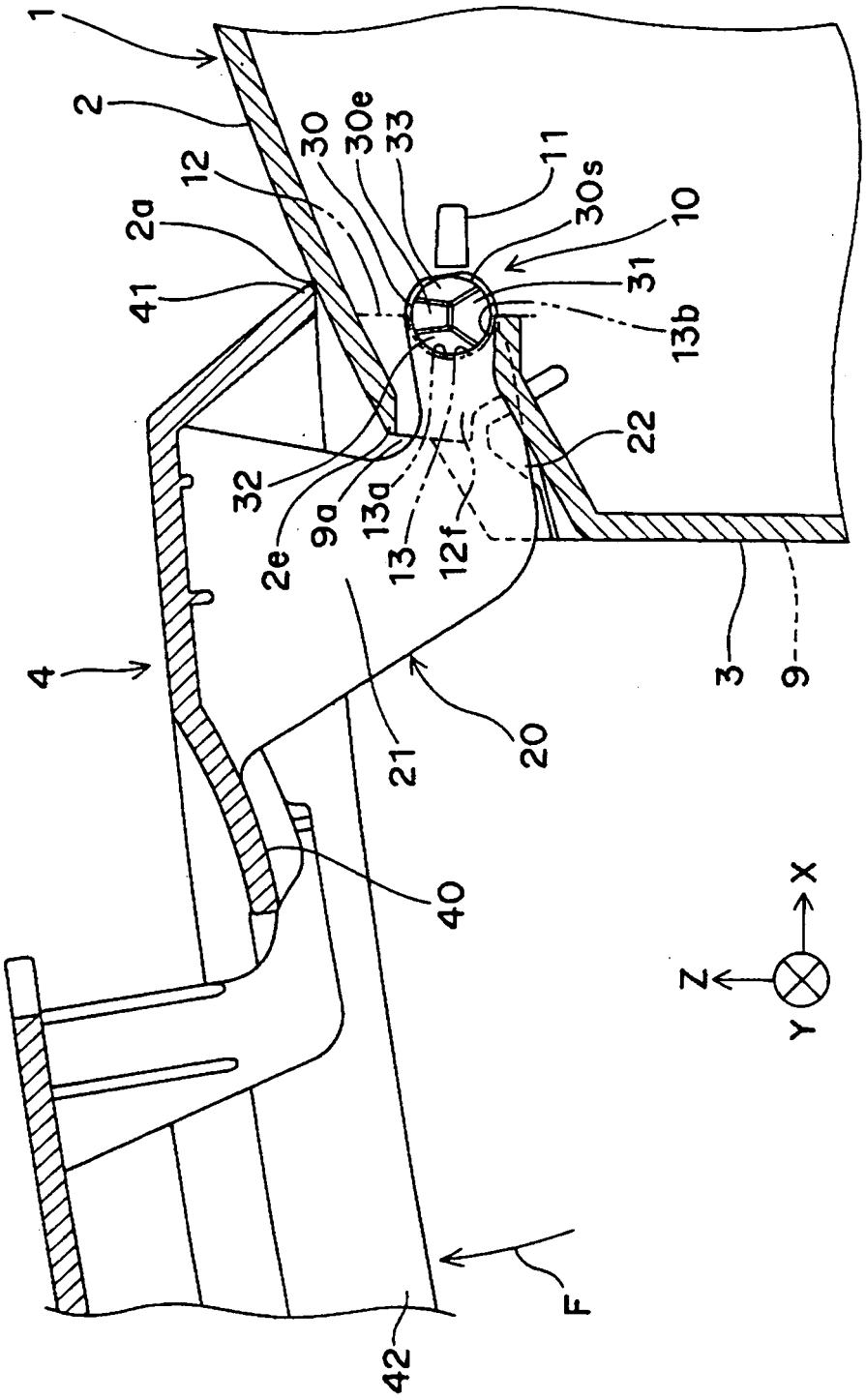

1
2
30
30e
33
11
12
30s
10
2a
31
41
13b
22
32
9a
13a
13
12f
2e
4
3
9
21
20
40
X
Z
Y
F
42

Fig.1

Fig.2

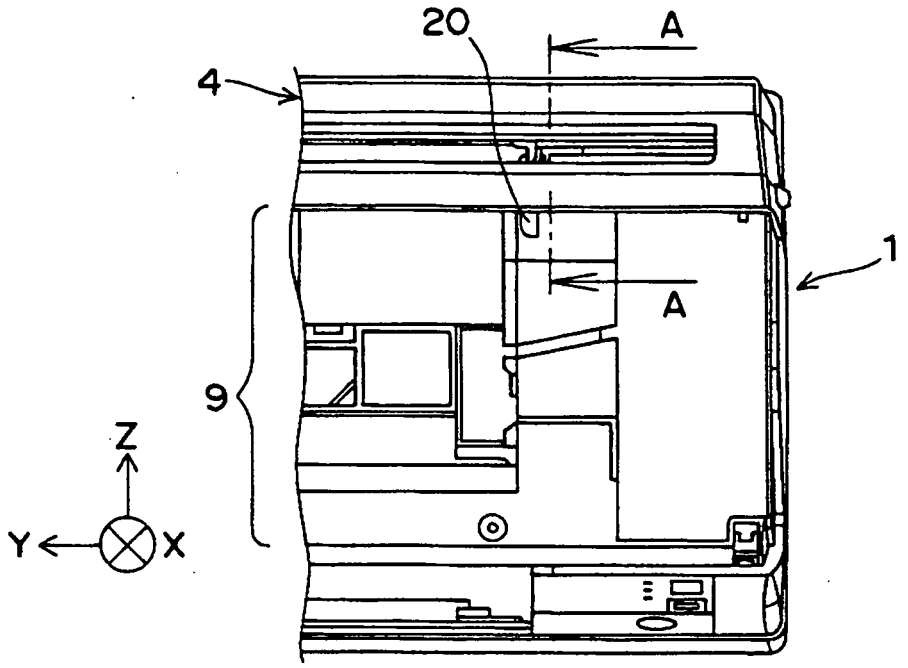


Fig.3

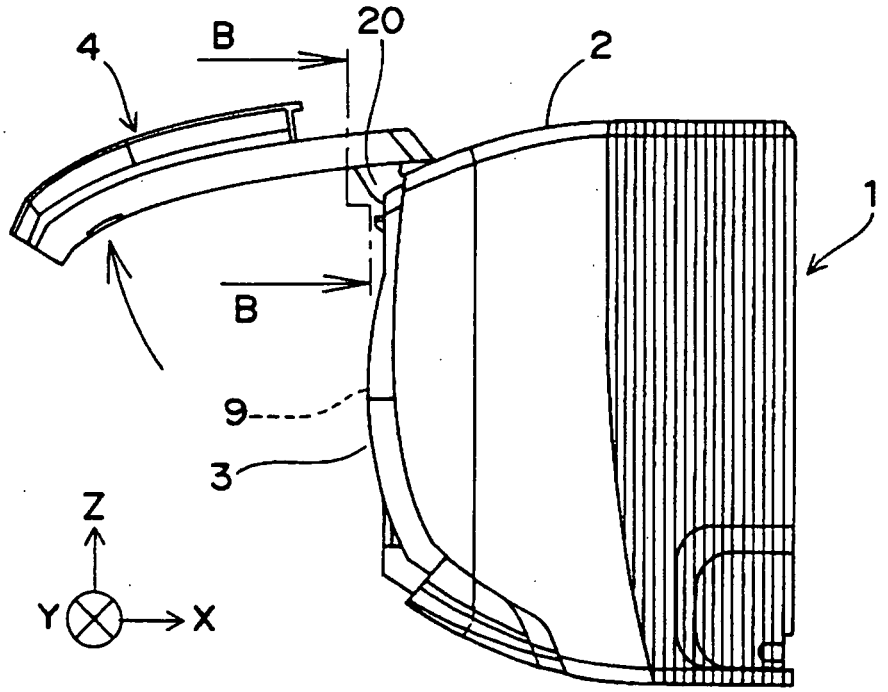


Fig.4

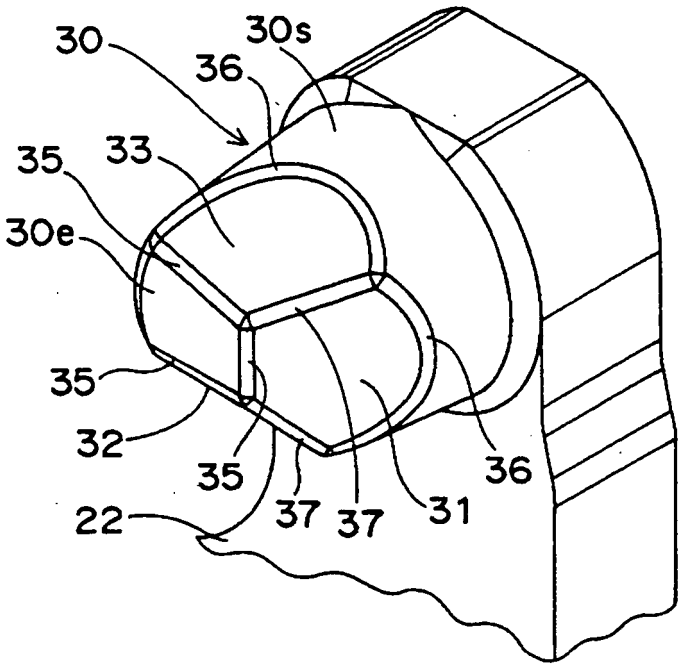

30
30s
36
35
33
30e
35
32
35
37
37
31
36
22

Fig.5

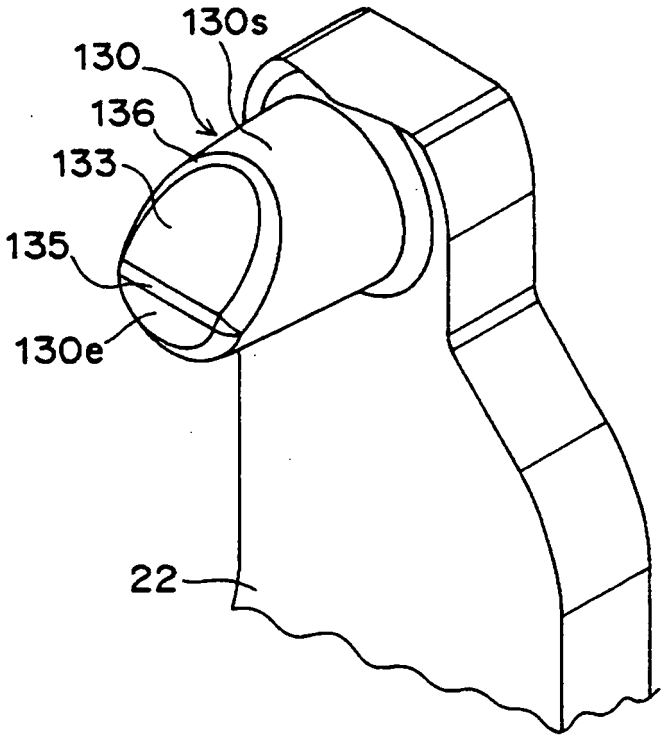

130s
130
136
133
135
130e
22

Fig.6

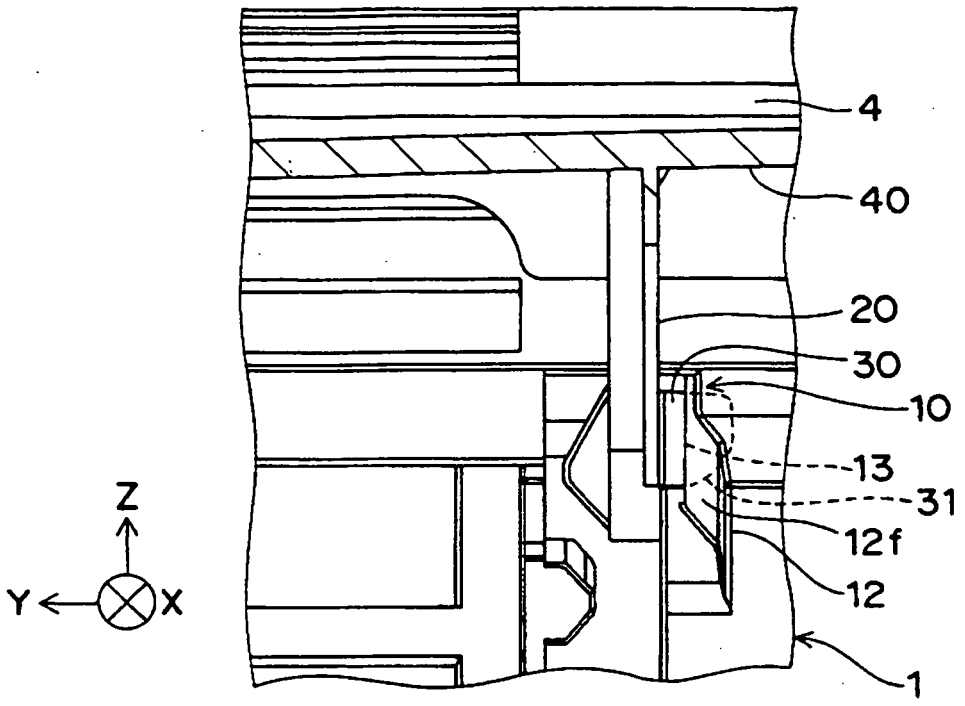


Fig.7

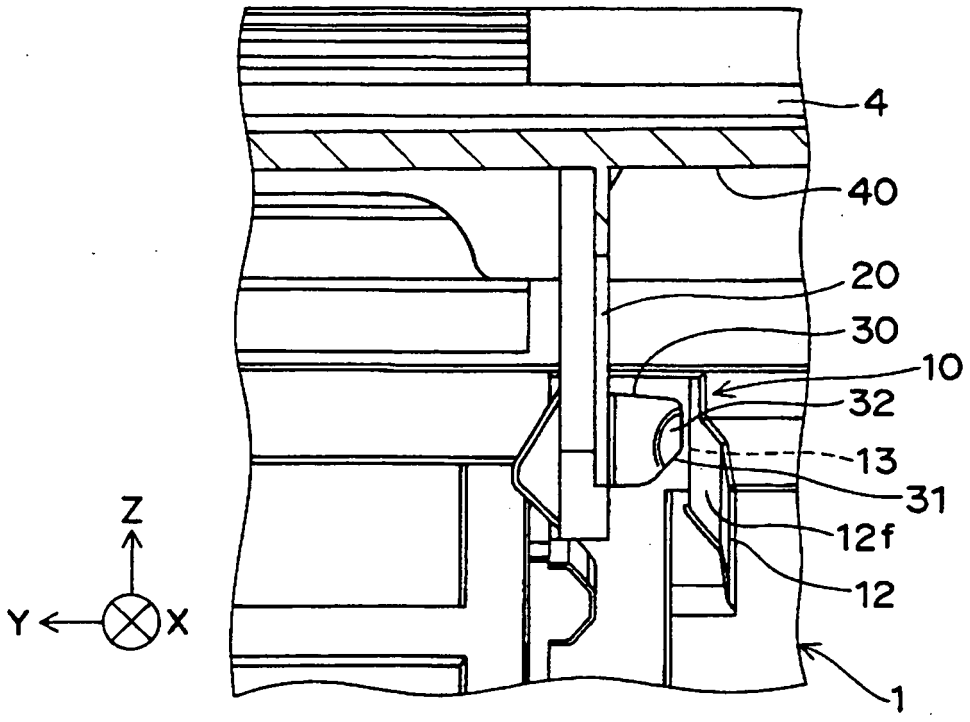


Fig.8

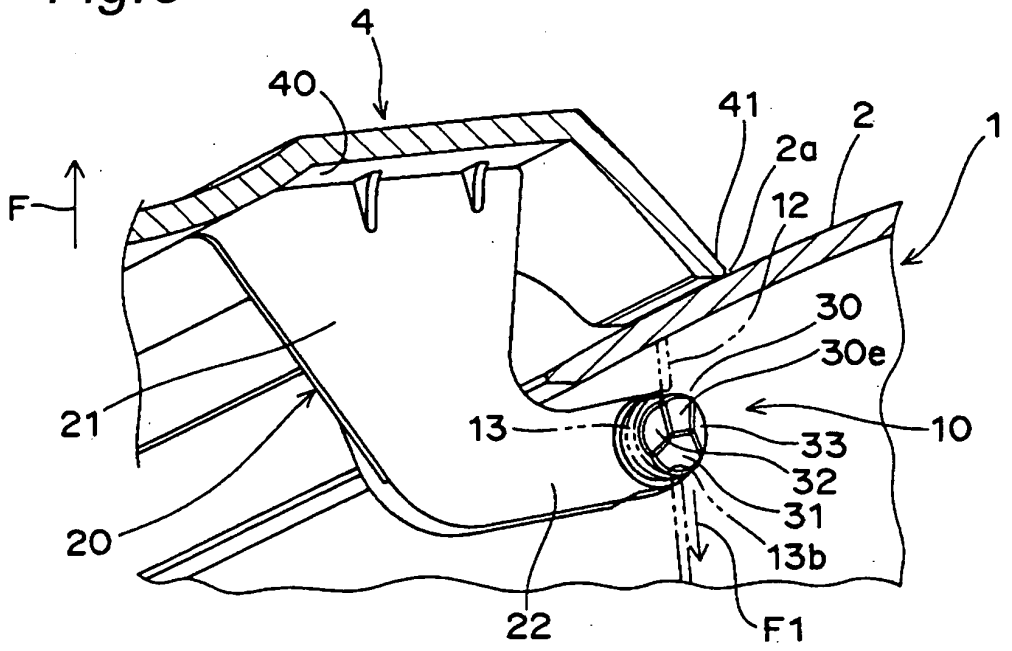

4
40
41
2a
2
1
F
12
30
30e
21
13
10
33
32
31
20
13b
22
F1

Fig.9

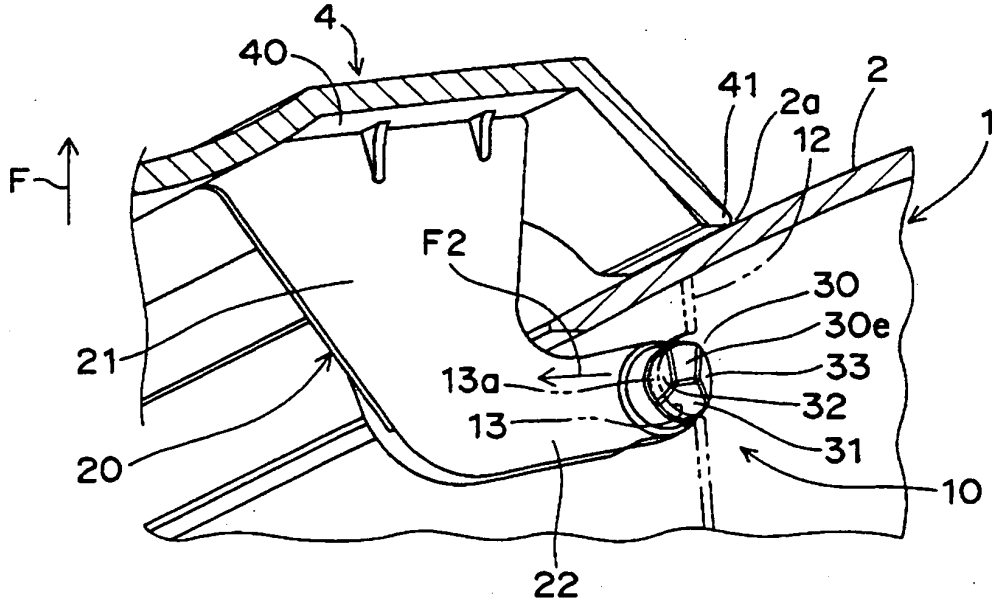

4
40
41
2a
2
1
F
12
F2
30
30e
21
13a
33
32
13
31
20
10
22

Fig.10

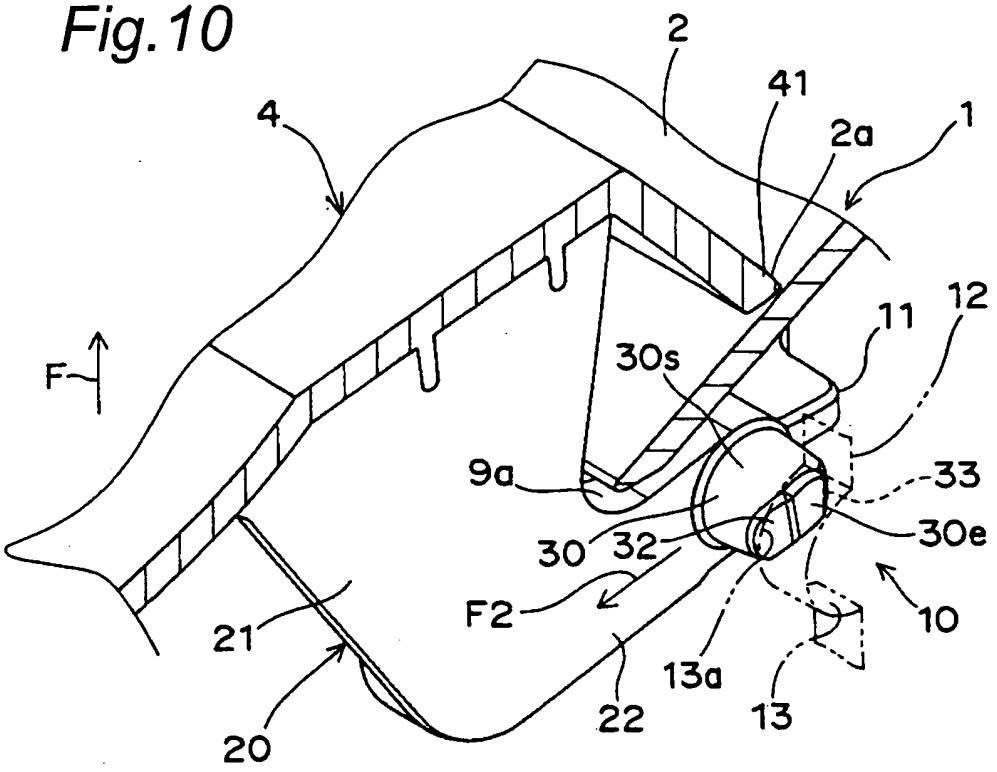
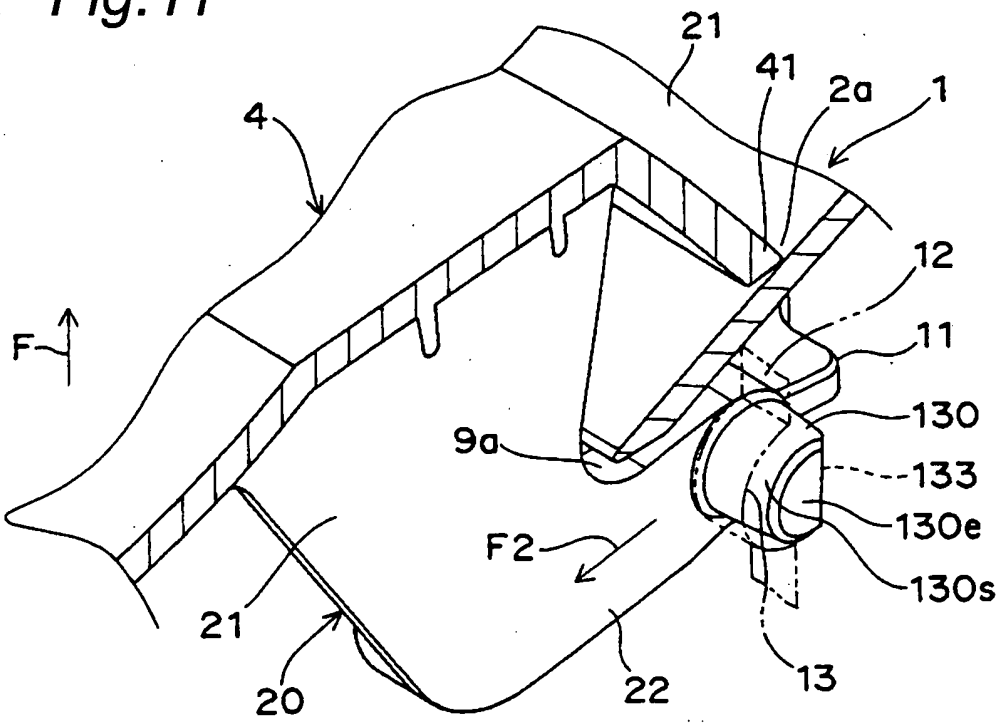

2
41
4
2a
1
11
12
30s
F
9a
33
30
32
30e
F2
10
21
13a
22
13
20

Fig.11


21
41
2a
1
4
12
11
F
130
9a
133
130e
F2
130s
21
13
20
22

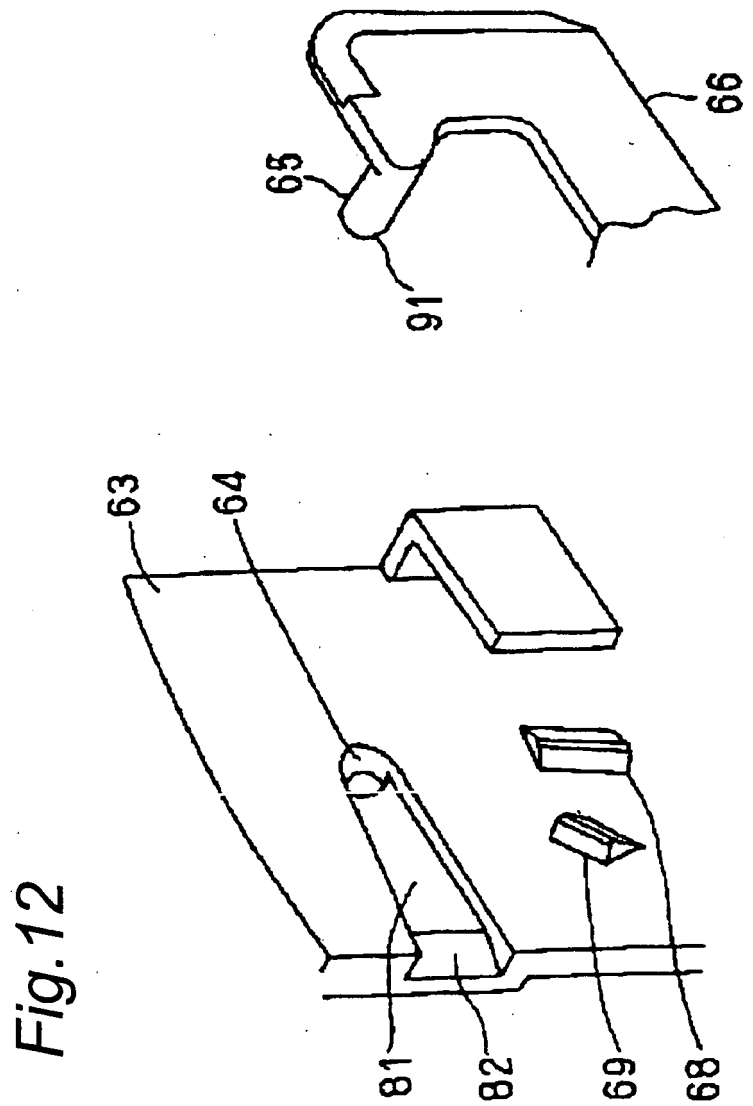


Fig.12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/066434

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/20(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)
F24F13/20

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.
A	JP 11-51417 A (Daikin Industries, Ltd.), 26 February, 1999 (26.02.99), Par. Nos. [0015], [0017]; Fig. 5 (Family: none)	1-4
A	JP 9-137961 A (Daikin Industries, Ltd.), 27 May, 1997 (27.05.97), Par. Nos. [0011] to [0019]; Figs. 4, 6 (Family: none)	1-4

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"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
15 November, 2007 (15.11.07)	27 November, 2007 (27.11.07)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 8135994A H **[0002]**