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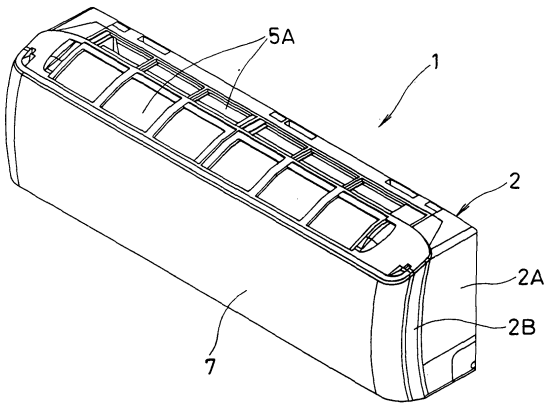
(54) Air conditioner

(57) An air conditioner comprises an air conditioner body (2) and a front panel (7) covering the front of the air conditioner body. The front panel (7) is supported on the air conditioner body (2) as reciprocally movable by a drive mechanism (27) between a first state closed and a second state open to ensure a certain air intake. The drive mechanism (27) includes a drive cum member (33) provided on the air conditioner body (2) and operative to reciprocally swing by an electrically driven mechanism (34), and a follower cum member (35) provided to impinge on the drive cum member (33) and operative to reciprocally swing by the drive cum member (33).

Fig. 1



EP 1 630 481 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an air conditioner equipped with an open/close mechanism for varying an inlet of air flowing into a heat exchanger arranged in the air conditioner.

Description of the Related Art

[0002] An air conditioner includes a heat exchanger and a fan arranged therein. While the air conditioner operates, a front panel of the air conditioner is made open to widen an air inlet such that a sufficient amount of air can flow into the heat exchanger. An intake grille is divided into upper and lower grilles to which gears are provided respectively. A middle gear engaged with one of the gears is driven by a motor to rotate the one gear, and a rack (linear gear) engaged with the middle gear is operated to rotate the other gear to open/close both intake grilles (upper and lower grilles). Such a mechanism has been known (for example, see Patent Document 1: JP-A 2003-156225).

[0003] The mechanism of Patent Document 1 is configured to transmit the driving force from the motor to the intake grilles via the gears. Therefore, in combination of the intake grilles with the air conditioner body, the gears must be assembled on certain engagement. For that purpose, the intake grilles require accuracy of attaching locations, whichmakes it difficult to implement assembling on production and assembling at the time of internal repairing and checking. In addition, the need for a plurality of gears and racks complicates assembling and increases costs.

[0004] In order to reduce a thickness of an air conditioner in consideration of such the point, the present invention provides an air conditioner capable of closing a front panel when the air conditioner is not used and opening the front panel to suck air sufficientlywhen the air conditioner is operated. The front panel is driven not by combined gears but by application of a simple mechanism. In addition, the front panel is configured removable and easily assembled to provide an air conditioner that is easy for assembling on production and internal repairing and checking.

SUMMARY OF THE INVENTION

[0005] In a first aspect the invention provides an air conditioner, which comprises an air conditioner body housing a heat exchanger and a fan therein, and a front panel covering the front of the air conditioner body. The front panel is supported on the air conditioner body as reciprocally movable by a drive mechanism between a first state closed and a second state open to ensure a certain air intake. The drive mechanism includes a drive cum member provided on the air conditioner body and operative to reciprocally swing by an electrically driven mechanism, and a follower cum member provided to impinge on the drive cum member and operative to reciprocally swing by the drive cum member.

[0006] In a second aspect of the invention, the front panel is removable from the air conditioner body together with the follower cum member.

[0007] In a third aspect of the invention, the air conditioner body and the front panel are linked to each other by the left and right operation arms pivoted at the front of the air conditioner body and the rear of the front panel. A follower cum surface is formed in the rear surface of at least one of the operation arms. A drive cum surface impinging on the follower cum surface is formed on the front of the drive cum member, and the drive cum member operative to reciprocally turn by the electrically driven mechanism is provided on the air conditioner body.

[0008] In a fourth aspect of the invention, a base member is provided behind the front panel as removably supported on the front of the air conditioner body. The base member and the front panel are linked and supported to each other via the left and right operation arms pivoted at the base member and the front panel.

[0009] In a fifth aspect of the invention, the front panel and the base member are detachably attached in set to the air conditioner body while linked by the left and right operation arms.

[0010] In a sixth aspect of the invention, the front panel is controlled to turn into the first state while the air conditioner is not operated and to turn into the second state while the air conditioner is operated.

[0011] In the present invention, the driving force from the electrically driven mechanism for opening/closing the front panel is transmittedvia impingement between the drive cum member and the follower cum member. Therefore, in comparison with the power transmission system with gear engagement , the driving force transmission mechanism has a larger margin of combination. Accordingly, assembling on production and assembling at the time of internal repairing and checking can be performed easily. This is suitable for configuring the opening/closing front panel to be removable from the air conditioner body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a top perspective view of an air conditioner according to the present invention (Example 1);

Fig. 2 is a top perspective view of the air conditioner according to the present invention with a front panel kept open (Example 1);

Fig. 3 is a vertical cross-sectional side view of the air conditioner according to the present invention (Example 1);

Fig. 4 is a top perspective view showing a relation

between the front panel and a base member according to the present invention (Example 1);
Fig. 5 isavertical cross-sectional side view illustrative of the front panel according to the present invention kept closed (Example 1);
Fig. 6 isavertical cross-sectional side view illustrative of the front panel according to the present invention kept open (Example 1);
Fig. 7 is a partial perspective view of the front of the air conditioner body according to the present invention (Example 1) ;
Fig. 8 is a perspective view of the left-side coupling portion between the front panel and the base member according to the present invention shown from the rear (Example 1);
Fig. 9 is a perspective view of the right-side coupling portion between the front panel and the base member according to the present invention shown from the rear (Example 1); and
Fig. 10 is a perspective view of a detachably attachable coupling structure between the front panel and an operation arm according to the present invention and an exploded view thereof (Example 1).

DETAILED DESCRIPTION OF THE INVENTION

[0013] An air conditioner of the present invention comprises an air conditioner body housing a heat exchanger and a fan therein, and a front panel covering the front of the air conditioner body. The front panel is supported on the air conditioner body as reciprocally movable by a drive mechanism between a first state closed and a second state open to ensure a certain air intake. The drive mechanism includes a drive cum member provided on the air conditioner body and operative to reciprocally swing by an electricallydrivenmechanism, andafollower-cummemberprovided to impinge on the drive cum member and operative to reciprocally swing by the drive cum member.

[0014] Embodiments of the present invention will nowbe described. Fig. 1 is a top perspective view of an air conditioner according to the present invention. Fig. 2 is a top perspective view of the air conditioner according to the present invention with a front panel kept open. Fig. 3 is a vertical cross-sectional side view of the air conditioner according to the present invention. Fig. 4 is a top perspective view showing a relation between the front panel and a base member according to the present invention. Fig. 5 is a vertical cross-sectional side view illustrative of the front panel according to the present invention kept closed. Fig. 6 is a vertical cross-sectional side view illustrative of the front panel according to the present invention kept open. Fig. 7 is a partial perspective view of the front of the air conditioner body according to the present invention. Fig. 8 is aperspectiveviewof the left-side coupling portion between the front panel and the base member according to the present invention shown from the rear. Fig. 9 is a perspective view of the right-side coupling portion between the front panel and the base member according to the present invention shown from the rear. Fig. 10 is a perspective view of a detachably attachable coupling structure between the front panel and an operation arm according to the present invention and an exploded view thereof.

[0015] In the figures, an air conditioner 1 according to the present invention is a wall-mount indoor air conditioner of the type that is mounted on a wall in a room. The air conditioner is contained in a set of separate air conditioning device, which also contains an outdoor machine that houses a refrigerant compressor, a condenser, a heat exchanging fan and so forth. The air conditioner 1 comprises a heat exchanger 3 and a fan 4 arranged therein and has an air inlet 5 formed in the top.

[0016] Specifically, the air conditioner 1 has a laterally elongated shape composed of an air conditioner body 2 and a front panel 7. The air conditioner body 2 has a basic section 2A located behind the air conditioner 1 and a cover section 2B combined with the front of the basic section 2A. The cover section 2B is formed in the shape of a frame, like the outer shape of the air conditioner 1, having front and rear apertures. Abase member 20 is detachably attached to the cover section 2B to cover the front aperture of the cover section 2B therewith. This structure allows the base member 20 to be detachably provided at the front of the air conditioner body 2.

[0017] The front panel 7 is removably attached to the base member 20 as described later. To the front of the basic section 2A, the heat exchanger 3, the fan 4, an electrical equipment box and so forth are attached. The cover section 2B covers around these parts and the base member 20 covers the front thereof. When the air conditioner 1 is mounted on a wall in a room, the rear of the basic section 2A is attached to an attachment plate fixed on the wall in the room.

[0018] As described above, the heat exchanger 3 and the fan 4 are arranged in the air conditioner body 2. The heat exchanger 3 has a front heat exchanging section 3A arranged almost in an inverted V-shape and a rear heat exchanging section 3B. The front heat exchanging section 3A has a lower portion formed as a folded-back portion 3A1. The heat exchanger 3 is structured as a plate fin heat exchanger, which includes a plurality of thin aluminum plates P arranged in parallel and refrigerant pipes Q arranged to pass therethrough. The fan 4 is a lateral flowing fan, in which a plurality of wings 4A extending in the lateral direction are arranged along a circumference and a lateral shaft 4B is rotated by a motor. The fan is located inside the heat exchanger 3 and has a length almost spanning the whole lateral width of the heat exchanger 3.

[0019] The air sucked through the air inlet 5 into the air conditioner 1 on operation of the fan 4 flows from the top and front of the air conditioner body 2 into the heat exchanger 3. For that purpose, laterally elongated air inlets are formed through the top and front of the laterally elongated air conditioner body 2. Therefore, through the

top of the air conditioner body 2 is formed a laterally elongated top air inlet 5A, and through the front of the air conditioner body 2 is formed a laterally elongated front air inlet 5B.

[0020] The top air inlet 5A is formed through the basic section 2A and the cover section 2B in the shape of grids. The front air inlet 5B is formed through the base member 20 in the shape of grids. A mesh filter 6 is arranged behind these air inlets 5A and 5B.

[0021] The filter 6 includes a filter mesh and plastics frame formed around the filter mesh. The mesh is integrated with the frame simultaneously when the frame is injection-molded. Such filters are employed as a set of the left and right filters. Filter support rails 9 are formed on both the left and right sides and the middle portion of the air conditioner body 2. When the front panel 7 is kept open, the left and right filters 6 canbe detachably attached to the filter support rails 9 by sliding insertion from the front opening of the cover section 2B toward upward.

[0022] The set of the left and right filters 6 are supported at the left and right edges by the filter support rails 9 provided behind. In such the state, the filters are located proximate to or against the rear of the air inlets 5A, 5B to cover the entire region of the front and top of the heat changer 3.

[0023] For the purpose of facilitating the filter 6 sliding into the filter support rails 9 and preventing the middle portion of the filter 6 from lowering toward the heat exchanger 3, a frame may be formed in the shape of grids as a support behind the filter 6. The frame is formed of lateral bolts 9A spanning the left and right filter support rails 9, 9 and vertical bolts 9B spanning the lateral bolts 9A vertically.

[0024] To improve the heat exchange at the heat exchanger 3 in the shown state, the air conditioner 1 makes the front panel 7 open forward as shown with the dashed line in Fig. 3 to widen the area at the front of the air inlet 5. As a result, the air inlet 5 is extended forward to expand the air sucking area, thereby increasing the amount of air sucked through the front air inlet 5B. The reference numeral 10 denotes an air cleaning filter, which is composed of a chemical fibrous filter that has an air cleaning action with higher accuracy than the filter 6.

[0025] On operation of the fan 4, the air heat-exchanged with the heat exchangers 3A, 3B is blown toward the front through a laterally elongated rectangular air outlet 11 formed at the lower portion of the front of the air conditioner 1. The air outlet 11 is equipped with a vertical wind shifter 12 pivoted as vertically movable by a pivot 12A, and a lateral wind shifter 13 operative to divide the blowing air flow into a plurality of lateral flows. The dew or dewdrop flowing down from the heat exchangers 3A, 3B is received in drain pans 14, 15 located below and discharged to outside the room.

[0026] The following description is given to the configuration, in which the front panel 7 operates to open forward so as to widen the air inlet 5. The front panel 7 is linked/supported on the base member 20 by vertically arranged pairs of the left and right operation arms 21A, 21B. At one end, the left and right operation arms 21A, 21B are rotatablypivoted at the pivots 22A, 22B on the rear of the front panel 7. At the other end, the left and right operation arms 21A, 21B are passed through elongated holes 24A, 24B in the base member 20 and rotatably pivoted at the pivots 23A, 23B on the rear of the base member 20. In axial coupling between the upper operation arms 21A, 21B and the base member 20, the ends of the operation arms 21A, 21B are attached to a lateral rod 50 laterally attached to the rear of the upper portion of the base member 20 to configure the pivots 23A, 23B.

[0027] With such the configuration, the front panel 7 are supported on the base member 20 by the operation arms 21A, 21B and movable in the forward and backward directions relative to the base member 20 as the operation arms 21A, 21B rotationally move. In the embodiment shown in the figures, the front panel 7 is elongated laterally. Accordingly, in order to stabilize the movements of the front panel 7 in the forward and backward directions relative to the base member 20, the middle portion of the front panel 7 is linked/supported on the base member 20 by a middle operation arm 21C.

[0028] The operation arm 21C has one end rotatably pivoted at the pivot 22C on the rear of the front panel 7 and the other end passed through the base member 20 and rotatably pivoted at the pivot 23C on the lateral rod 50. The support by the middle operation arm 21C is an auxiliary and accordingly can be omitted depending on the model of the air conditionerl.

[0029] To support the base member 20 removably on the front of the air conditioner body 2, hooks 25A, 25B are formed on the left and right upper portions of the base member 20. The hooks 25A, 25B can detachably engage an engagement section 26A formed as a hole or recess in the front of the cover section 2B of the air conditioner body 2. The lower portion of the base member 20 may be attached to the cover section 2B by screws, engagement members with resilient hooks, or other detachable support means. In such the case, the base member 20 can be attached to the front of the air conditioner body 2 with stability and removably supported thereon.

[0030] Supporting the base member 20 removably on the front of the air conditioner body 2 allows the following operations. When the base member 20 is attached to the front of the air conditioner body 2, the front panel 7 supported on the base member 20 by the operation arms 21A, 21B, 21C can also be attached to the front of the air conditioner body 2 at the same time. When the base member 20 is removed from the front of the air conditioner body 2, the front panel 7 can also be removed from the front of the air conditioner body 2 at the same time.

[0031] The front panel 7 is supported on the air conditioner body 2 as reciprocally movable between a first state closed and a second state opened by a drive mechanism 27. The drive mechanism 27 includes an electrically driven mechanism 34 equipped with a drive cum

member 33, and a follower cum member 35 operative to follow the drive cum member 33.

[0032] The electrically driven mechanism 34 includes, as shown in Fig. 5, a motor 28, a small gear 29 rotatably driven by the motor 28, a large gear 30 engaging with the small gear 29, a small gear 31 located coaxially with the large gear 30, and the drive cum member 33 having teeth 32 formed thereon to engage with the small gear 31. The drive cum member 33 is rotatably pivoted at the pivot 36 in a recess 37 formed in the cover section 2B of the air conditioner body 2.

[0033] The follower cum member 35 is rotatably pivoted on the front of the air conditioner body 2. Specifically, the follower cum member 35 is formed integrally with the one operation arm 21B and has a follower cum surface 35A formed in the rear of the operation arm 21B.

[0034] A mountain-like cum surface 33A is formed on the front of the drive cum member 33 and a valley-like cum surface 35A is formed on the rear of the follower cum member 35. Impingement between both cum surfaces 33A and 35A allows the follower cum member 35 to reciprocally rotate as the drive cum member 33 reciprocally rotates. Reciprocal rotations of the drive cum member 33 can be caused from normal and reverse rotations of the motor 28.

[0035] In the air conditioner 1, the front panel 7 is linked to the base member 20 via the operation arms 21A, 21B, 21C and the base member 20 is attached to the front of the air conditioner body 2. While the air conditioner 1 is not running, the front panel 7 is shifted to the base member 20 and turned into the closed state (first state) as shown in Fig. 5. In such the state, when the run switch of the air conditioner 1 is turned ON, the motor 28 rotates in the normal direction to rotationally move the drive cum member 33 from the state in Fig. 5 clockwise and rotationally move the follower cum member 35 correspondingly. This movement shifts the front panel 7 apart from the base member 20 and turns it into the opened state (second state) as shown in Fig. 6. When the front panel 7 reaches the opened second state, the motor 28 is controlled to halt normal rotations by a controller (not shown).

[0036] In such the state, when the halt switch of the air conditioner 1 is turned ON, the motor 28 rotates in the reverse direction to rotationally move the drive cum member 33 counterclockwise from the state shown in Fig. 6 and correspondingly rotationally move the follower cum member 35 counterclockwise. This movement returns the front panel 7 to the closed state (firststate) such that the front panel 7 impinges on or locates proximate to the base member 20 as shown in Fig. 5. When the front panel 7 reaches the closed first state, the motor 28 is controlled to halt reverse rotations by the controller (not shown).

[0037] Thus, in the state of the air conditioner 1 halted running, the front panel 7 is brought into the first state closed, which holds the air inlet 5 narrowed and presents a thinned appearance of the air conditioner 1. This is effective to reduce gloomy and suppress invasions of dust and dirt.

[0038] When the front panel 7 is brought into the second state opened, the air inlet 5 is widened to ensure a certain air intake through the front air inlet 5B. Accordingly, it is possible to promote the heat exchange at the front heat exchanger 3A and achieve a nice air conditioning effect.

[0039] Turning ON of the run switch and the halt switch of the air conditioner 1 means an operation of the switch manually operated or timer-controlled to select any one of cooling, heating, dehumidifying, ventilating and indoor air circulating of the air conditioner 1.

[0040] The pivots 22A, 22B, 22C serving as the coupling portions between the front panel 7 and the operation arms 21A, 21B, 21C are configured detachable. In a word, the ends of the operation arms 21A, 21B, 21C are combined to sandwich a bearing 40 formed behind the front panel 7 as shown in Fig. 10. A shaft 41 passes through the operation arms 21A, 21B, 21C and the bearing 40, extending from a shaft member 42. The shaft member 42 is supported axially slidable on supports 43, 43 formed behind the front panel 7. Therefore, resilience of the supports 43, 43 fits protrusions 45 of the supports 43, 43 into a groove 44 in the shaft member 42. In this state, the shaft member 42 is held at a location where the shaft 41 passes through the operation arms 21A, 21B, 21C and the bearing 40.

[0041] As the front panel 7 is removed, the shaft member 42 is strongly pulled laterally (right side in Fig. 10) from the fitted state shown in Fig. 10. As a result, resilience of the supports 43 , 43 can remove the protrusions 45 from the groove 44 to detach the front panel 7 from the operation arms 21A, 21B, 21C at the coupling portions. Therefore, the front panel 7 can be removed from the base member 20, leaving the operation arms 21A, 21B, 21C. If the protrusions 45 are fitted in another groove 46 in the shaft member 42, the shaft member 42 can be held in this state with stability.

[0042] As described above, the base member 20 is provided behind the front panel 7 as removably supported on the front of the air conditioner body 20. The front panel 7 is linked to and supported on the base member 20 via the left and right operation arms 21A, 21B pivoted at the front panel 7 and the base member 20.

[0043] In addition, the follower cum surface 35A is formed in the rear surface of at least one 21B of operation arms. The drive cum surface 33A impinging on the follower cum surface 35A is formed on the front of the electrically driven mechanism 34. The drive cum member 33 operative to reciprocally turn by the electrically driven mechanism 34 is provided on the air conditioner body 2.

[0044] The front panel 7 is reciprocally movable by the electrically drive mechanism 34 between the first state closed and the second state open to ensure a certain air intake. The front panel 7, the pivots 22A, 22B between the front panel 7 and the left and right operation arms 21A, 21B are removable from the base member 20 by the detachably attachable coupling. Further, the front panel 7 and the base member 20 are removable from

the air conditioner body 2 while linked by the left and right operation arms 21A, 21B.

[0045] Thus, the drive cum surface is configured to impinge on the follower cum surface formed in the rear surface of one operation arm to transmit the driving force. Therefore, the one operation arm can be utilized effectively. In addition, the driving force can be transmitted surely with few components to the front panel with a simplified configuration.

[0046] The pivots coupling between the front panel and the operation arm are configured detachable. Accordingly, only the front panel can be removed or otherwise the base member and the front panel can be removed in set. Therefore, easy assembling can be achieved on production. In addition, it is possible to select conveniently whether the front panel is removed or the base member and the front panel are removed in set depending on the situation at the time of internal repairing and checking.

[0047] The front panel and the base member can be removed in set. Thus, at the time of internal repairing and checking, the front of the air conditioner body can be opened wider. In addition, multiple types of front panels with different colors and multiple types of front panels with different graphic patterns may be prepared. In this case, it is possible to provide an air conditioner having a front panel structure that can be replaced or selected depending on tastes of consumers or corresponding to the interior in a room for installation.

[0048] The air conditioner of the present invention is not limited to the above embodiments as for the forms of the air inlet and so forth but rather applicable to various air conditioners without departing from the technical scope of the present invention.

Claims

1. An air conditioner, comprising;
   an air conditionerbodyhousing a heat exchanger and a fan therein, and a front panel covering the front of the air conditioner body, **characterized in that**
   the front panel is supported on the air conditioner body as reciprocally movable by a drive mechanism between a first state closed and a second state open to ensure a certain air intake,
   wherein the drive mechanism includes a drive cum member provided on the air conditioner body and operative to reciprocally swing by an electrically driven mechanism, and a follower cum member provided to impinge on the drive cum member and operative to reciprocally swing by the drive cum member.

2. The air conditioner according to claim 1, wherein the front panel is removable from the air conditioner body together with the follower cum member.

3. The air conditioner according to claim 1, wherein the air conditioner body and the front panel are linked to each other by the left and right operation arms pivoted at the front of the air conditioner body and the rear of the front panel, wherein a follower cum surface is formed in the rear surface of at least one of the operation arms, wherein a drive cum surface impinging on the follower cum surface is formed on the front of the drive cum member, and the drive cum member operative to reciprocally turn by the electrically driven mechanism is provided on the air conditioner body.

4. The air conditioner according to claim 1, wherein a base member is provided behind the front panel as removably supported on the front of the air conditioner body, wherein the base member and the front panel are linked and supported to each other via the left and right operation arms pivoted at the base member and the front panel.

5. The air conditioner according to claim 4, wherein the front panel and the base member are detachably attached in set to the air conditioner body while linked by the left and right operation arms.

6. The air conditioner according to any one of claims 1-4, **characterized in that** the front panel is controlled to turn into the first state while the air conditioner is not operated and to turn into the second state while the air conditioner is operated.

Fig. 1

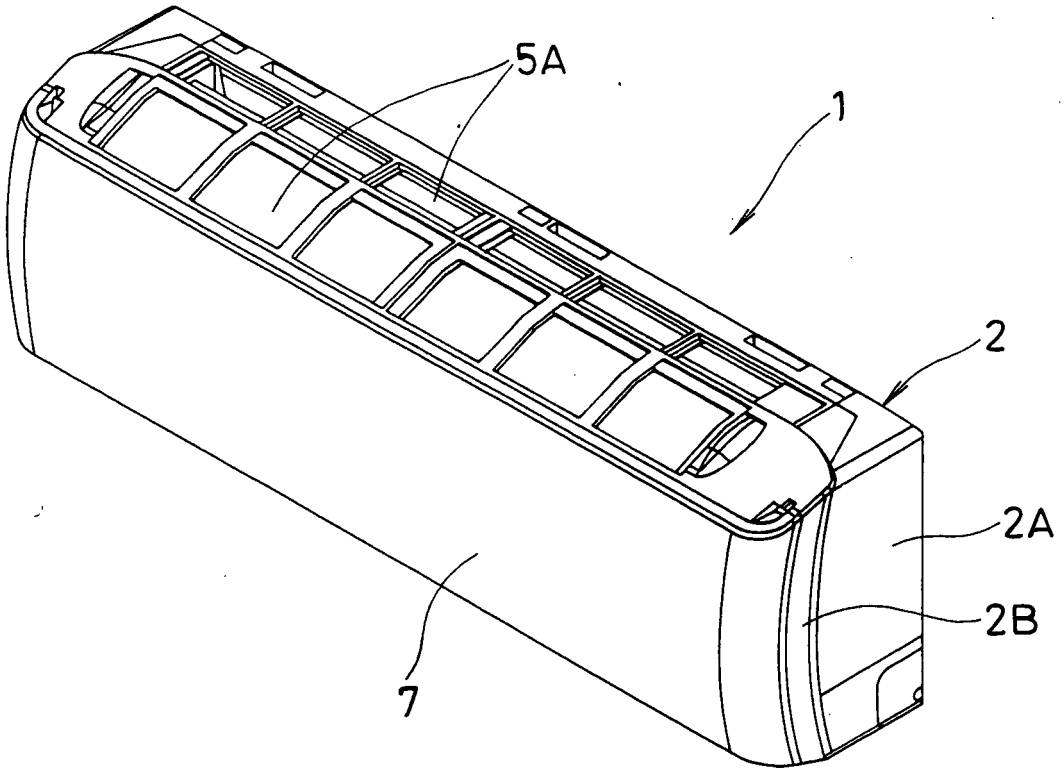


Fig. 2

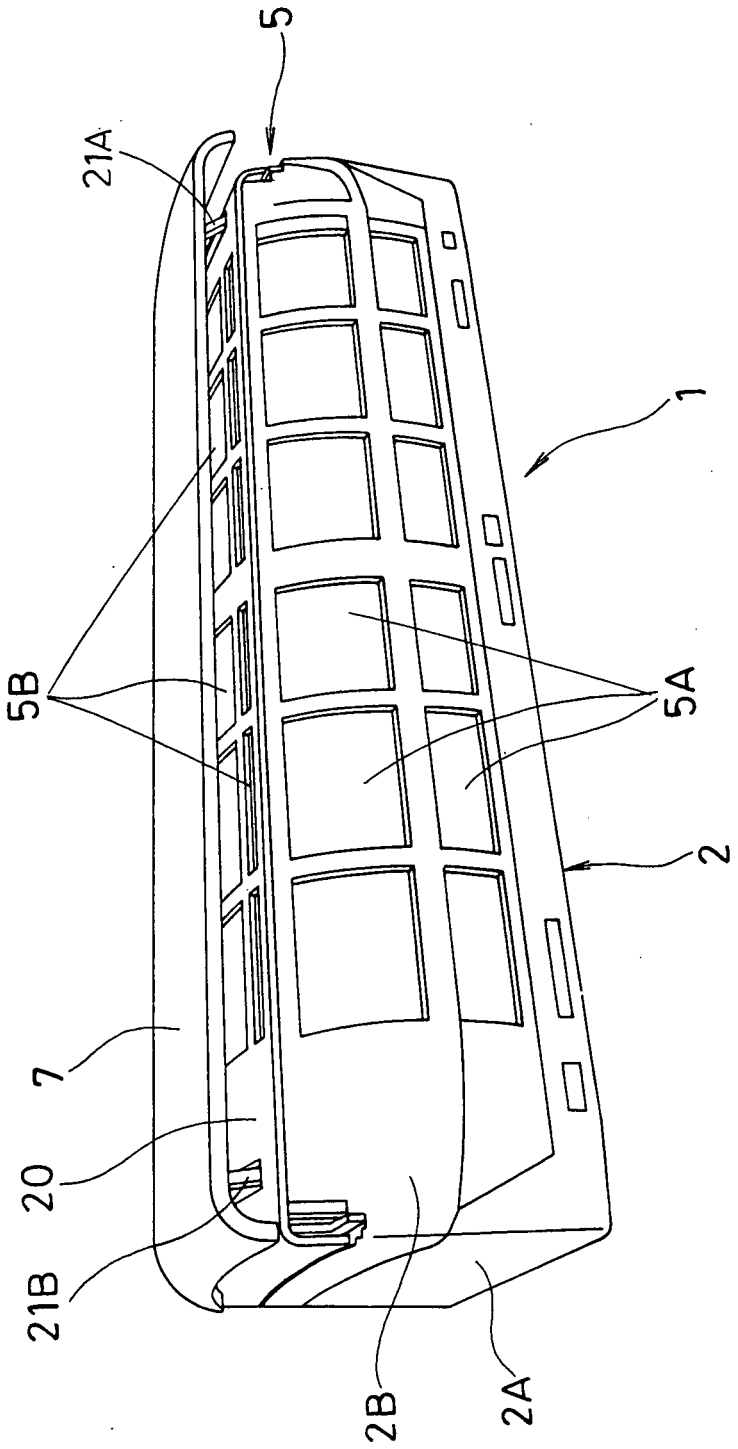


Fig. 3

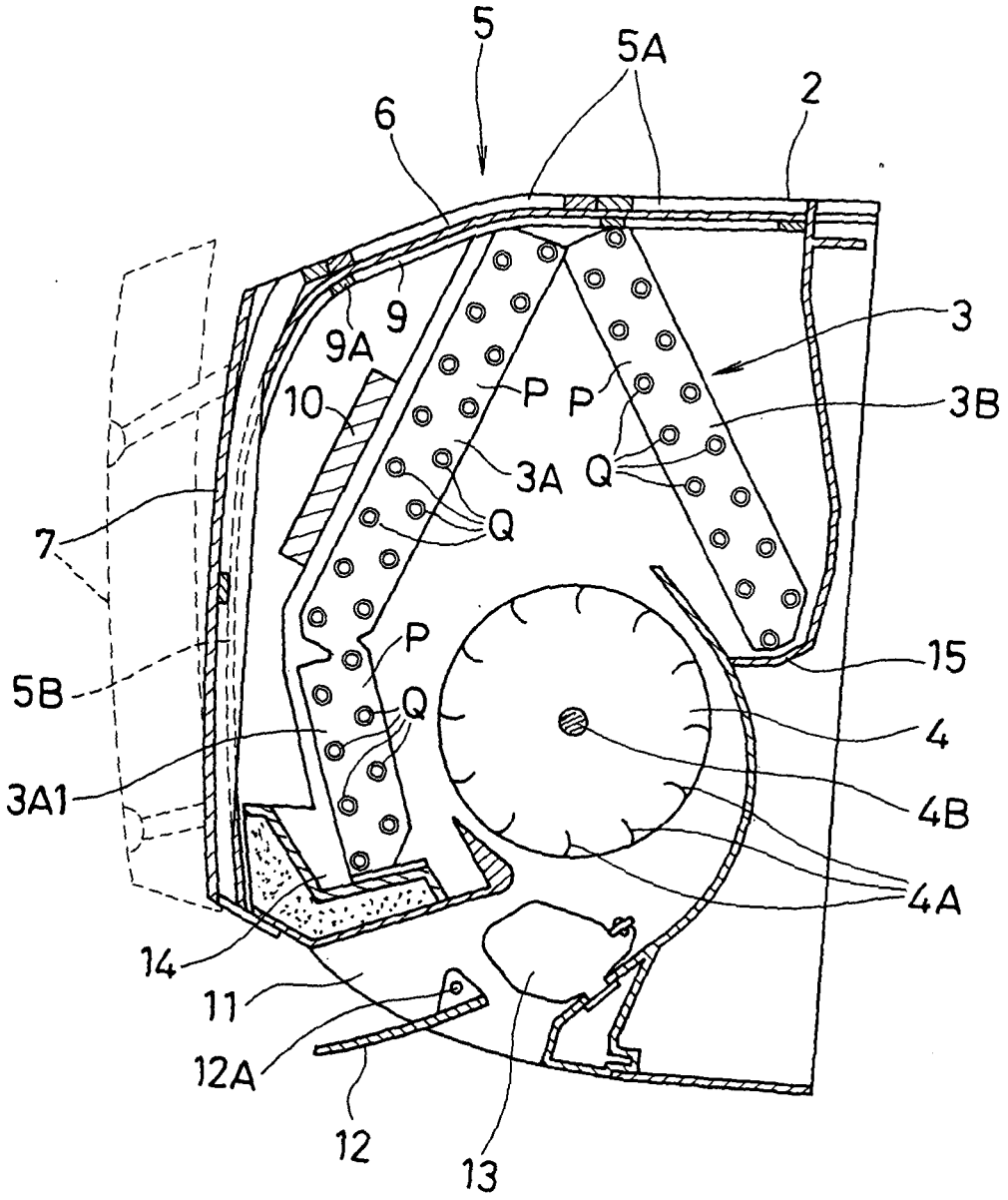


Fig. 4

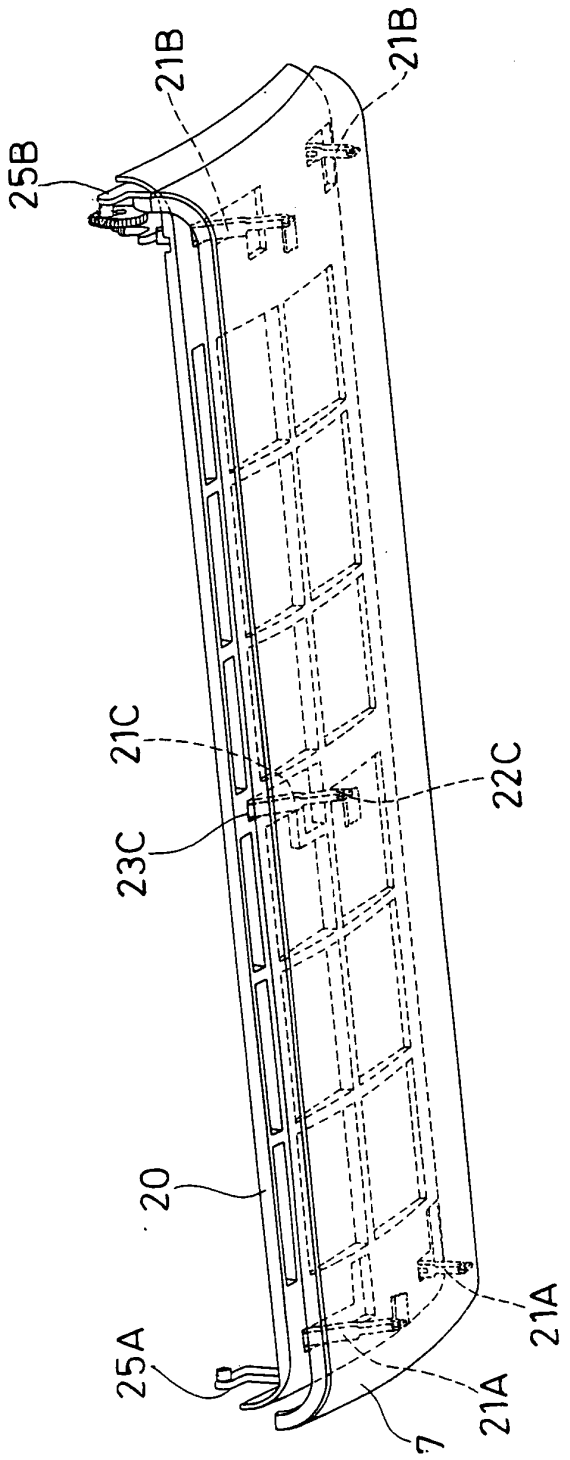


Fig. 5

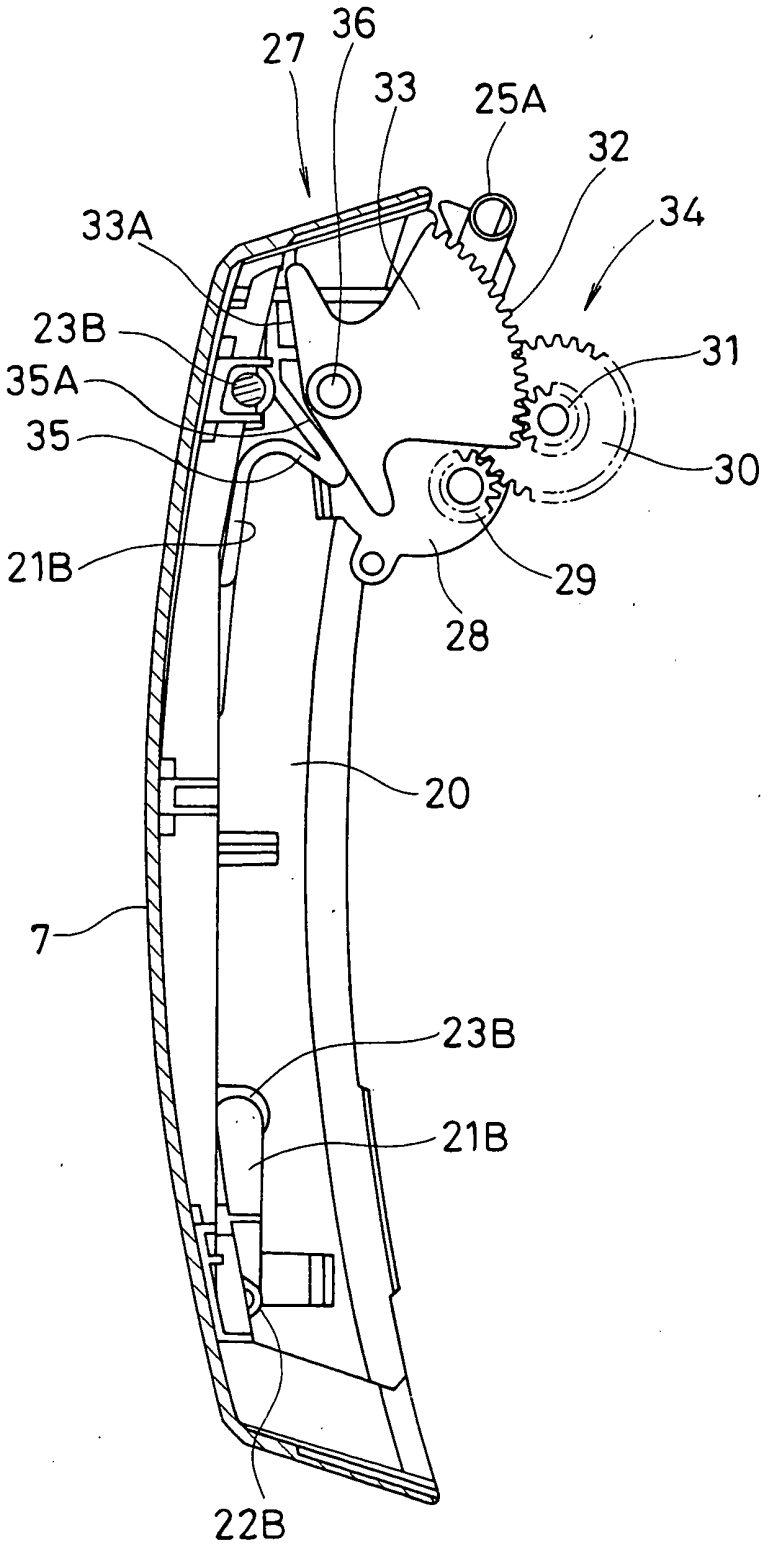


Fig. 6

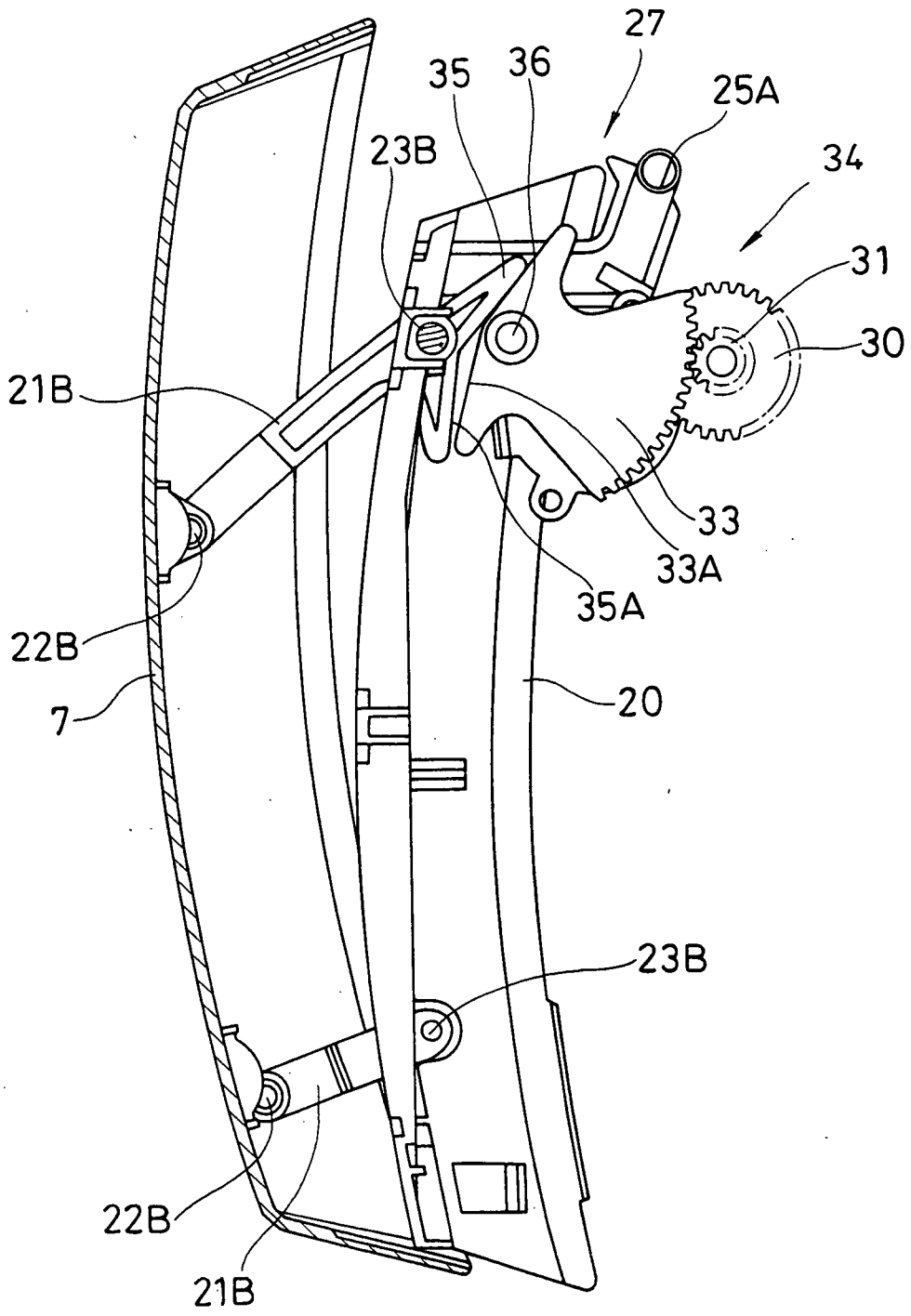


Fig. 7

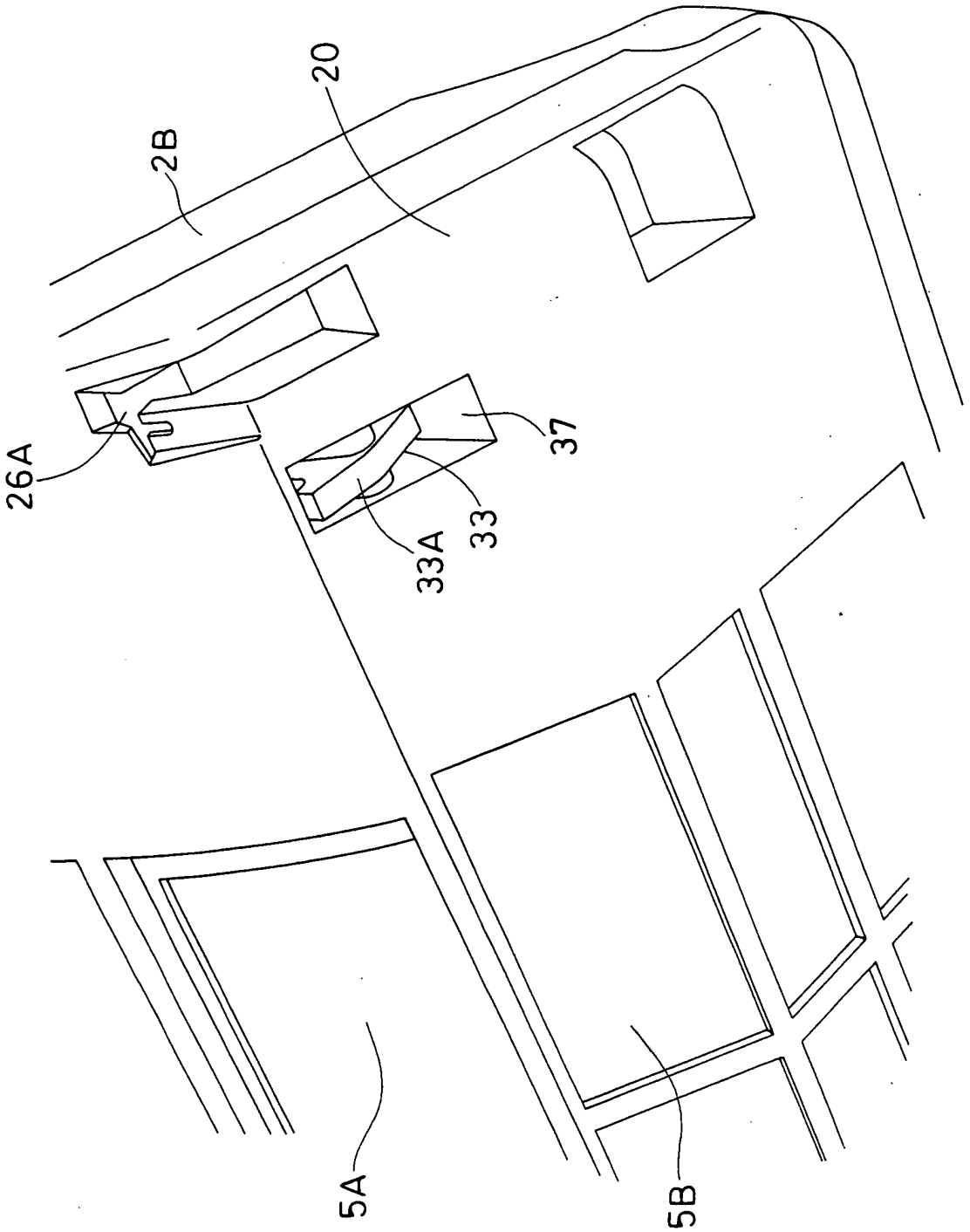


Fig. 8

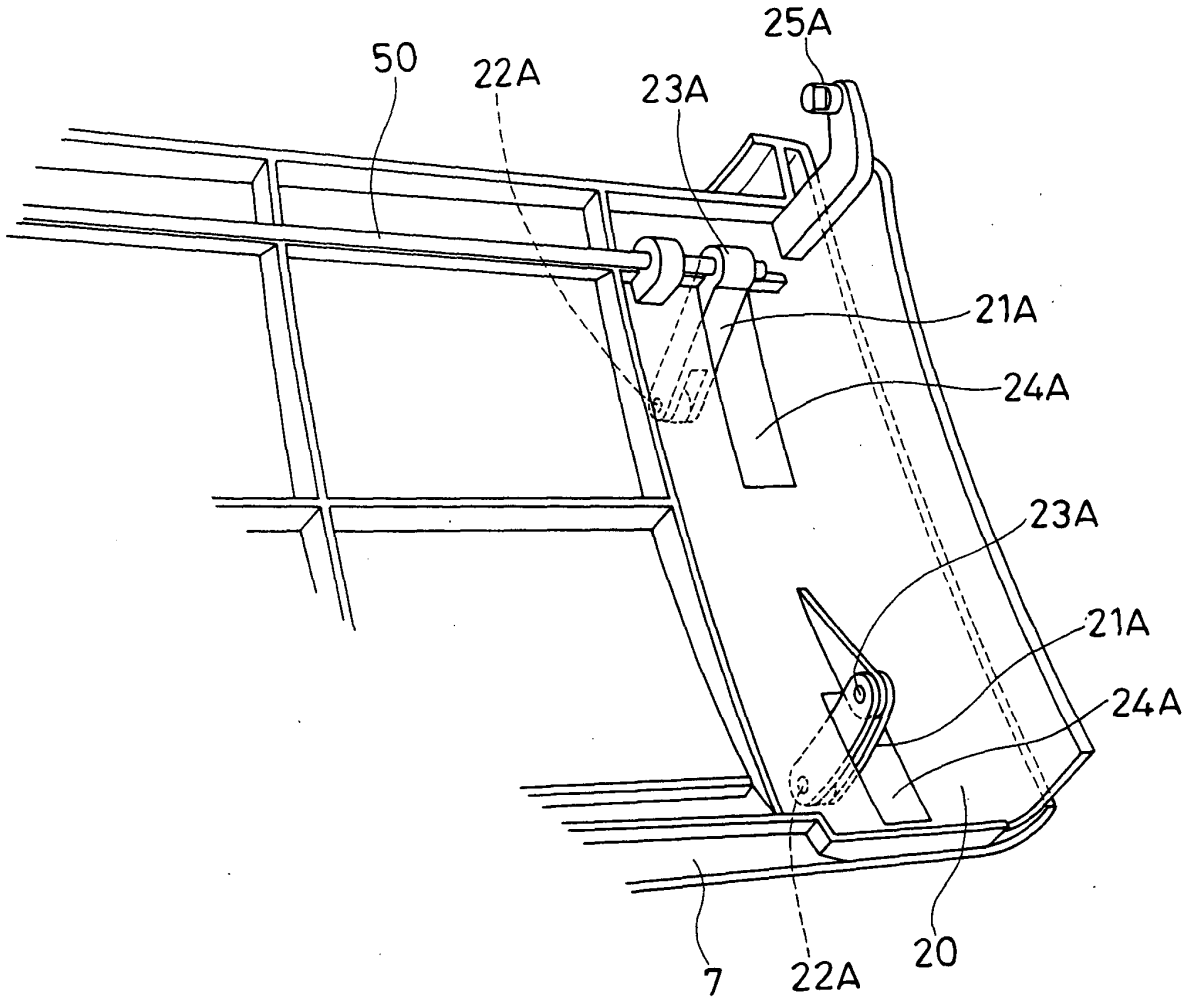


Fig. 9

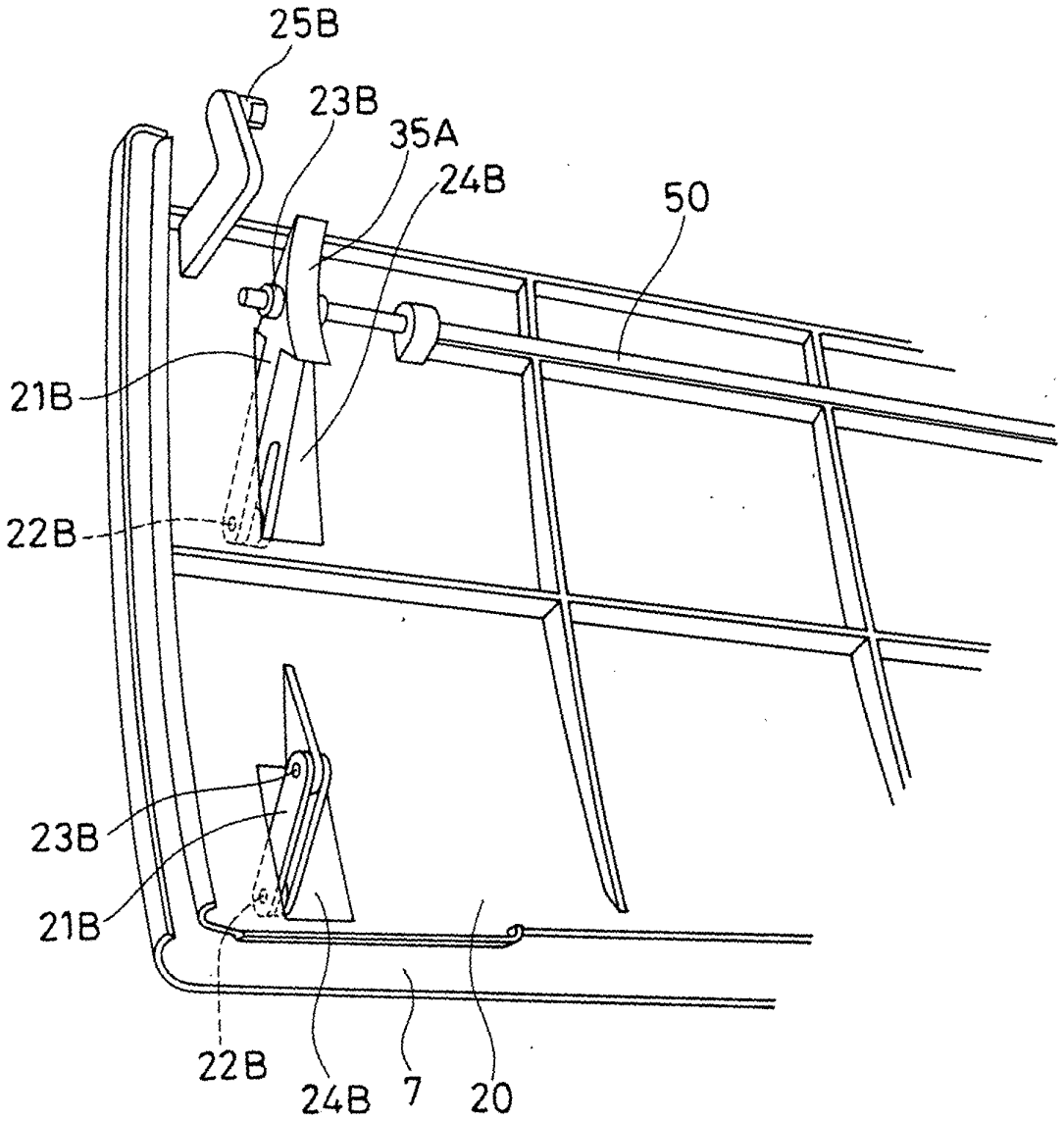


Fig. 10