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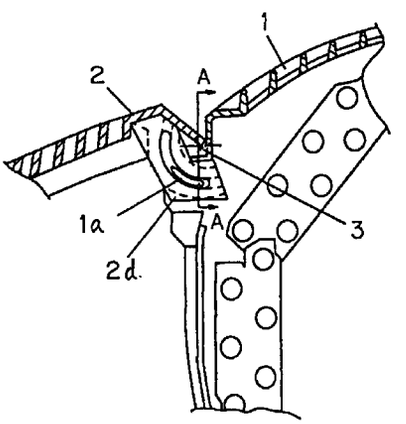
(54) Indoor unit of an air conditioner

(57) An indoor unit of an air conditioner having a front frame 1 composing an outer cover, and an intake grille 2, attachable to the front frame, also composing the outer cover and being free for opening and closing. The front frame 1 is provided with a fixed arc rib 1a and 1b which is concentric with an imaginary center 3 of open/close rotating movement of the intake grille 2. The intake grille 2 is provided with rotary arc ribs 2a and 2b or a projection 2d, having a groove 2c, which is/are also concentric with the imaginary center 3, and engage(s) with the fixed rib 1a and 1b over the range of the open/close rotating movement. The present invention thus simplifies mold structure, improves strength and accuracy, and reduces restrictions in design to provide better quality and more inexpensive indoor unit.

Fig 1



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Description

FIELD OF THE INVENTION

The present invention relates to an indoor unit of an air conditioner (hereinafter called "indoor unit" in short) equipped with an open/close device for its intake grille.

BACKGROUND OF THE INVENTION

Fig. 20 shows a conventional open/close device for an intake grille of an indoor unit. There is a rotary shaft hole 11b behind a guide groove 11a on a front frame 11. To open/close the intake grille 12, a rotary shaft 12b on the intake grille 12 is inserted along the guide groove 11a from the front until the rotary shaft 12b fits into the rotary shaft hole 11b on the front frame.

Projections 11c and 12c, provided in a position facing each other on the front frame 11 and the intake grille 12, engage on rotating the inlet grille 12 to a certain angle. The intake grille 12 remains open by the interference resistance ofthe projections 11c and 12c. When the intake grille 12 is further opened, an arm 12a of the intake grille 12 opens with an inclination 11d provided on the front frame 11, and the rotary shaft 12b of the intake grille 12 is taken off from the rotary shaft hole 11b. The intake grille 12 can then be removed from the front frame 11 by pulling out the intake grille 12 along the guide groove 11a toward the front.

The above open/close mechanism, however, requires complicated molds for making the rotary shaft 12b and the rotary shaft hole 11b. In particular, the area for creating the rotary shaft hole 11b on the front frame 11 is limited due to the shape of the front frame 11. Great efforts and time have been spent for overcoming such disadvantages, including the low strength of the rotary shaft 12b and the arm 12a.

To keep the intake grille 12 open, the conventional mechanism also requires the provision of projections 11c and 12c, facing each other, widthwise on the intake grille 12 and the front frame 11. This causes difficulties in the range of control. For example, variations in the length of the projections 11c and 12c, or warpage caused by molding often affect the holding power for keeping the intake grille 12 open, and also make assembly difficult.

Furthermore, when the intake grille 12 is held open during cleaning of internal parts such as the air filter, the rotary shaft 12b comes off with relatively little force, which often costs users repeated attempts to reattach the intake grille.

SUMMARY OF THE INVENTION

The present invention solves the disadvantages of the conventional device. An object of the invention is to provide an indoor unit equipped with a better quality and a less expensive open/close device for its intake grille, and more particularly, molds of simple structure and an open/close device of improved strength and accuracy which offers fewer restrictions in design.

The present invention provides an indoor unit with an outer cover composed of a front frame and an intake grille removably attached thereto with an open/close device to achieve the object. A fixed arc rib on the front frame and a rotary arc rib or a projection having a groove on the intake grille are provided at a position which is concentric with the center of the open/close rotating movement of the intake grille against the front frame. Here, the fixed arc rib engages with the rotary arc rib or the projection having the groove over the range of the open/close rotating movement of the intake grille. Thus, the present invention realizes a more simple open/close device for the intake grille which does not require complicated processing or assembling. The invention also improves strength and usability.

More specifically, the present invention relates to an open/close device for an intake grille, comprising a fixed arc rib on a front frame and a rotary arc rib or a projection having a groove on the intake grille. The fixed arc rib is placed concentric with the center of open/close rotating movement of the intake grille. The projection is also placed concentric with the center and engages with the fixed arc rib over the range of open/close rotating movements. The present invention thus realizes a simpler structure for molds used in processing and reduces restrictions in designing a fulcrum for the open/close rotating movement. Moreover, the invention improves the strength of an arc arm of the intake grille by setting a desired concentric dimension.

The present invention also relates to an arc portion of the front frame and the projection of the intake grille. The arc portion which is concentric with the fixed rib is disposed as a part of the front frame, composing its outer cover. The projection, which engages with the periphery of the arc portion, is turned into the arc arm which is concentric with the center of open/close rotating movement of the intake grille. The structure of the outer cover is simplified by incorporating the arc portion as a part of the front frame composing the outer cover. In addition, the mold is designed easier to construct by simplifying the shape of the open/close device because the projection on the intake grille can be used also as an arm. This will also reduce the space required for inserting the arm.

The present invention also relates to an arc-shaped projection provided on the intake grille. The arc-shaped projection engages with the periphery of the arc portion and is concentric with the center of the open/close rotating movement. This will enable smooth opening/closing of the intake grille by preventing the intake grille from sinking into the front frame due to warpage or other reasons.

The present invention also relates to a protrusion provided on the lower part of the arc portion to receive the arc-shaped projection on the intake grille. This will facilitate attachment of the intake grille to the front frame.

The present invention further relates to the length of the fixed rib, which is set preferably to extend 30° or more toward the front frame from a vertical line extended from the center of the open/close rotating movement of the intake grille. This will provide a wider guide, thereby allowing some inward warpage caused by molding as well as a degree of inaccuracy of the dimensions of the fixed rib and the rotary rib or the groove on the projection.

The present invention still further relates to the open/close device for the intake grille. The side edge of the fixed rib at the side of the intake grille is made thinner by tapering or sloping. This will also facilitate attachment of the intake grille to the front frame.

The present invention further relates to the shape of the fixed rib. When a vertical line is extended from the center of the open/close rotating movement of the intake grille, the shape of the fixed rib beyond the vertical line toward the intake grille is straight between horizontal and downward inclination. This will allow the intake grille to be attached horizontally from the front.

The present invention further relates to a spring member disposed on the open/close device. A small projection is disposed radially on the outermost periphery of the arc arm of the intake grille. On opening/closing the intake grille, the spring member interferes with the small projection. Specifically, on opening, the spring member bends in the interference direction, and on closing, the spring member keeps the intake grille open without closing to the required angle at least by a force couple of the intake grille itself. This will improve the open/close operability of the intake grille.

The present invention further relates to the slide knob disposed on the open/close device. The small projection is provided radially on the outermost periphery of the arc arm of the intake grille. When the intake grille is opened more than necessary, the slide knob encounters the small projection, providing a feeling of resistance and indicating the maximum extent to which it can be opened. This will prevent over-opening the intake grille.

The present invention further relates to the slide knob comprising a slide grip, and a concave and convex portion. The slide grip is provided perpendicular to a sliding direction on the surface of the slide knob. On the back side of the slide knob, there is a sliding groove running in the sliding direction with the concave and convex portion formed by notching a part of a wall composing the sliding groove. A rail provided on the front frame which engages with the sliding groove has a concave and convex notch which fit into the concave and convex portion of the slide knob.

The slide knob of the intake grille is inserted and slid to the front frame from the front by fitting the concave and convex portion into the concave and convex notch.

Furthermore, the back side of the slide knob is provided with a rib perpendicular to the sliding direction. An interference rib is provided correspondingly on the surface contacting the slide knob on the front frame in the same direction as the rib whose vertical section view of an interference height is trapezoid, semicircular, or triangle. This will facilitate the fitting of the slide knob on the front frame, and a clicking feel makes it easier to recognize precisely the required sliding operation. The grip face of the sliding grip efficiently transmits the operative force in the sliding direction.

The present invention furthermore relates to a slit provided on the rib. The slide grip is provided at the lowest part of the slide knob, and the slit is made on three sides around the rib on the back side of the slide knob, except for the side on the slide grip. This will facilitate the sliding operation with a smaller force by efficiently applying the moment on the rib at the back side of the slide knob, using the base of the slide grip as a fulcrum.

The present invention furthermore relates to a seal or label, indicating the sliding direction and its purpose, on the surface of the slide knob. This will provide better information for assuring proper operation of the slide knob.

The present invention finally relates to a stopper on the slide knob and an protrusion rib on the intake grille. The stopper, similar to the letter "L," is disposed on an upper part of the surface of the slide knob. The stopper interferes with and stops movement by means of the small projection provided on the arc arm of the intake grille. The protrusion rib is made to extend to the bottom of the roof part of the stopper, in a way that the distance between the protrusion rib and the outermost periphery of the arc arm remains longer than the length of the roof part in the sliding direction when closing the intake grille.

This will elevate the intake grille when the slide knob is out of its normal position to immediately indicate failure in operation of the slide knob.

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of a part concerned of a first exemplary embodiment of the present invention including an open/close device for the intake grille.

Fig. 2 is a partial and sectional side view of a first exemplary embodiment of the present invention including a front frame.

Fig. 3 is a partial and sectional side view of a first exemplary embodiment of the present invention including the intake grille.

Fig. 4 is a sectional view taken along lines A-A of Fig. 1.

Fig. 5 is a partial and sectional side view of a part concerned of a second exemplary embodiment of the present invention including an open/close device for the intake grille.

Fig. 6 is a sectional view taken along B-B lines of Fig. 5.

Fig. 7 is a sectional side view of a part concerned of a third exemplary embodiment of the present invention including the open/close mechanism of the intake grille.

Fig. 8 is a sectional side view of a part concerned of a fourth exemplary embodiment of the present invention including the open/close device for the intake grille.

Fig. 9 is a partial and sectional side view of a fourth exemplary embodiment of the present invention including the front frame.

Fig. 10 is a partial and sectional side view of a fifth exemplary embodiment including the front frame.

Fig. 11 is a sectional side view of a part concerned of a sixth exemplary embodiment including the open/close device for the intake grille.

Fig. 12 is a sectional side view of a part concerned of a seventh exemplary embodiment including the open/close device for the intake grille.

Fig. 13 is a sectional side view of a part concerned of a eighth exemplary embodiment including the open/close device for the intake grille.

Fig. 14 is a sectional side view of a part concerned of a ninth, tenth, and thirteenth exemplary embodiments including an arc arm and a slide knob.

Fig. 15 is a bottom view of a ninth exemplary embodiment including the slide knob.

Fig. 16 is an exploded perspective view of a ninth and twelfth exemplary embodiments including the slide knob and the front frame.

Fig. 17 is a front view of a eleventh exemplary embodiment including the slide knob.

Fig. 18 is a sectional side view of a eleventh exemplary embodiment including the slide knob.

Fig. 19 is a sectional side view of a part concerned of a thirteenth exemplary embodiment including the intake grille and the slide knob.

Fig. 20 is a partial side view of the open/close device for the intake grille of a conventional indoor unit.

DETAILED DESCRIPTION OF THE INVENTION

Exemplary embodiments of the present invention is described below using the figures 1 to 19.

The first exemplary embodiment

In Fig. 1 to Fig. 4, a front frame 1 composes an outer cover of an indoor unit, and an intake grille 2 also composes the outer cover. The intake grille 2 is movably attached for opening/closing to the front frame 1.

To be more specific, the front frame 1 has one or more fixed arc rib 1a and 1b whose face is concentric with an imaginary center 3 of open/close rotating movement of the intake grille 2. The intake grille 2 has rotary arc ribs 2a and 2b or a projection 2d having an arc-shaped groove 2c which engage(s) with the fixed rib 1a and 1b. As shown in Fig. 4, the fixed rib 1a and 1b engage with the rotary rib 2a and 2b or the projection 2d having the groove 2c when the intake grille 2 is opened/closed, holding the lower part of the intake grille 2.

The second exemplary embodiment

Fig. 5 and Fig. 6 show an arc portion 1c provided, instead of the fixed rib 1b shown in Fig. 2, as a part of the front frame 1 composing the outer cover. The arc 1c is concentric with the fixed rib 1a and 1b whose centers are same as the imaginary center 3. A back projection 2d' engages with the periphery of the arc portion 1c over the range that the intake grille 2 opens/closes. Thus, the projection 2d of the intake grille 2 itself becomes an arc am 2e concentric with the imaginary center 3 of the intake grille. As shown in Fig. 6, the periphery of the arc portion 1c engages with the back projection 2d', and the fixed rib 1a engages with the groove 2c of the arc arm 2e when the intake grille 2 opens/closes. A hole 4 is for accepting the arm. Dimension of the arc portion 1c can be changed as required, including a minimum arc, in connection with the outer cover and the entire structure.

The third exemplary embodiment

Fig. 7 shows an arc-shaped projection 2f, provided on the intake grille 2, having the back projection 2d' which engages with the periphery of the arc portion 1c over the range that the intake grille 2 opens/closes.

The fourth exemplary embodiment

Fig. 8 and 9 show an protrusion 1d further provided on the lower part of the arc portion 1c which receives the arc-shaped projection 2f on the intake grille 2. The protrusion 1d will guide the intake grille 2 to facilitate attachment to the front frame.

The fifth exemplary embodiment

Fig. 10 shows the length of the fixed rib 1a. The fixed rib 1a is set to extend 30° or more toward the front frame 1 from the vertical line extended from the imaginary center 3 of the open/close rotating movement of the intake grille 2.

The sixth exemplary embodiment

Fig. 11 shows a side edge 1e of the fixed rib 1a. The side edge 1e at the side of the intake grille 2 is tapered or sloped to make a thinner edge.

The seventh exemplary embodiment

Fig. 12 shows an edge 1f of the fixed rib 1a. The edge 1f is a part of the fixed rib 1a from a vertical line extended from the imaginary center 3 of open/close rotating movement of the intake grille 2 to the end toward the intake grille, and is straight between horizontal and downward inclination.

The eighth exemplary embodiment

Fig. 13 shows a spring member 5 and one or more small projection(s) 2g. When the intake grille opens/closes, the spring member 5, interferes with the small projection(s) 2g disposed radially on the outermost periphery of the arc arm 2e. On opening, the spring member, such as a resin spring, bends toward an interference direction at interfering with the small projection 2g. On closing, the spring member 5 keeps the intake grille open, preventing it from closing at a desired angle at least by the moment of the intake grille itself.

The ninth exemplary embodiment

Fig. 14 shows an slide knob 6 having a stopper 6a disposed on the frame 1. When the intake grille 2 opens more than necessary, the stopper 6a provides a feeling of resistance by interfering the small projection 2g described in the eighth exemplary embodiment.

The tenth exemplary embodiment

As shown in Fig. 14, 15 and 16, the slide knob 6 has a slide grip 6b whose surface is perpendicular to a sliding direction. On the back side of the slide knob 6, there is a sliding groove 6c running in the sliding direction on both sides, and a concave and convex portion 6d is formed by notching a part of a wall composing the groove 6c. On the front frame 1, there is a rail 1g which contacts the groove 6c of the slide knob 6. The rail 1g has a concave and convex notch 1h which engages relatively with the concave and convex portion 6d. By fitting the concave and convex portion 6d and the concave and convex notch 1h, the slide knob 6 can be inserted and slid into the front frame 1 from the front of the intake grille.

In addition, on the back side of the slide knob 6, a rib 6e is provided perpendicular to the sliding direction. On a surface of the front frame 1, contacting the slide knob 6, an interference rib 1j is provided in the same direction as the rib 6e. A vertical sectional view of a height of the interference rib 1j which contacts the rib 6e is trapezoid, semicircle, or triangle.

The eleventh exemplary embodiment

Fig. 17 and Fig. 18 show the slide grip 6b disposed on the lowest part of the slide knob 6, and a slit 6f provided on three sides, except for the side on the slide grip 6b, around the rib 6e on the back side of the slide knob 6. This will apply larger moment F on the rib 6e on the back side of the slide knob 6, using the base of the slide grip 6b as a fulcrum, and facilitate sliding with a smaller force E.

The twelfth exemplary embodiment

Said Fig. 16 also shows a seal or label 6g on the surface of the slide knob 6 which indicates the sliding direction and its purpose.

The thirteenth exemplary embodiment

Fig. 19 shows a protrusion rib 2f on the intake grille 2. As shown in Fig. 14, the stopper similar to an alphabet "L" is disposed on the upper part of the slide knob 6 to interfere and prevent movement of small projection(s) 2g provided on the arc arm 2e of the intake grille 2. The protrusion rib 2f is provided long enough to reach the base of a roof part 6a' so that a distance to the outermost periphery of the arc arm 2e remains longer than the length of the roof part 6a' along the sliding direction.

Claims

1. In an indoor unit of an air conditioner having a front frame (1) composing an outer cover, an intake grille (2) attachable to the front frame (1) also composing the outer cover and being free for opening and closing, an open/close device of said intake grille (2) comprising:

   an fixed arc rib (1a), (1b) on said front frame (1), said fixed arc rib (1a), (1b) being concentric with the center (3) of open/close rotating movement of said intake grille (2); and
   a projection (2d) on said intake grille (2), said projection (2d) having one of a rotary arc rib (2a), (2b) and a groove (2c), said rotary arc rib (2a), (2b) being same as said concentric circle and engaging with said fixed arc rib (1a), (1b) over the range of open/close rotating movement.

2. The indoor unit of claim 1, wherein the indoor unit further comprises an arc portion (1c) concentric with said fixed arc rib (1a) as a part of the outer cover of the front frame (1), and said projection (2d) of the intake grille (2) which engages with the periphery of said arc portion (1c), used as an arc arm (2e) concentric with the center of the open/close rotating movement of the intake grille (2).

3. The indoor unit of claim 2, wherein the intake grille (2) further comprises an arc-shaped projection (2f) which engages with the periphery of said arc portion (1c) and is concentric with the center of the open/close rotating movement of the intake grille (2).

4. The indoor unit of claim 2 or 3, wherein the front frame (1) further comprises a protrusion (1d), on the lower part of said arc portion (1c), to receive said arc-shaped projection (2f) on the intake grille (2).

5. The indoor unit of claim 1, wherein the length of said fixed arc rib (1a) is set to extend 30° or more toward the front frame (1) from a vertical line extended from the center of the open/close rotating movement of the intake grille (2).

6. The indoor unit of claim 1, 3, or 5, wherein a side edge (1e) of said fixed arc rib (1a) at the side of the intake grille (2) is made thinner by tapering or sloping.

7. The indoor unit of claim 1, 3, 5, or 6, wherein the shape of a part of said fixed arc rib (1a) from a vertical line extended from the center of the open/close rotating movement of the intake grille (2) toward the intake grille (2) is straight between horizontal and downward inclination.

8. The indoor unit of claim 2, wherein the open/close device further comprises a spring member (5) and a small projection (2g) in the radiating direction on the outermost periphery of said arc arm (2e) of the intake grille (2), said spring member (5) interferes with said small projection (2g) on opening/closing said intake grille (2); whereas on opening, said spring member (5) bends toward a interference direction, and on closing, said spring member keeps said intake grille (2) open without closing at a certain angle at least by a force couple of said intake grille (2) itself.

9. The indoor unit of claim 8, wherein the open/close device further comprises a slide knob (6) which interferes with said small projection (2g) provided in a radiating direction on the outermost periphery of said arc arm (2e) of the intake grille (2) when the intake grille (2) opens more than necessary, so as to provide a feeding of resistance and indicating the maximum extent to which it can be opened.

10. The indoor unit of claim 9, wherein the slide knob (6) further comprises:

a slide grip (6b) on the surface of said slide knob (6) in a direction perpendicular to the sliding direction;
a concave and convex portion (6d) formed by making a sliding groove (6c) running in the sliding direction on both sides at the back of said slide knob (6) and notching a part of a wall composing said sliding groove (6c), said concave and convex portion (6d) engages correspondingly with a concave and convex notch on a rail (1g) provided on the front frame (1); whereas said slide knob (6) is inserted and slid to said front frame (1) from the front of said intake grille (2) by engaging said concave and convex portion (6d) with said concave and convex notch;
a rib (6e) provided perpendicular to the sliding direction at the back of said slide knob (6); whereby an interference rib (1j), whose vertical sectional view of interference height is one of trapezoid, semicircular, and triangle, is provided on a surface of said front frame (1) contacting said slide knob (6) in the same direction as said rib (1j) so as to interfere with said rib (1j).

11. The indoor unit of claim 10, wherein the slide knob (6) further comprises a slit (6f) on three sides around the rib (6e) on the back side of said slide knob (6), except for the side on the slide grip (6b) which is placed on the lowest part of said slide knob (6).

12. The indoor unit of claim 9 or 10, wherein the slide knob (6) furthermore comprises one of a seal and label (6g) with characters on the surface of said slide knob (6) to indicate the sliding direction and its purpose.

13. The indoor unit of claim 9, wherein the open/close device further comprises:

a n L-shape stopper (6a) provided on an upper part of the slide knob (6) so as to interfere and stop movement of the small projection (2g) provided on the arc arm (2e) of the intake grille (2); and
a protrusion rib (2f) on the intake grille (2) extended to the bottom of a roof part (6a') of said L-shape stopper (6a) in a way that a distance between said protrusion rib (2f) and the outermost periphery of the arc arm (2e) becomes longer than the length of said roof part (6a') in the sliding direction when closing said intake grille (2).

Fig 1

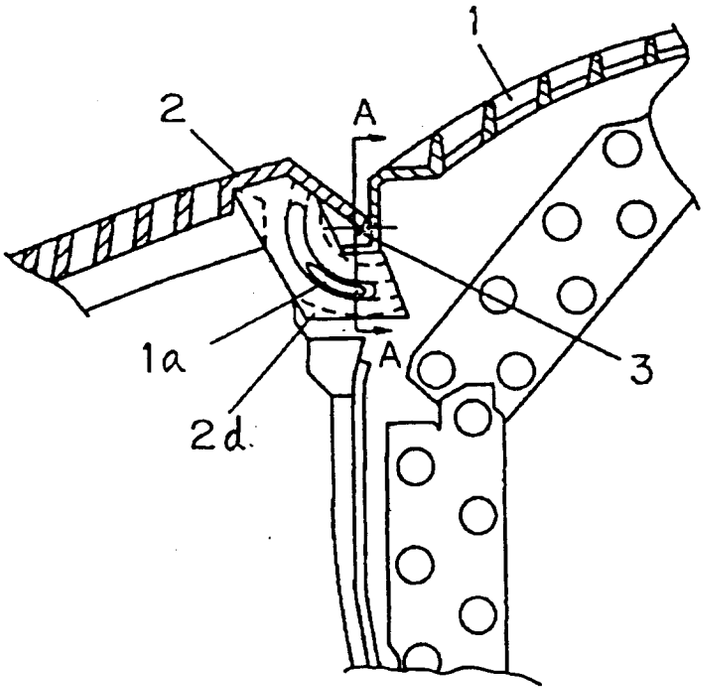

Fig 2

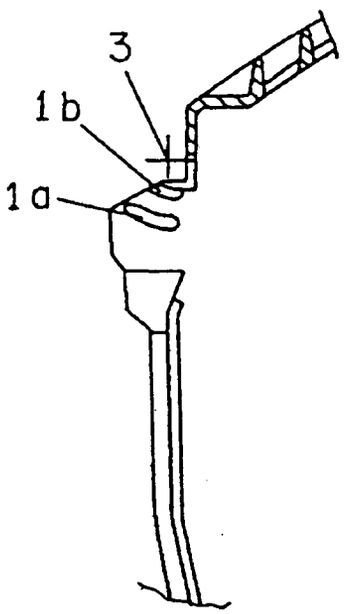

Fig 3

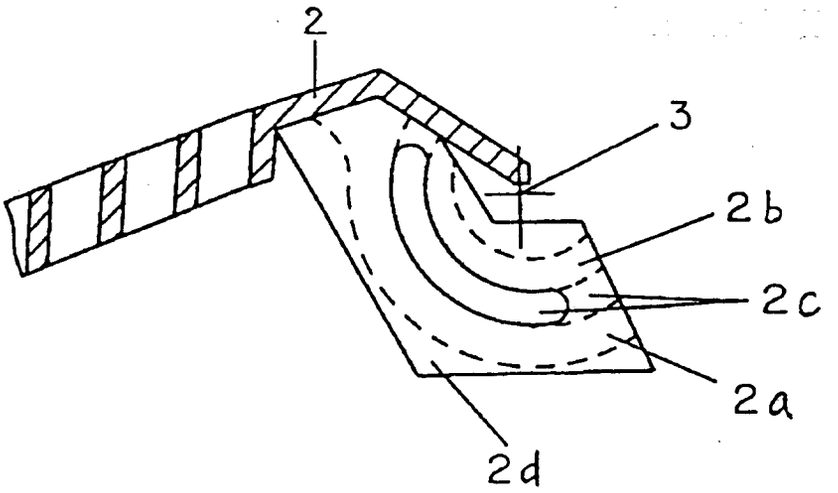

Fig 4

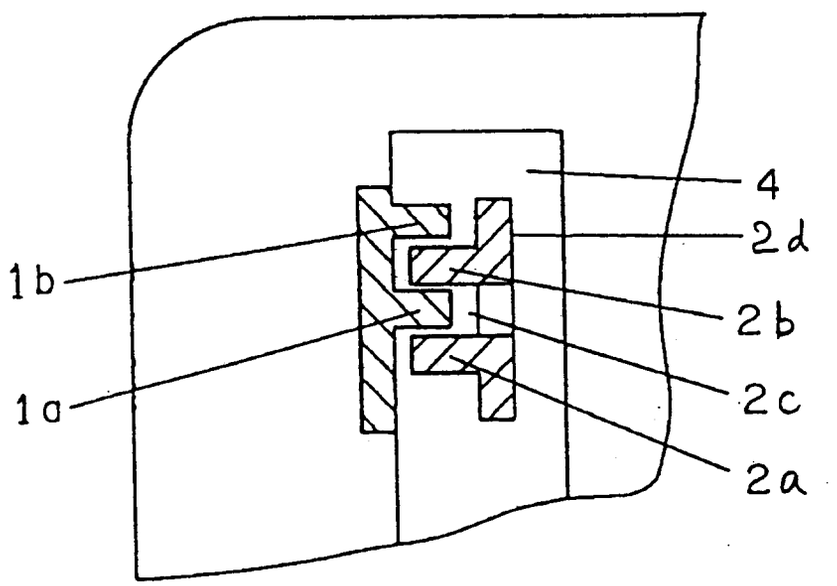

Fig 5

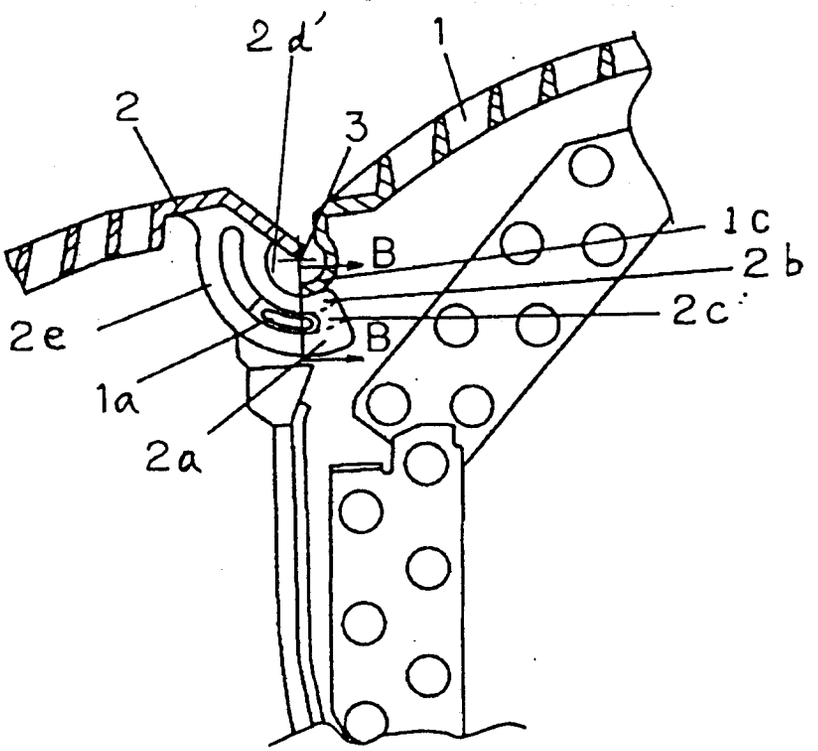

Fig 6

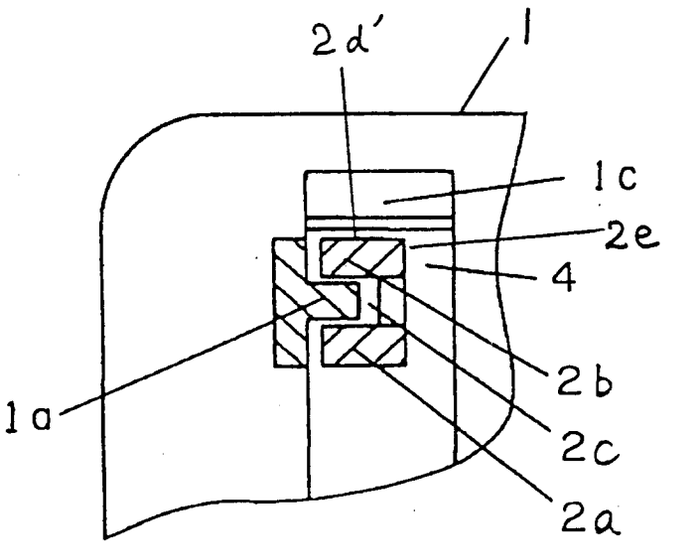

Fig 7

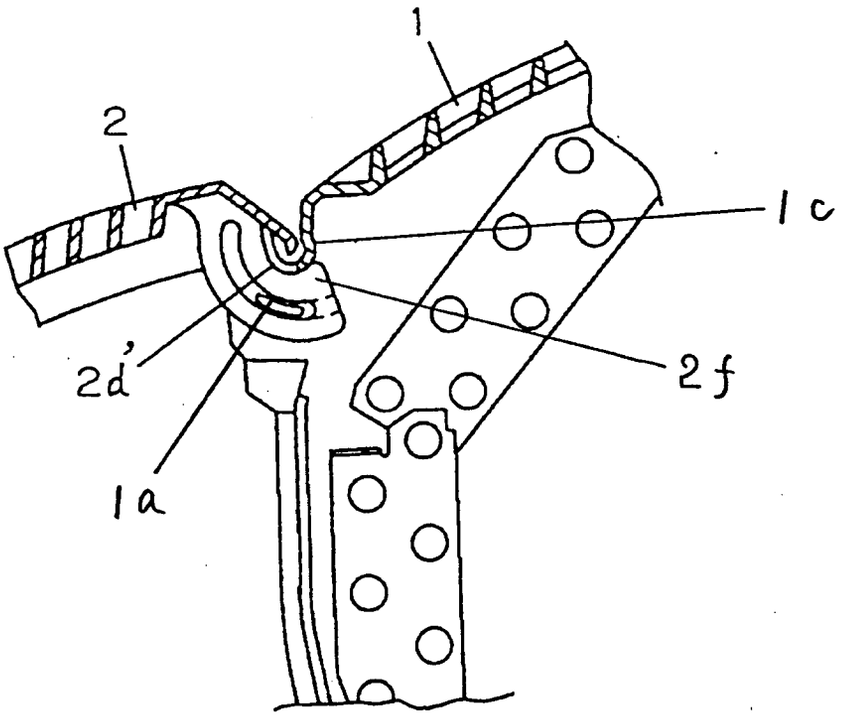

Fig 8

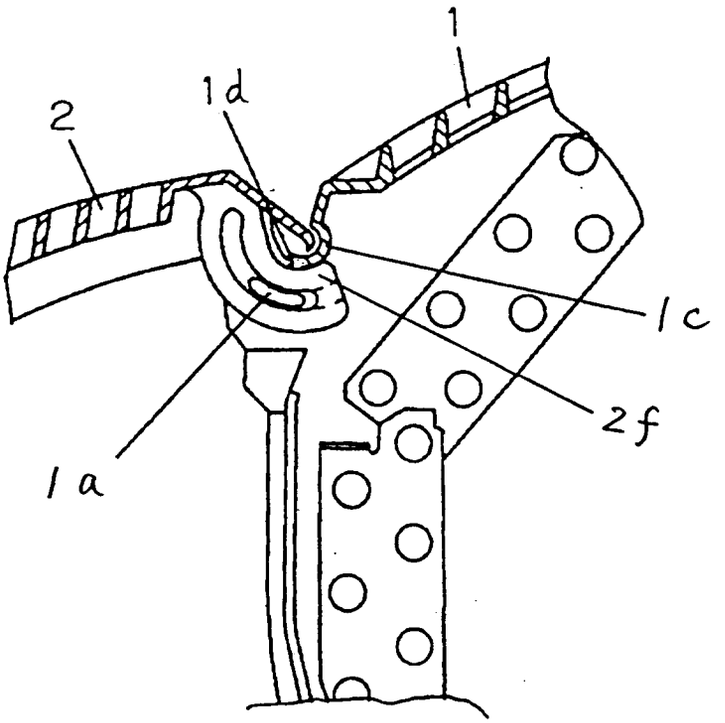

Fig 9

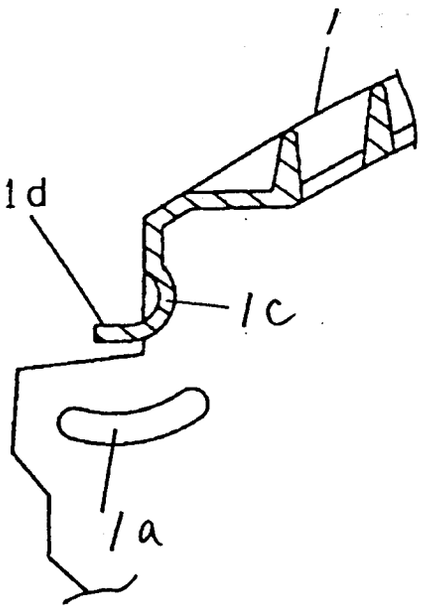

Fig 10

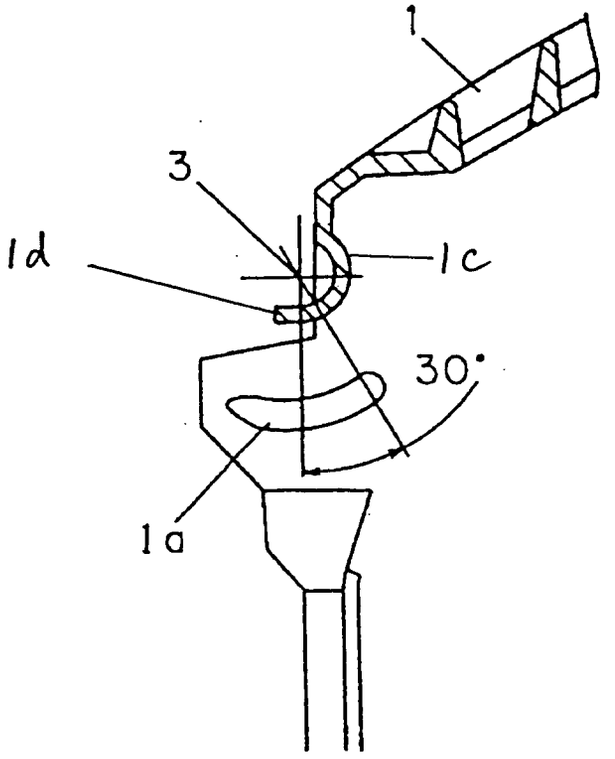

Fig 11

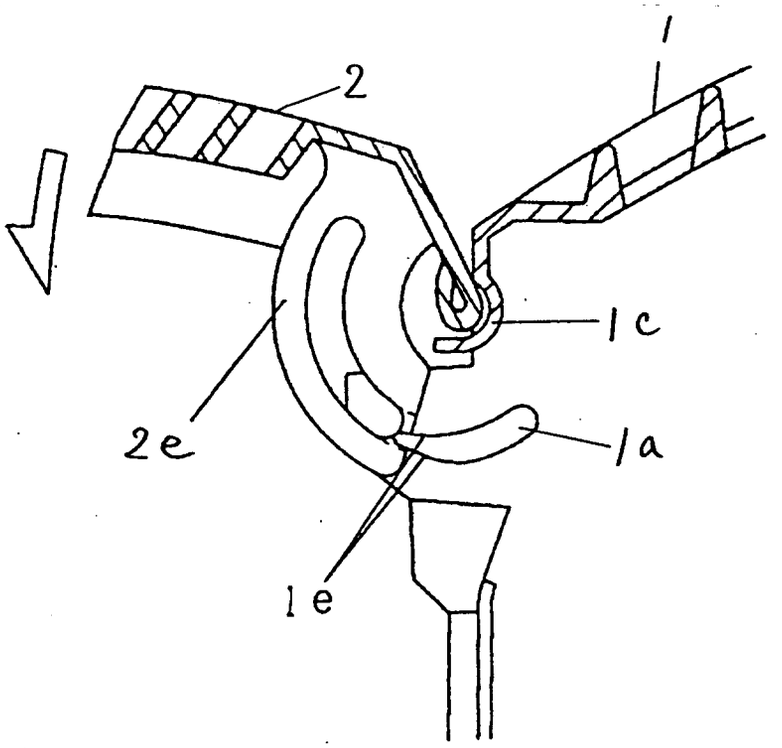

Fig 12

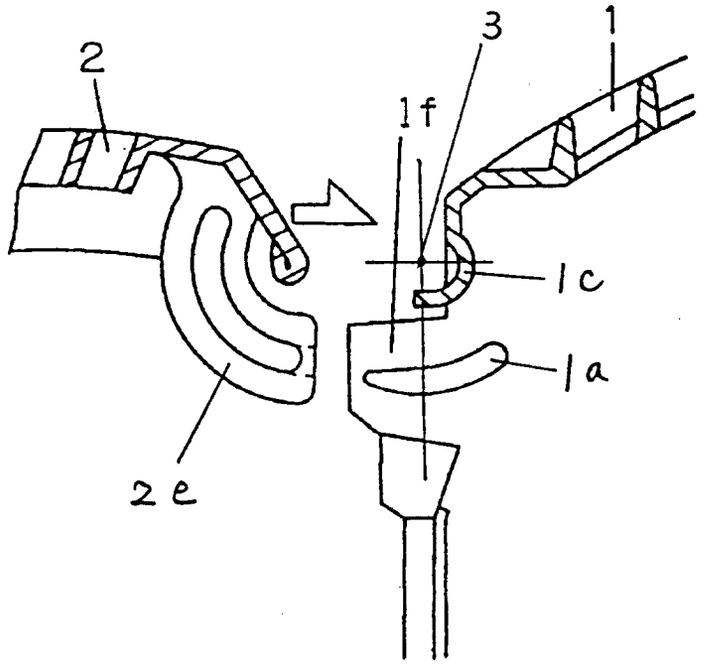

Fig 13

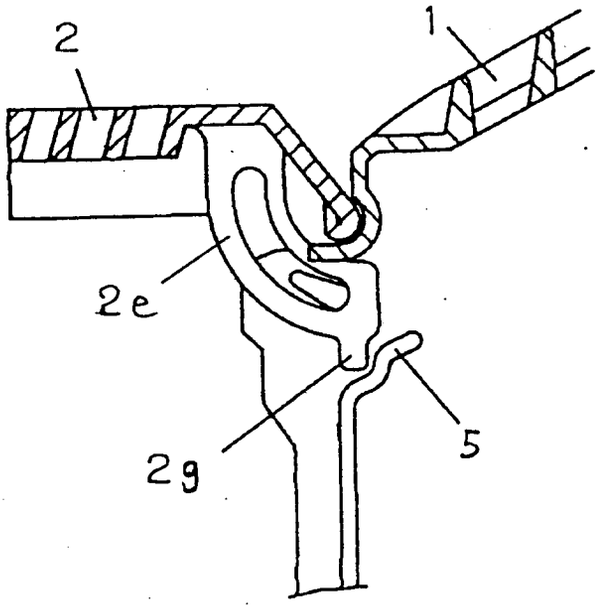

Fig 14

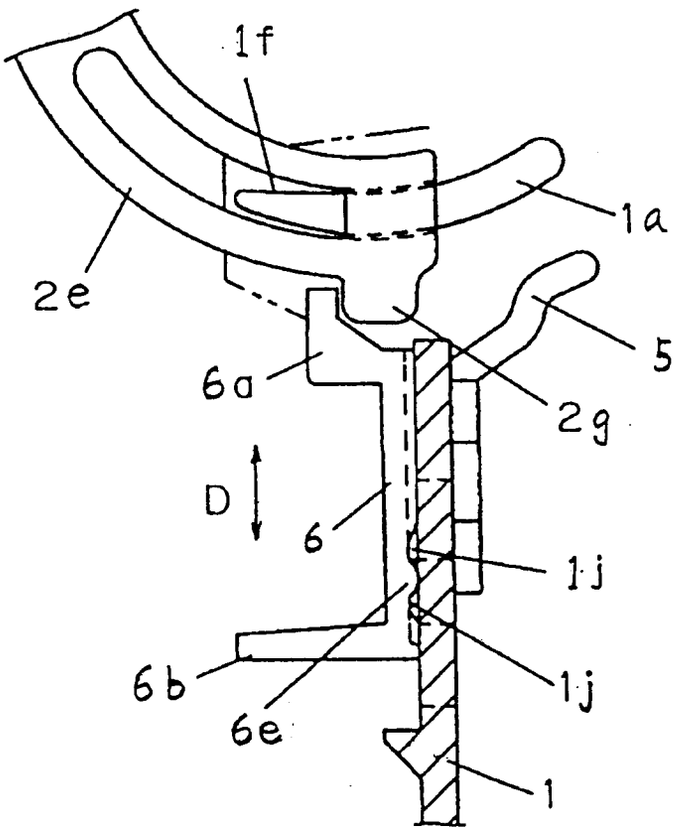

Fig 15

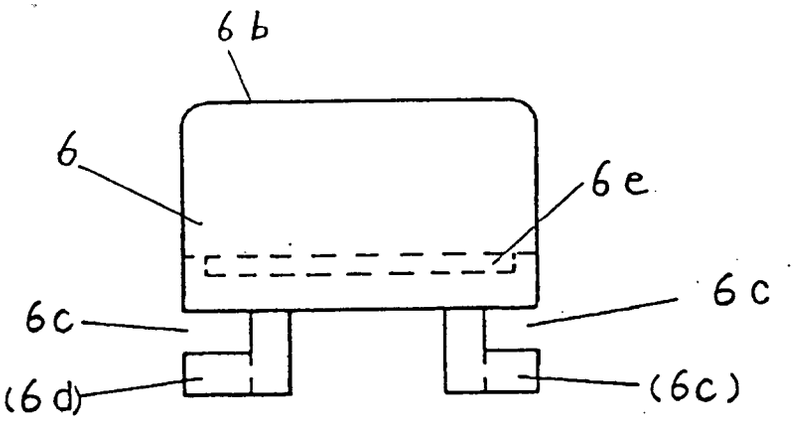

Fig 16

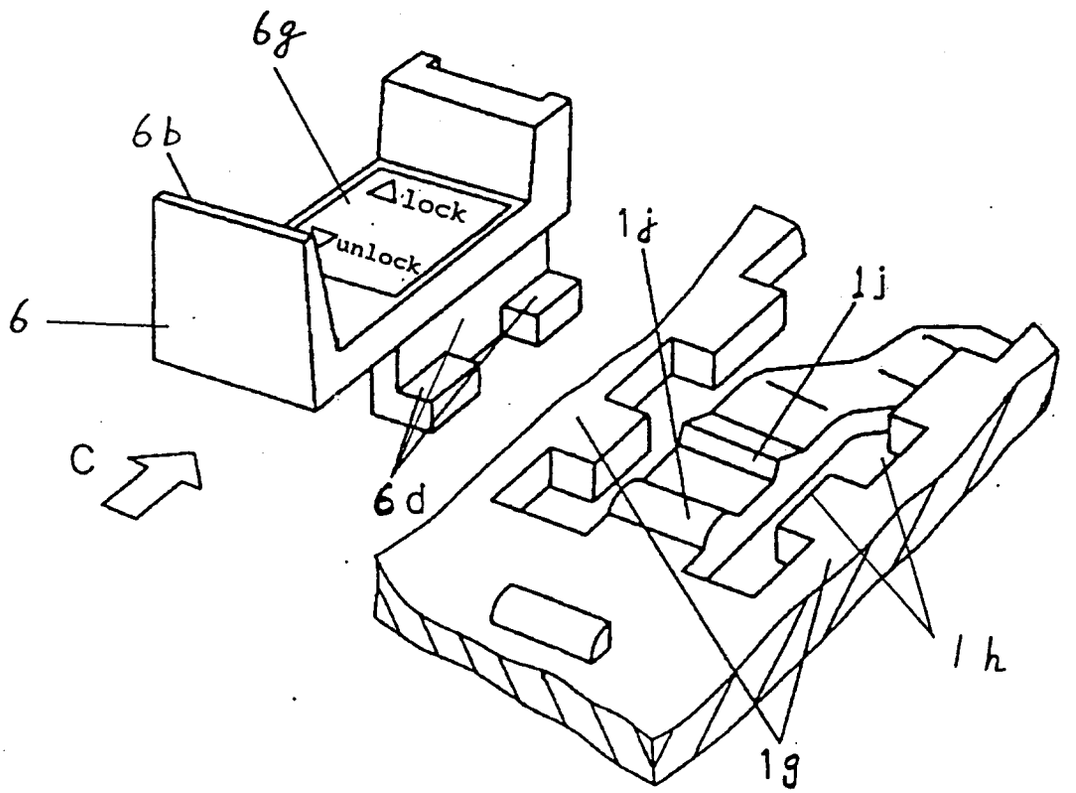

Fig 17

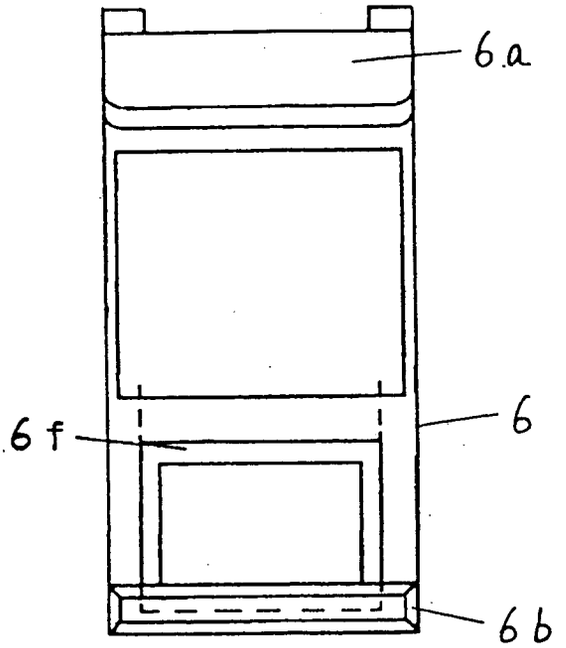

Fig 18

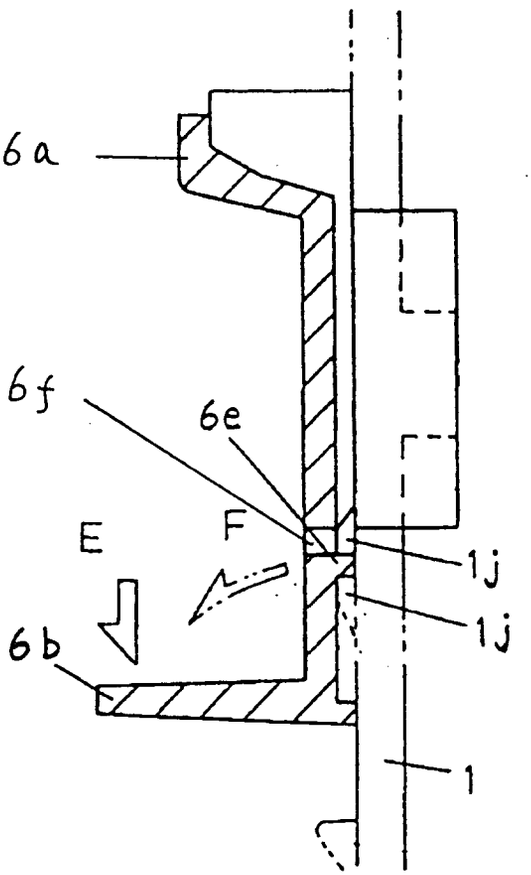

Fig 19

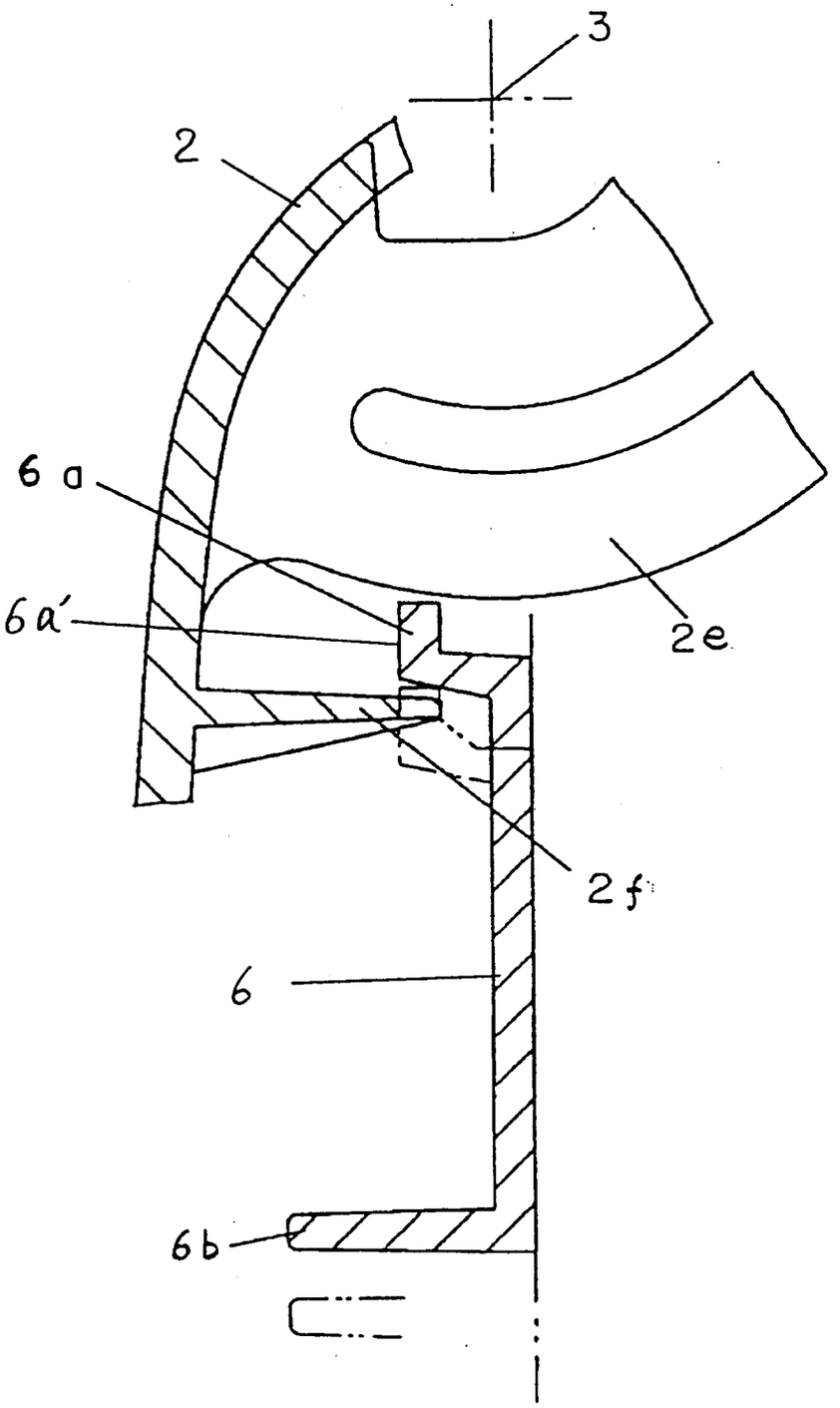

Fig 20