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(54) A glazed structural element

(57) A glazed structural element comprising a window frame having a first and a second glass pane and an intervening ventilatable hollow space enabling an air flow, said hollow space having a slit-shaped entry situated at one side of said window frame, which comprises a linear air box situated at an opposite side with respect to said entry, said window frame comprises a first and a second sub-frame, said first sub-frame being connected to said second sub-frame by a transport mechanism enabling a movement of said first sub-frame between an open and a closed position of the window frame, and wherein said air box comprises a first and a second part situated respectively in said first and second sub-frame, said first part comprising a grid of apertures facing an opening into said second part, each of said apertures being provided with a sealing gasket applied around a peripheral of said apertures, said transport mechanism being provided with a pushing member provided for pushing said gaskets towards said opening when said window frame is in closed position.

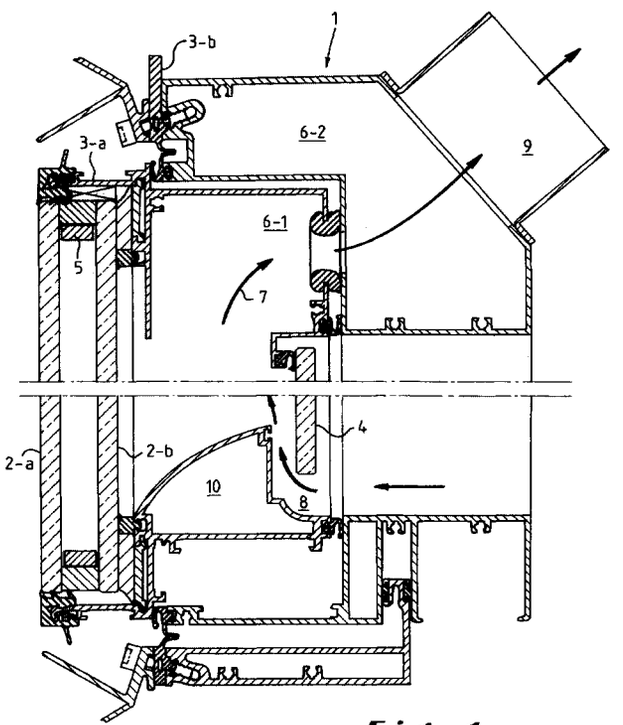

Fig. 1

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Description

[0001] The invention relates to a glazed structural element comprising a window frame having a first and a second glass pane and an intervening ventilatable hollow space enabling an air flow, said hollow space having a slit-shaped entry situated at one side of said window frame and provided for enabling ambient air to penetrate into said hollow space, said window frame comprising a linear air box situated at an opposite side with respect to said entry and enabling an outflow of the air out of said hollow space

[0002] Such a glazed structural element is known from DE-A 2607937. The ventilatable hollow space situated between the first and second glass pane enables a management of the ambient temperature of the room situated behind the glazed structural element. Indeed, ambient air can reach the hollow space by means of the slit-shaped entry, generally situated at a bottom side of the window frame. The entered ambient air crosses the hollow space in order to reach the linear air box. The latter is generally connected to the ventilation system of the room. The hollow space thus acts as an air/air exchanger since a laminar convection flow is created inside the hollow space. Since the first glass pane is generally in contact with the outside air and the second glass pane is in contact with the ambient air of the room, the hollow space acts as a buffer between the outside air temperature and the ambient air temperature, reducing in such a manner the temperature gradient between the outside and the ambient air. By creating a flow inside the hollow space, the thermal exchange is thus improved leading to less energy consumption, which energy would otherwise be required to heat up or cool down the ambient air.

[0003] A drawback of the known glazed structural element is that the window frame can not be opened as a whole enabling in such a manner the entry of outside air into the room. Despite the presence of air conditioning, heating and ventilation, the user still wants to open simply the window in order to breath fresh air.

[0004] An object of the present invention is to realise a glazed structural element having the possibility to be opened without affecting the properties of the glazed structural element when the latter is in closed position.

[0005] For this purpose a glazed structural element according to the present invention is characterised in that said window frame comprises a first and a second sub-frame, said first sub-frame carrying said glass panes and being connected to said second sub-frame by a transport mechanism enabling a movement of said first sub-frame between an open and a closed position of the window frame, and wherein said air box comprises a first and a second part situated respectively in said first and second sub-frame, said first part comprising a grid of apertures facing an opening into said second part, each of said apertures being provided with a sealing gasket applied around a peripheral of said apertures, said transport mechanism being provided with a pushing member provided for pushing said gaskets towards said opening when said window frame is in closed position. By dividing the window frame into a first and second sub-frame, which are connected by the transport mechanism, it becomes possible to "open the window". Indeed, since the first sub-frame carries both glass panes and as the first sub-frame is movable with respect to the second sub-frame, the glass panes can be moved away in order to open the window. As the hollow space remains fixed between both glass panes, the hollow space follows the movement of the first sub-frame. The separation of the air box into a first and second part enables to reconnectably detach the air box from the ventilation system and to let the first part of the air box follow the movement of the first sub-frame whereas the second part of the air box remains fixed into the second sub-frame and thus connected to the ventilation system. However the laminar flow inside the hollow room, when the window is closed, may not be disturbed by the presence of that first and second part of the air box. For this purpose the first part of the air box comprises a grid of apertures which enables a laminar flow distributed over the whole length, depth and width of the hollow space. Since those apertures face an opening into the second part, the air crossing the apertures will flow into the second part via the opening. Since each apertures has a sealing gasket around its peripheral, and since the pushing member pushes those gaskets towards the opening, air and water leaks via the separation between first and second part of the air box are avoided. By avoiding those leaks not only a watertight construction is obtained, but also no outside air can leak into the ventilation system or the hollow space, which would otherwise adversely affect the thermal regulation properties of the glazed structural element.

[0006] A first preferred embodiment of a glazed structural element according to the invention is characterised in that said pushing member is formed by locking means provided for locking said first sub-frame to said second sub-frame. In such a manner the pushing of the gaskets is applied simultaneously with the locking which guaranties a simple and reliable sealing.

[0007] A second preferred embodiment of a glazed structural element according to the invention is characterised in that said transport mechanism comprises a pantograph enabling a translational movement of said first sub-frame with respect to said second sub-frame. Since the window frame comprises two glass panes, which are mounted in the first sub-frame, the latter has a heavy weight to carry, in particular with glass panes of more than 1 m^2. The use of a pantograph enables to carry such heavy weights without affecting the reliability and the easiness in use of the transport mechanism.

[0008] A third preferred embodiment of a glazed structural element according to the invention is characterised in that said second sub-frame comprises a first and a second groove extending substantially in parallel

with respect to each other along said inner peripheral of the second sub-frame, said first groove being provided for receiving slidable anchorage points of said pantograph and said second groove being provided for receiving said locking slots. In such a manner there is one groove for the anchorage points of the pantograph and one groove for the locking member. Their mutual movement is not disturbed since they have each their own groove.

[0009] Preferably said first glass pane is formed by a double glass pane. The use of a double glass facing the outside air improves the temperature management.

[0010] Preferably said second glass pane is pivotably mounted onto said first sub-frame. In such a manner the second glass can be pivoted away and an access is created to the hollow space enabling also to clean the inner sides of the glass panes.

[0011] The invention will now be described in more details with reference to a preferred embodiment shown by way of example in the drawings wherein :

figure 1 shows a cross section in a direction from top to bottom of a glazed structural element according to the invention;
figure 2 illustrates the laminar flow inside the hollow space and the air box;
figure 3 shows details of the second part of the air box;
figures 4 and 5 show the sealing gasket applied around the apertures of the first part of the air box when the frame is in open respectively closed position;
figure 6a, b and c illustrate the opening and closing of the window frame;
figure 7 shows a handle provided for operating the transport mechanism;
figure 8 shows an exploded view of the handle;
figure 9 shows how the locking means are applied in the glazed structural element; and
figure 10 illustrates a detail of the locking means.

[0012] In the drawings a same reference has been assigned to a same or analogous element.

[0013] The glazed structural element 1 shown in figure 1 comprises a first glass pane 2 and a second glass 4 mounted in a window frame 3. The window frame is for example made of extruded aluminium, but other materials such as wood or synthetic material could also be used. In the example shown in figure 1, the first glass pane 2 is formed by a double glass pane and thus comprises two glass panes 2-a and 2-b extended in parallel to each other and separated by a spacer 5. The use of a double glass is advantageous for thermal and noise insulation. It will however be clear that a single glass pane or other multiple glass panes could also be used for the first glass pane. The first glass pane is provided to face the outside air, whereas the second glass pane faces the ambient air of a room situated behind the window frame.

[0014] The first 2 and the second 4 glass pane extend substantially in parallel to each other and are separated by an intervening ventilatable hollow space 10 enabling an air flow. For this purpose the hollow space 10 has a slit-shaped entry 8 situated at one side, preferably the bottom side, of the window frame 3 and a linear air box 6 situated at the opposite side with respect to the entry 8. The ambient air penetrates via the entry 8 into the hollow space 10 and flows through the latter in order to reach the linear air box 6 as indicated by arrow 7.

[0015] The air box 6 is connected to a ventilation system 9. So the ambient air crosses the hollow space where either it takes up the hot air, if the outside temperature is warm, trying to penetrate through the glass, or prevents the cold air, if the outside temperature is cold, to reach the room. The hollow space thus operates as an air/air heat exchanger.

[0016] To improve the heat exchange properties of the hollow space, a blind or a curtain could be mounted inside the hollow space. Preferably the blind has pivotable strips which pivot between a horizontal position, enabling the sunlight to enter and a substantially vertical position, enabling a reflection of the sunlight. The blind or curtain is preferably driven by an electrical motor which is controlled by the temperature management system in such a manner that they contribute actively to the temperature management of the room.

[0017] Figure 2 shows, in a front view of the glazed structural element, the linear laminar flow of ambient air into the hollow space 10. To avoid condensation and the formation of pockets of immobilised air, it is important that a laminar movement of the air is created inside the hollow space. Since the ventilation system 9 generally has a narrower cross section than the width of the glass panes, it is necessary to guide the air flow inside the air box 6, otherwise a funnel shape air flow would be created inside the hollow space. Therefore the air box is provided with a grid of apertures 11. The apertures may be of rectangular, circular, oval or another geometric shape. Also the different apertures do not necessarily have a same dimension. The number, geometry and the dimension of the different apertures 12 of the grid 11 have to be determined for each glazed structural element depending on the width, the height and the depth of the hollow space 10. However such a determination is known as such and will not be described in further detail as it is not relevant as such for the present invention. The presence of this grid aperture however plays an important role in the problem solved by the present invention.

[0018] The ambient air entering the slit-shaped entry 8 situated at a bottom part of the window frame, for example formed by the bottom of the second glass pane 4 and a top of the lower beam 3-c of the window frame 3 is sucked through the hollow space. The presence of the grid of apertures 11 now causes that the suction pressure applied on the ambient air in the hollow space

is substantially equal over the whole width of the hollow space so that a laminar flow is created.

[0019] Despite the fact that an ambient air management system using a glazed structural element offers a lot of advantage for what concerns the temperature control and the quality of the ambient air, the user sometimes simply wants to open the window in order to let fresh air coming into the room. This is in particular the case when the user wants to evacuate smoke or simply refresh the air for example after that a meeting took place in the room. However the known glazed structural elements are generally closed as the opening thereof would create leakage problems and disturb the flow in particular in the air box. Indeed, to enable an opening of the window frame, it is necessary to provide a first and a second sub-frame for the window frame. The first sub-frame has then to be movable with respect to the second sub-frame which remains fixed to the building.

[0020] In order to avoid a cumbersome operation where the first and second glass panes are separately opened, both glass panes should be opened together. However if the first and second glass pane follow a common opening movement, the hollow space must follow this movement since the intervening ventilatable hollow space can not be dissociated from the glass panes. But if the hollow space is moved, this signifies that either a flexible connection with the ventilation system 9 is required or that the air box has to be divided into a first 6-1 movable part and a second 6-2 fixed part. The use of a flexible connection is cumbersome and susceptible to wear and thus inappropriate. On the other hand, the division of the air box 6 into two parts is generally avoided by the skilled person as this could lead to water leakage problems and disturb the air flow. Indeed, the pressure applied on the inner side and outer side of the glazed structural element varies continuously and is strongly dependent of the weather conditions. So for example during rain showers accompanied by a blast of wind, the window frame is pushed somewhat inside the room and can cause water to penetrate along the window frame periphery. That water could reach the separation between the first part 6-1 and the second part 6-2 of the air box and penetrate in such a manner into the ventilation system, the hollow space and even inside the room. Leakage inside the room and the hollow space could thus occur. Thus even if the skilled person could separate the air box, he would not act in such a manner as this would create leakage problems. Moreover, air from the outside could also reach the ventilation system and the hollow space via that separation and thus disturb the air flow therein.

[0021] The present invention offers a solution to this problem and thus enables to satisfy the wish of the user to open the window. The glazed structural element according to the invention has indeed an air box made of a first part 6-1 that is part of the first sub-frame 3-a of the window frame. The second sub-frame 3-b, which remains fixed to the wall, comprises the second part 6-b of the air box. The relative movement of the first sub-frame with respect to the second sub-frame will be described hereinafter, after describing the construction of the first and second part of the air box 6.

[0022] As illustrated in the figures 1 and 2, the grid of apertures 11 is situated at an output of the first part 6-1 of the air box and faces an opening 12 (figure 3) in the second part 6-2 of the air box. So the air crossing the apertures in the first part reaches the second part of the air box by means of the opening 12. In such a manner a passage towards the second part is created without affecting the properties of the air box as the grid of apertures remains in the air box.

[0023] In order to prevent water and outside air to penetrate into the air box via the separation between the first and second part of the air box, each aperture 12 of the grid 11 is provided with a sealing gasket 13 applied around its peripheral (see figure 4). The sealing gasket is preferably made of rubber, silicone or another resilient material. When the window frame is in closed position, as shown in figure 5, the gasket is pushed against the wall of the second part 6-2 of the air box creating in such a manner a tight connection between the first and the second part of the air box. The pushing force applied on the gasket is created by the closing mechanism of the window frame as will be described below.

[0024] The opening and closing of the glazed structural element according to the present invention is illustrated in figure 6, showing the window in its closed (6a), half open (6b) and completely open (6c) position. The window frame comprises, as already described, a first sub-frame 3-a carrying the glass panes and the hollow space, and a second sub-frame 3-b, fixed to the wall. The first and second sub-frame are connected to each other by means of a transport mechanism 15 enabling a movement of the first sub-frame with respect to the second sub-frame. In the illustrated example, the transport mechanism is formed by a pantograph enabling a translational movement. The use of a pantograph has the advantage that it enables to carry a considerable load, which is the case due to the weight of the glass panes, in a reliable manner and offers a mechanism which is easy to operate. However other mechanisms could be used such as pivotable arms or pistons enabling an translational of a pivotable movement.

[0025] The pantograph has two fixed anchorage points 22 and 23 and two slidably mounted anchorage points 16 and 18. The anchorage points 23 and 16 are mounted on a first groove 20 of the first sub-frame whereas the anchorage points 22 and 18 are mounted in a first groove of the second sub-frame. The anchorage points are formed by pivots connected to the arms of the pantograph. The pivots of the anchorage points 16 respectively 18 are mounted on a sliding member 17 respectively 19 which slides in the first grooves 20 and 21.

[0026] When the user wants to open the window of the glazed structural element according to the invention,

he will unlock the window and apply a forward or pivot movement to the window frame. This movement is transferred to the anchorage points 16 and causes the sliding member 17 to slide into the first groove. The sliding of sliding member 17 will cause the pantograph to open (see figure 6 b) and thus the other sliding member 19 to follow the sliding movement of the sliding member 17. The opening of the pantograph causes the first sub-frame, which is connected to the pantograph, to be moved with respect to the second sub-frame and thus to open the window. When the sliding members 17 and 19 have reached their end positions (figure 6 c), the window is completely open.

[0027] As is illustrated in figure 6, the opening of the window causes the first part 6-1 of the air box to follow the movement of the first sub-frame 3-1 and thus to be separated from the second part 6-2. When the window is closed again, the first part of the air box travels towards the second part and the sealing gasket 13 is pushed against the outer wall of the second part by the pressure applied by the closing of the first sub-frame.

[0028] Due to the presence of the second glass pane 4, the handle 14 is offset with respect to the first groove 20. A transmission member is thus required in order to bridge that distance. The figures 7 and 8 illustrate the handle and its mechanism in more detail. The handle comprises a handle grip 25 placed in front of a housing 28 which comprises a toothed wheel 29. The latter is connected to the handle grip by means of a screw 30. The toothed wheel 28 grips into rack gearing 31 and 32 which are part of protrusions 26 and 27. A cover 33 closes the housing 28 and is provided with an opening 34 through which the protrusions 26 and 27 extend. The rack gearing 32 grips into the upper side of the toothed wheel 29 whereas rack gearing 31 grips into the bottom side of the toothed wheel. The movement of the handle grip 25 causes a rotation of the toothed wheel 29. As the toothed wheel grips into the rack gearings 31 and 32, the rotation of the toothed wheel is transferred to the rack gearings which start their sliding movement, driving in such a manner the protrusions 26 and 27. The movement of the handle thus causes the protrusion to slide into opening 34 and to move away from each other by opening the window.

[0029] As illustrated in figure 9, the protrusions 26 and 27 are connected to a cable or a slidable bar 30 extending in a second groove 34. The later extends substantially in parallel with the first groove 20 where the anchorage points of the pantograph are situated. In such a manner the movement of the sliding members 19 will not disturb the one of the locking means 32 to which the cable or bar 30 is connected. The locking means 32 are provided for locking the first sub-frame to the second sub-frame. They comprise a set of locking pins 35 (see figure 10) applied on an inner peripheral of the second sub-frame 3-b co-operating with a set of locking slots 36 applied on an outer peripheral of the first sub-frame 3-a. The locking slots are for example formed by plates having a cavity of the inner wall narrow towards the bottom of the cavity.

[0030] Since the protrusions 26 and 27 are connected to the locking means, in particular to the locking pins 35, the movement of the protrusions such as imposed by the one of the handle grip 25, is transferred to the locking pins 35. The forward and backward movement of the protrusions will cause the locking pins to slide into the second groove 34 and also into the locking slots 36, causing to lock or unlock the first sub-frame with respect to the second sub-frame. As the movement of the locking pins into the locking slots causes a pressure to be applied on the first sub-frame, that pressure is transferred to the sealing gaskets 13 around the apertures 12. In such a manner, the locking means create the necessary pushing force on the gaskets.

[0031] As illustrated in figure 9, the locking means 32 are preferably applied over the whole peripheral of the window frame in order to apply a tight closure between the first and second sub-frame. It is indeed necessary that the pushing force applied on the gaskets by the locking means is also applied on the upper side of the window frame where the air box is situated. To transfer the movement of the handle, generally situated at a bottom side of the window frame, over the whole peripheral, corner elements 33 are provided in the inner corners of the second sub-frame. Those corner elements enable a transmission of the sliding movement over an angle of approximately 90 degrees. A cable 38 is preferably situated inside the corner element 33 in order to transfer the sliding movement of a sliding member 37 on which a locking pin 35 is mounted to a further sliding member 39 on which a locking pin 35' is also mounted. The locking pin 35' also serves to engage a further sliding member 40 on which further locking pins are mounted.

[0032] Preferably the second glass pane is pivotably mounted onto the first sub-frame as illustrated with phantom lines in figure 6. Therefore the second glass pane is mounted on an auxiliary frame 41 attached to pivots 42, which are fixed on the first sub-frame. This enables to open the second glass pane separately and thus to get access to the inner sides of the first and second glass panes and the hollow space, for example for cleaning purposes. A further handle, not shown, enables the locking - unlocking of that pivotable second glass pane.

Claims

1. A glazed structural element comprising a window frame having a first and a second glass pane and an intervening ventilatable hollow space enabling an air flow, said hollow space having a slit-shaped entry situated at one side of said window frame and provided for enabling ambient air to penetrate into said hollow space, said window frame comprising a linear air box situated at an opposite side with re-

spect to said entry and enabling an outflow of the air out of said hollow space, **characterised in that** said window frame comprises a first and a second sub-frame, said first sub-frame carrying said glass panes and being connected to said second sub-frame by a transport mechanism enabling a movement of said first sub-frame between an open and a closed position of the window frame, and wherein said air box comprises a first and a second part situated respectively in said first and second sub-frame, said first part comprising a grid of apertures facing an opening into said second part, each of said apertures being provided with a sealing gasket applied around a peripheral of said apertures, said transport mechanism being provided with a pushing member provided for pushing said gaskets towards said opening when said window frame is in closed position.

2. A glazed structural element as claimed in claim 1, **characterised in that** said pushing member is formed by locking means provided for locking said first sub-frame to said second sub-frame.

3. A glazed structural element as claimed in claim 2, **characterised in that** said locking means comprises a set of locking pins and locking slots applied on an outer peripheral respectively an inner peripheral of said first and second sub-frame.

4. A glazed structural element as claimed in anyone of the claims 1-3, **characterised in that** said transport mechanism comprises a pantograph enabling a translational movement of said first sub-frame with respect to said second sub-frame.

5. A glazed structural element as claimed in claim 3 and 4, **characterised in that** said second sub-frame comprises a first and a second groove extending substantially in parallel with respect to each other along said inner peripheral of the second sub-frame, said first groove being provided for receiving slidable anchorage points of said pantograph and said second groove being provided for receiving said locking slots.

6. A glazed structural element as claimed in anyone of the claims 1-5, **characterised in that** said first glass pane is formed by a double glass pane.

7. A glazed structural element as claimed in anyone of the claims 1-6, **characterised in that** said second glass pane is pivotably mounted onto said first sub-frame.

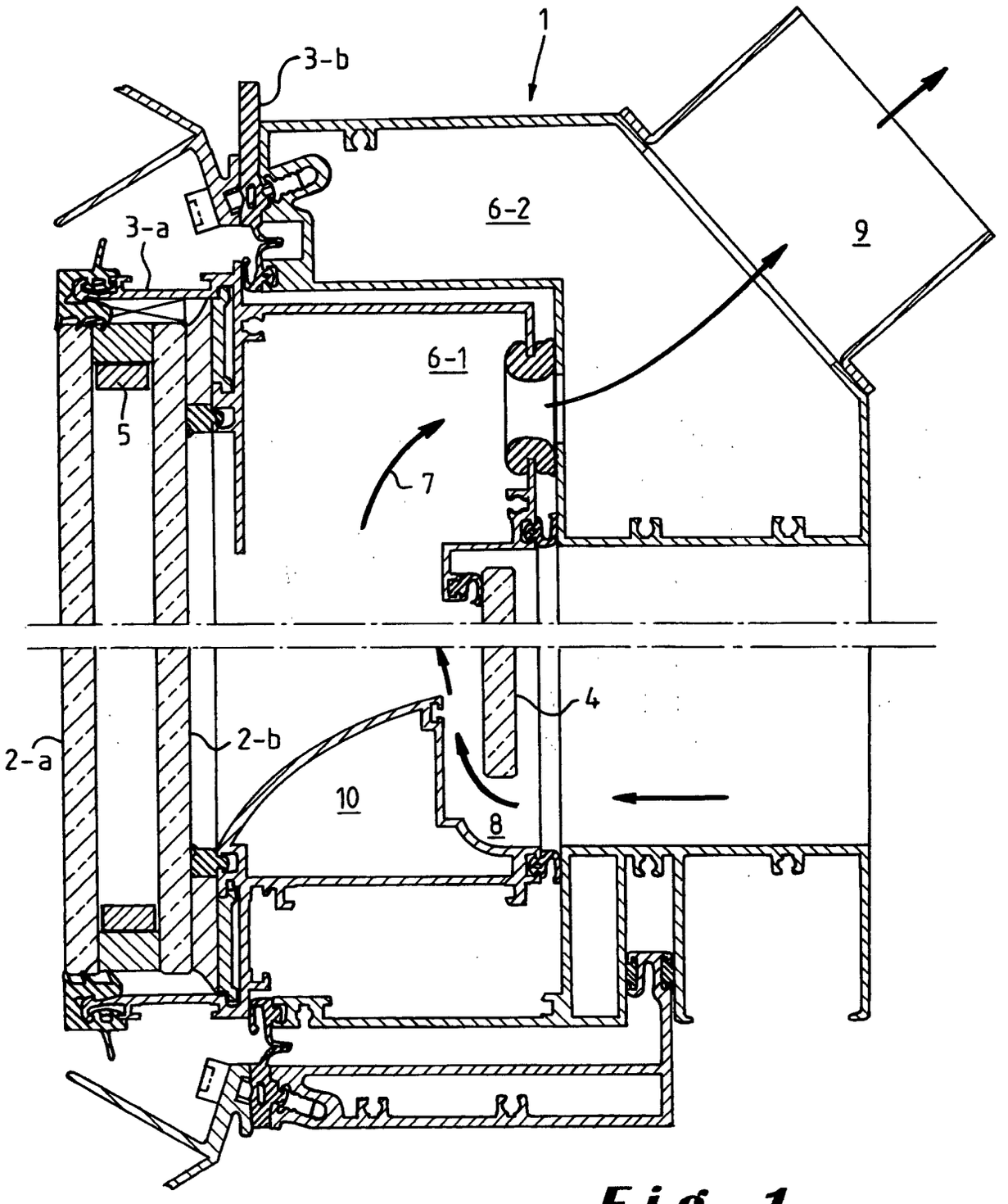


Fig. 1

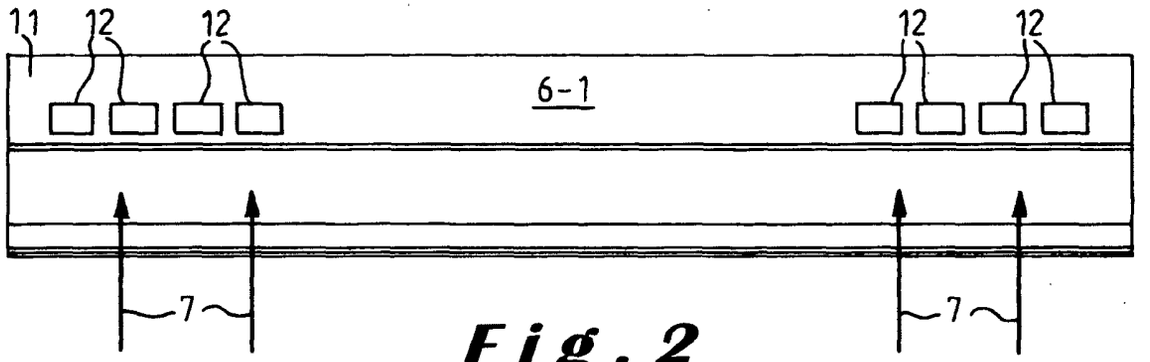


Fig. 2

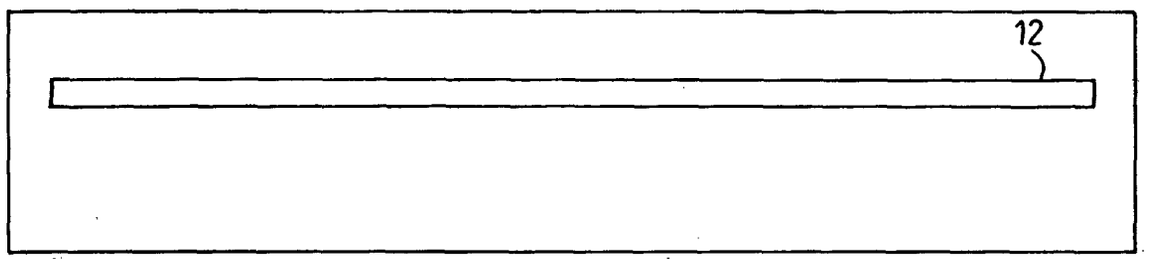


Fig. 3

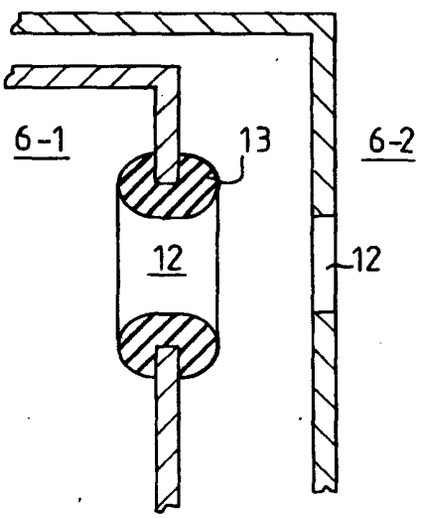


Fig. 4

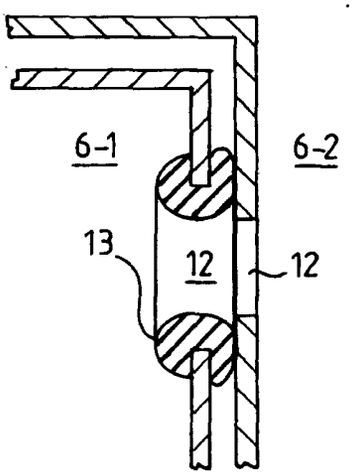


Fig. 5

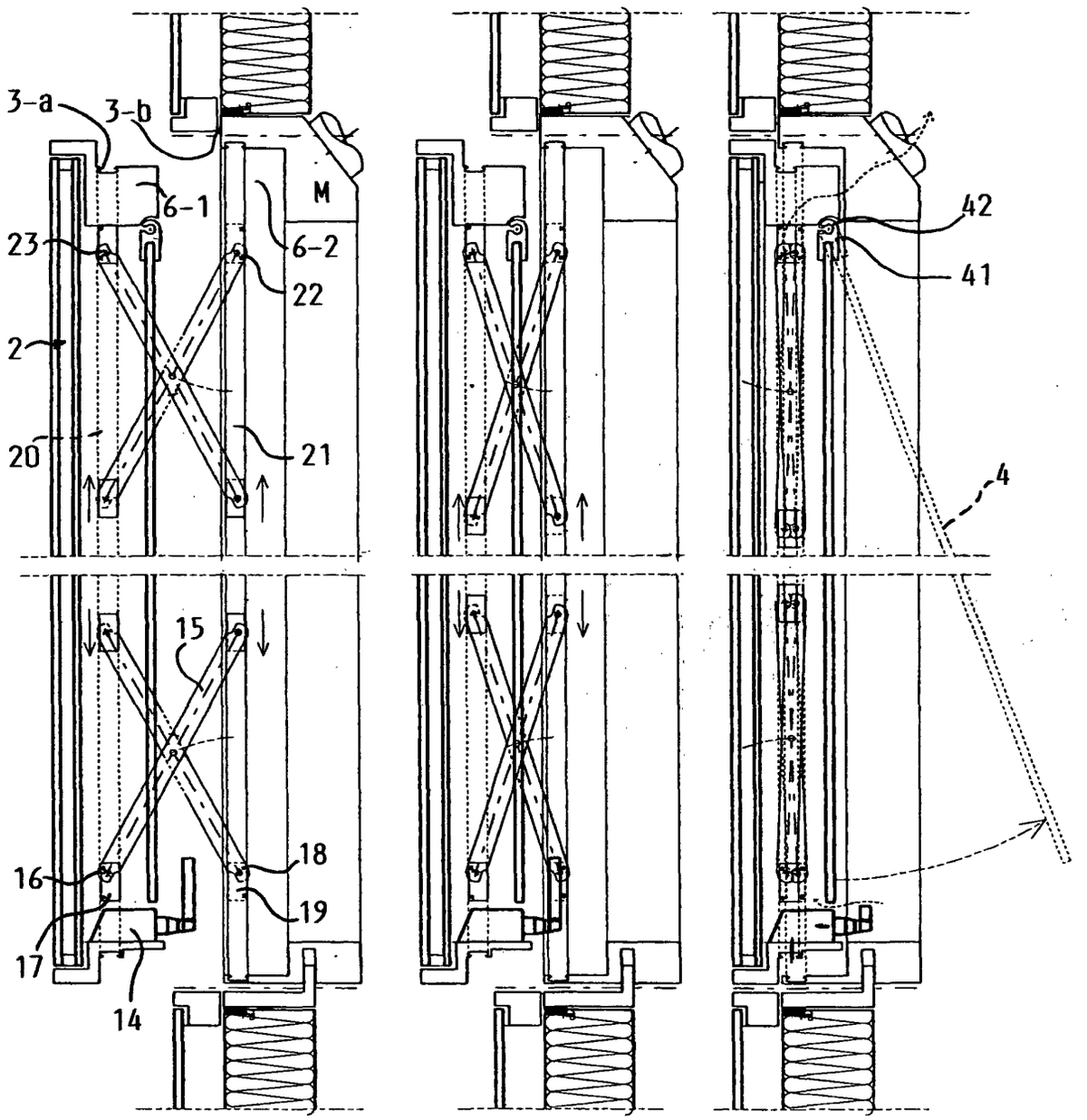


Fig. 6c Fig. 6b Fig. 6a

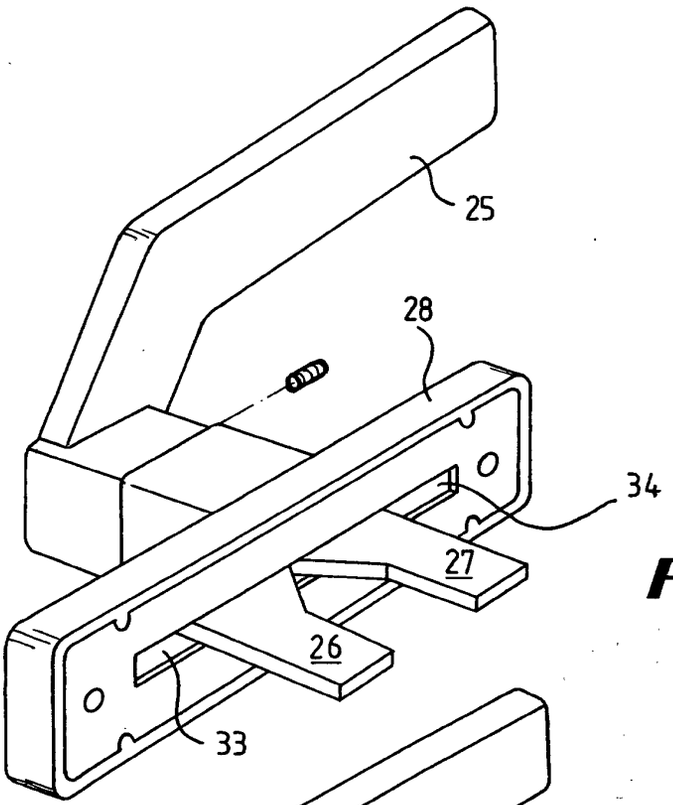


Fig. 7

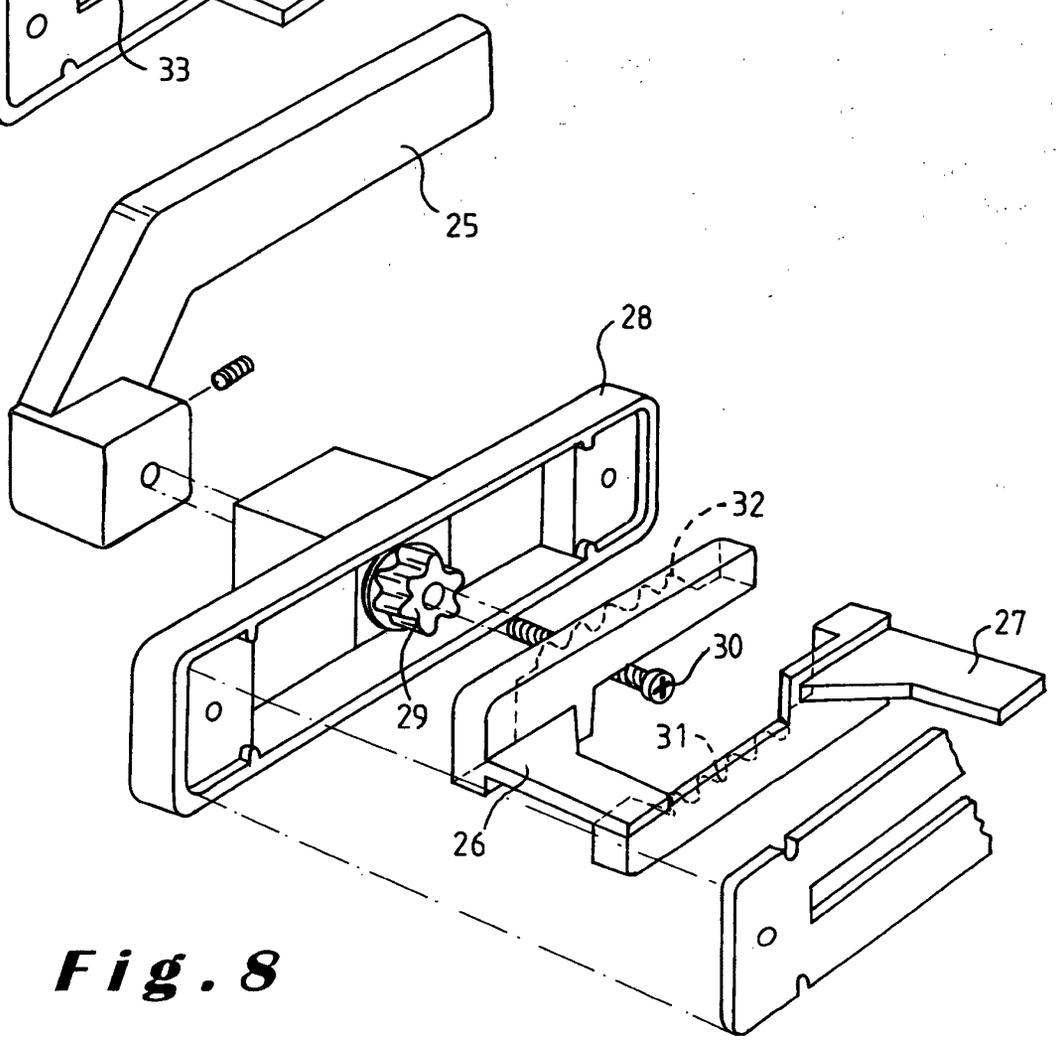
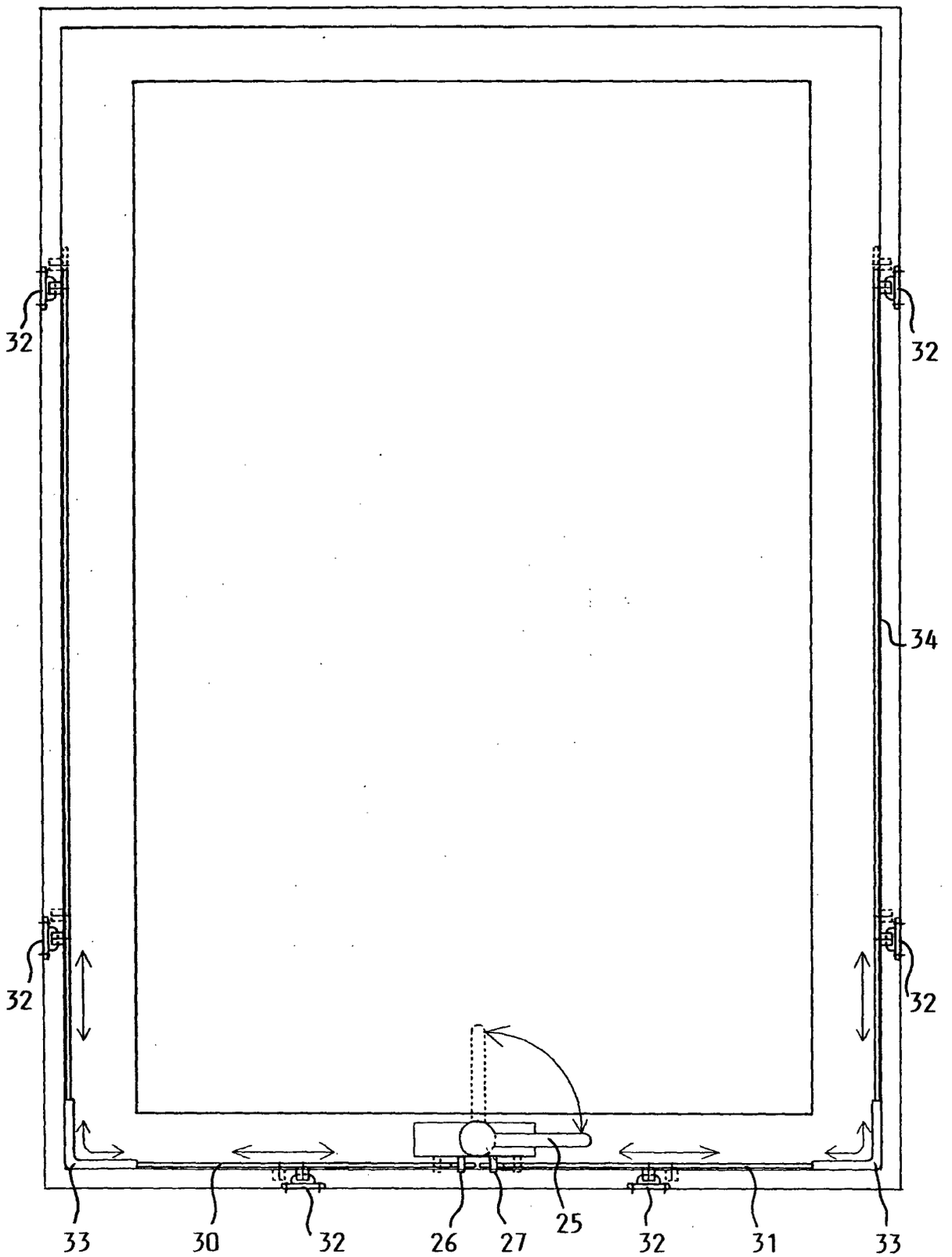


Fig. 8

Fig. 9



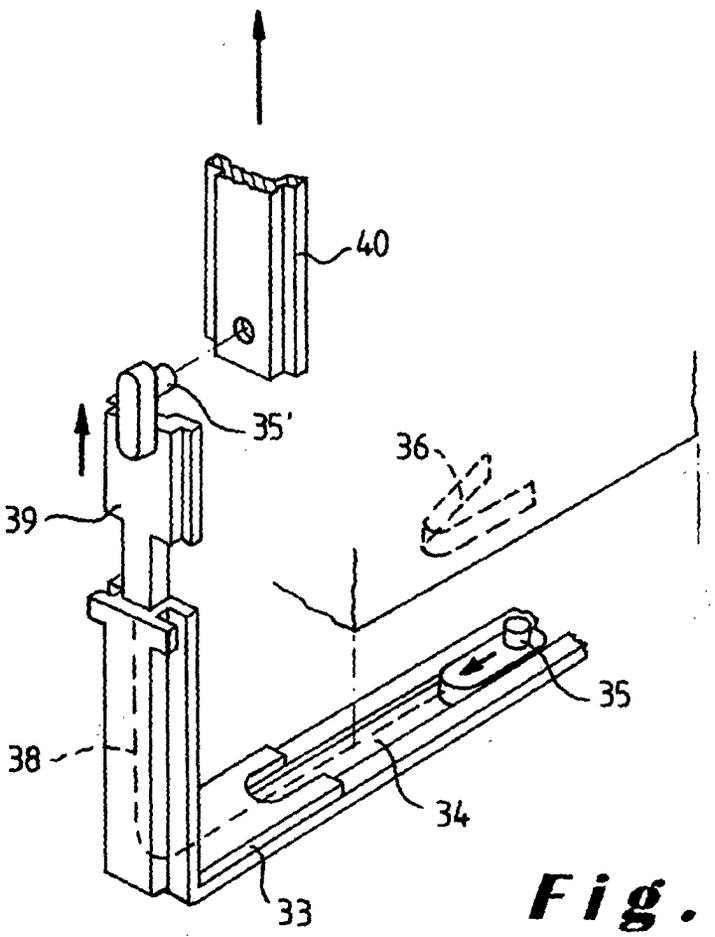


Fig. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 20 1934

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E06B
F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 October 2000	Fordham, A

CATEGORY OF CITED DOCUMENTS

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