

DESCRIPTION

CURTAIN WALL UNIT AND CURTAIN WALL

Technical Field

[0001] The present invention relates to a curtain wall unit arranged on an outer perimeter of a building, and to a curtain wall comprising the curtain wall unit. More specifically, it relates to a double-skin curtain wall unit and a curtain wall.

Background Art

[0002] A curtain wall has now been adopted for new buildings, replacement buildings and the like more often since it can be used by way of simply attaching preassembled curtain wall units to the building framework with a clamp, thus being excellent in a construction performance, and since it can also respond to the recent demands for an external glass tone appearance.

[0003] There are two types of curtain wall unit: a single-skin curtain wall which separates indoor from outdoor with one sheet of glass panel; and a double-skin curtain wall which separates indoor from outdoor with a plurality of glass panels (usually two sheets of glass panel) aligned indoor and outdoor sides with a predetermined spacing. This double-skin curtain wall has an intermediate space layer formed between the glass panel disposed on the outdoor side and the glass panel disposed on the indoor side. This intermediate space layer functions as a heat-insulating layer in cold days such as winter and can improve a heating efficiency on the indoor side. On the other hand, in

hot days such as summer, by changing the air inside the intermediate space layer for ventilation, it is possible to ease the temperature increases of for example a glass panel warmed up by direct sunlight and a blind disposed inside the intermediate space layer. And as the heat thereof can be inhibited from flowing indoor, the cooling efficiency on the indoor side can be improved.

[0004] In order to respond to the recent needs for preventing global warming and to realize energy savings for reducing the emission of greenhouse effect gases, the above described structure of the curtain wall unit that enables improvement of the cooling and heating efficiencies has become far more important than ever before.

[0005] In the double-skin curtain wall unit, the glass panels are aligned in an indoor/outdoor direction, so it inevitably becomes necessary to get a space on the indoor side. Therefore, the installation space is preferably as thin as possible. However, making the space thin in this way causes the intermediate space layer to become narrow, thereby the above described ventilation efficiency being likely to degrade due to the decreased ventilation amount and increased ventilation resistance.

[0006] Patent Document 1 discloses a means for ventilating an intermediate air layer. A curtain wall described in Patent 1 comprises air vents communicating with the intermediate air layer, the air vents being respectively arranged on a lower horizontal frame and upper horizontal frame which form a frame body and thereby enabling air to flow between the upper and lower air vents.

[0007] In addition, a curtain wall unit (double-window unit) described in Patent Document 2 has a plurality of holes communicating with the intermediate air layer arranged along a vertical frame of a frame body, thereby enabling ventilation inside the intermediate air layer.

Citation List

Patent Literature

[0008]

Patent Document 1: Japanese Patent No. 4325806

Patent Document 2: Japanese Patent Application Laid-Open No. 2006-2395

Summary of Invention

Problems to be Solved by the Invention

[0009] However, in the curtain wall described in Patent Document 1, the air vent disposed on the upper horizontal frame of a curtain wall unit and the air vent disposed on the lower horizontal frame of an upper-adjacent curtain wall unit, are arranged in a vertically adjacent manner. Consequently, there tends to occur a so-called short circuit, in which the air having flown out of the lower-side curtain wall unit flows back into the upper-side curtain wall unit again, thus degrading the ventilation efficiency. Further, since the upper and lower horizontal frames respectively having an air vent overlap each other, the horizontal frame area becomes thick when forming a curtain wall, causing an unfavorable external appearance.

[0010] On the other hand, in the curtain wall described

in Patent Document 2, all of the plurality of air vents are formed on the vertical frame; thus it is possible to prevent the horizontal frame to become thick and to reduce occurrence of the short circuit with a plurality of holes arranged. However, since the air flow is generally on the same line in a vertical direction, there still remains the short circuit problem.

[0011] Accordingly, in view of the above problems, an object of the present invention is to provide a curtain wall unit which is capable of preventing a short circuit and which has an excellent external appearance. Further, the present invention provides a curtain wall comprising the curtain wall unit.

Means for Solving the Problems

[0012] The present invention will be described below. Although the reference symbols given in accompanying drawings are shown in parentheses for the purpose of easy understanding, the invention is not limited to an embodiment shown in the drawings.

[0013] A first aspect of the present invention is a curtain wall unit (10A, 10B) to be disposed on an outer perimeter of a building, the curtain wall unit comprising: a frame body (15) which is formed of horizontal frames (40, 50, 60) and vertical frames (20A, 30A, 20B, 30B); a first glass panel (70) to be disposed inside a frame defined by the frame body; and a second glass panel (75) to be disposed inside a frame defined by the frame body such that a face thereof opposes to one face of the first glass panel with a predetermined spacing with the first glass panel, wherein an intermediate space layer (P) surrounded with the frame body,

the first glass panel, and the second glass panel is formed; one first flow opening (20Aa, 30Ba) leading to the intermediate space layer is arranged on one of the vertical frames of the frame body; and one second flow opening (30Aa, 20Ba) leading to the intermediate space layer is arranged on the other vertical frame at a position higher than that of the first flow opening.

[0014] A second aspect of the present invention is the curtain wall unit (10A, 10B) according to the first aspect, wherein a water intrusion prevention device (90, 190, 290, 390) for preventing water from entering the intermediate space layer (P) is provided to the vertical frame (20A, 30A, 20B, 30B).

[0015] A third aspect of the present invention is a curtain wall which is formed by arranging the curtain wall unit (10A, 10B) according to the first or second aspect horizontally and vertically along an outer perimeter of a building, wherein between the horizontally disposed curtain wall units, the vertical frames (20A, 30B) provided with the first flow opening (20Aa, 30Ba) are combined, and the vertical frames (30A, 20B) provided with the second flow opening (30Aa, 20Ba) are combined.

Effects of the Invention

[0016] According to the curtain wall unit and curtain wall of the present invention, in ventilating inside the intermediate space layer, a short circuit can be prevented and a temperature increase in the immediate space layer can be suppressed to a low degree. Thereby, it is possible to contribute to energy savings.

Further, the external appearance thereof can be made such that the horizontal frame is not thick, enabling a curtain wall

unit and curtain wall having an excellent external appearance to be provided.

Brief Description of the Drawings

[0017]

Fig. 1 is a front view seen from outdoor showing a curtain wall according to one embodiment;

Fig. 2 is a view focusing on two horizontally-adjacent curtain wall units;

Fig. 3 is a cross-sectional view taken from line III-III in Fig. 2;

Fig. 4 is a cross-sectional view taken from line IV-IV in Fig. 2;

Fig. 5 is a cross-sectional view taken from line V-V in Fig. 2;

Fig. 6 is a cross-sectional view taken from line VI-VI in Fig. 2;

Fig. 7 is a cross-sectional view taken from line VII-VII in Fig. 2;

Fig. 8 is a cross-sectional view taken from line VIII-VIII in Fig. 2;

Fig. 9 is a view focusing on a water intrusion prevention device 90;

Fig. 10 is a view focusing on a water intrusion prevention device 190;

Fig. 11 is a view focusing on a water intrusion prevention device 290.

Fig. 12 is a view focusing on a water intrusion prevention device 390.

Modes for Carrying Out the Invention

[0018] The functions and benefits of the present invention described above will be apparent from the following modes for carrying out the invention. The present invention will be described based on the embodiments shown in the accompanying drawings.

[0019] Fig. 1 shows a part of an external appearance of a building on which a curtain wall according to one embodiment is formed. As can be seen from Fig. 1, the curtain wall, which is one aspect of an outer wall of a building, is formed by attaching a plurality of curtain wall units 10A, 10A, ..., 10B, 10B, ... to the building framework in vertical and horizontal alignment. In the present embodiment, as apparent from Fig. 1, the curtain wall unit 10A and the curtain wall unit 10B are alternately arranged in a horizontal direction; and the curtain wall units 10A, 10A, ... and the curtain wall units 10B, 10B, ... are arranged in a vertical direction.

[0020] Fig. 2 is a front view of the external appearances focusing on two horizontally adjacent curtain wall units 10A, 10B.

Fig. 3 is a perspective cross-sectional view taken along line III-III in Fig. 2. Fig. 4 is a perspective cross-sectional view taken along line IV-IV in Fig. 2. Fig. 5 is a perspective cross-sectional view taken along line V-V in Fig. 2. Fig. 6 is a perspective cross-sectional view taken along line VI-VI in Fig. 2. Fig. 7 is a perspective cross-sectional view taken along line

VII-VII in Fig. 2. Fig. 8 is a perspective cross-sectional view taken along line VIII-VIII in Fig. 2. In Figs. 3 and 5, the left side of the sheet of paper represents an outdoor side, and the right side of the sheet of paper represents an indoor side. In Figs. 4 and 6, the right side of the sheet of paper represents an outdoor side, and the left side of the sheet of paper represents an indoor side. Further, in Figs. 7 and 8, the lower side of the sheet of paper represents the outdoor side, and the upper side of the sheet of paper represents the indoor side.

The curtain wall units 10A and 10B will be described with reference to Figs. 2 to 8 and to adequately selected figures.

[0021] The curtain wall unit 10A and the curtain wall unit 10B differ from each other only in terms of the positions of the slits 20Aa, 30Aa, 20Ba, 30Ba serving as a flow opening in the vertical frames 20A, 30A, 20B, 30B; but the shapes (e.g. cross-sectional shapes) thereof are the same. Therefore, the configurations of the curtain wall units 10A, 10B will be described first focusing on the part other than the slits 20Aa, 30Aa, 20Ba, 30Ba, wherein the curtain wall unit 10A will be adopted as a representative for the description. After that, the configurations of the slits 20Aa, 30Aa, 20Ba, 30Ba will be described.

[0022] As can be seen from Fig. 2, the curtain wall unit 10A comprises: a frame body 15; and an outdoor side glass panel 70, an indoor side glass panel 75 (see Figs. 3 and 4), a spandrel section glass panel 80, and a board 85 (see Figs. 3 and 4), which are disposed inside a frame defined by the frame body 15.

[0023] The frame body 15 is formed by combining, in a

rectangular shape, a vertical frame 20A, vertical frame 30A, upper horizontal frame 40, lower horizontal frame 50 and intermediate horizontal frame 60, these three serving as a horizontal frame. Here, in the curtain wall unit 10B the vertical frame 20B is equivalent to the vertical frame 20A, and the horizontal frame 30B is equivalent to the horizontal frame 30A.

As well shown in Fig. 2, the vertical frames 20A and 30A, upper horizontal frame 40, and lower horizontal frame 50 form a frame shape; and the intermediate horizontal frame 60 is disposed between the upper horizontal frame 40 and the lower horizontal frame 50 in a manner crossing between the vertical frames 20A, 30A. By this, a first compartment area 11 and a second compartment area 12 are formed, the first compartment area 11 being defined by the vertical frames 20A, 30A, intermediate horizontal frame 60, and lower horizontal frame 50, and the second compartment area 12 being defined by the vertical frames 20A, 30A, upper horizontal frame 40 and intermediate horizontal frame 60. The first compartment area 11 is arranged to be at a position on an outer perimeter of a building corresponding to a living space of the building. The second compartment area 12 is arranged to be at a position corresponding to a ceiling and flooring of each building floor, the area being sometimes called a spandrel section.

[0024] The upper horizontal frame 40 comprises a member 41 extending in an indoor/outdoor direction (depth direction), as the cross section thereof is shown in Figs. 3 and 4 (it should be noted that this upper horizontal frame 40 refers to an upper horizontal frame 40 of a curtain wall unit 10A which is disposed

under the curtain wall unit 10A shown by the solid line in Fig. 2; the cross section is the same, so this will be used for description since it is easy to describe.). Further, on the outdoor side of the member 41 there is provided a glass panel installation portion 42 for receiving an upper end portion of the spandrel section glass panel 80; and on the indoor side of the member 41 there is provided a board installation portion 43 for receiving an upper end portion of the board 85. Furthermore, on the upper surface side of the member 41 there is provided an engagement portion 44 for engaging a protrusion portion 54 of the lower horizontal frame 50 of an upper-adjacent curtain wall unit 10A.

[0025] The lower horizontal frame 50 comprises a member 51 extending in the indoor/outdoor direction (depth direction), as the cross section thereof is shown in Figs. 3 and 4. On the outdoor side of the member 51 there is provided a glass panel installation portion 52 for receiving a lower end portion of the outdoor side glass panel 70; and on the indoor side of the member 51 there is provided a glass panel installation portion 53 for receiving a lower end portion of the indoor side glass panel 75.

In addition, on the lower surface side of the member 51 there is provided the protrusion portion 54 for engaging with the engagement portion 44 of the upper horizontal frame 40 of the lower-adjacent curtain wall unit 10A.

[0026] The intermediate horizontal frame 60 comprises a member 61 extending in the indoor/outdoor direction (depth direction), as the cross section thereof is shown in Figs. 3 and 4. On the outdoor side of the member 61 there is provided a glass

panel installation portion 62 for receiving an upper end portion of the outdoor side glass panel 70; and on the indoor side of the member 61 there is provided a glass panel installation portion 63 for receiving an upper end portion of the indoor side glass panel 75. Further, a blind 13 is attached to the lower surface of the member 61 in a manner hanging downward.

Furthermore, on the outdoor side of the member 61 there is provided a glass panel installation portion 64 for receiving a lower end portion of the spandrel section glass panel 80; and on the indoor side of the member 61 there is provided a board installation portion 65 for receiving a lower end portion of the board 85.

[0027] The vertical frame 20A comprises a member 21 extending in the indoor/outdoor direction (depth direction), as the cross section thereof is shown in Fig. 7. On the outdoor side of the member 21 there is provided a glass panel installation portion 22 for receiving a side end portion of the outdoor side glass panel 70; and on the indoor side of the member 21 there is provided a glass panel installation portion 23 for receiving a side end portion of the indoor side glass panel 75.

Among the faces of the member 21, the face which faces the horizontally adjacent curtain wall unit 10B when the horizontally adjacent curtain wall unit 10B is combined, has a member 24 extending therefrom in a width direction, and a member 25 disposed on the more indoor side than the member 24.

[0028] The vertical frame 30A comprises a member 31 extending in the indoor/outdoor direction (depth direction), as the cross section thereof is shown in Fig. 8. On the outdoor side

of the member 31 there is provided a glass panel installation portion 32 for receiving the side end portion of the outdoor side glass panel 70; and on the indoor side there is provided a glass panel installation portion 33 for receiving the side end portion of the indoor side glass panel 75.

Among the faces of the member 31, the face which faces the horizontally adjacent curtain wall unit 10B when the horizontally adjacent curtain wall unit 10B is combined, has a member 34 extending therefrom in the width direction, and a member 35 disposed on the more indoor side than the member 24. A top end of each of the member 34 and the member 35 is provided with a packing material.

[0029] The outdoor side glass panel 70 is a first glass panel disposed on the outdoor side, in the first compartment area 11 of the above described frame body 15, as can be seen from Figs. 2 to 8. Accordingly, the four sides of the glass panel are attached, together with a packing material, to the glass panel installation portions 22, 32, 52, 62 of the vertical frame 20A, vertical frame 30A, lower horizontal frame 50, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0030] The indoor side glass panel 75 is a second glass panel disposed on the indoor side, in the first compartment area 11 of the above frame body 15; and is a multi-layered glass panel, as can be seen from Figs. 3 to 8. Accordingly, the outdoor side glass panel 70 and the indoor side glass panel 75 are aligned indoor/outdoor with a predetermined spacing. The four sides of the indoor side glass panel 75 are attached, together with a

packing material, to the glass panel installation portions 23, 33, 53, 63 of the vertical frame 20A, vertical frame 30A, lower horizontal frame 50, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0031] The spandrel section glass panel 80 is a glass panel disposed on the outdoor side, in the second compartment area 12 of the above frame body 15, as can be seen from Figs. 2 to 8. Accordingly, the four sides of the glass panel are attached, together with a packing material, to the glass panel installation portions 22, 32, 42, 64 of the vertical frame 20A, vertical frame 30A, upper horizontal frame 40, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0032] The board 85 is a board-like member which is disposed on the indoor side, in the second compartment area 12 of the above frame body 15, as can be seen from Figs. 3 to 8, to prevent the inside from being seen from outdoor. Accordingly, the spandrel section glass panel 80 and the board 85 are aligned indoor/outdoor with a predetermined spacing. The four sides of the board 85 are attached, together with a packing material, to the vertical frame 20A, vertical frame 30A, upper horizontal frame 40, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0033] As can be seen from Figs. 3 to 8, the curtain wall unit 10A formed by the above described combination has the four sides in the first compartment area 11 surrounded with the vertical frame 20A, vertical frame 30A, intermediate horizontal frame 60, and lower horizontal frame 50; and has the intermediate space layer P formed with its indoor outer surface closed by the

outdoor side glass panel 70 and the indoor side glass panel 75.

[0034] Next, the slits 20Aa, 30Aa, 20Ba, 30Ba serving as a flow opening will be described.

As can be seen from Figs. 2 and 4, the slit 20Aa is a first flow opening which is disposed in an area of the vertical frame 20A, the area facing the intermediate space layer P of the curtain wall unit 10A, on a lower area of the intermediate space layer P. The slit 20Aa penetrates the member 21, and communicates the outside area with the inside of the intermediate space layer P of the curtain wall unit 10A.

As can be seen from Figs. 2 and 3, the slit 30Aa is a second flow opening which is disposed in an area of the vertical frame 30A, the area facing the intermediate space layer P of the curtain wall unit 10A, on an upper area of the intermediate space layer P. The slit 30Aa penetrates the member 31, and communicates the outside area with the inside of the intermediate space layer P of the curtain wall unit 10A.

Herein, the slit 30Aa is disposed at a position higher than that of the slit 20Aa. The height difference between the slit 20Aa and the slit 30Aa is not particularly limited. However, since the air is allowed to flow out from the slit 30Aa with a buoyant force by the decrease in the air density, as described below, the height difference is preferably as large as possible.

[0035] Further, an opening area of the slits 20Aa, 30Aa is determined from a viewpoint of letting in and out the air smoothly. As one example of determining the opening area, it is possible to obtain a size of the opening area and the like based on the notion of an equivalent opening area. The equivalent opening

area refers to an effective area for ventilation; is represented by αA (cm^2); and is determined by the following Formula 1:

$$\alpha A = 2.78 (\gamma / 2g)^{1/2} \cdot Q_0 \cdot (\Delta p)^{(1/n-0.5)} \quad (1)$$

Herein, γ refers to an air density (kg/m^3). Q_0 refers to an air leakage volume Q (m^3/h) at a time of indoor/outdoor differential pressure $\Delta p = 1\text{mmAq}$ (9.8Pa). g refers to a gravity acceleration (m/s^2). n refers to a coefficient representing a spacing property (taking a value of 1 at a time of laminar flow, and a value of 2 at a time of turbulent flow). α refers to a flow volume coefficient.

[0036] On the other hand, as can be seen from Figs. 2 and 6, the slit 20Ba provided to the curtain wall unit 10B, is a second flow opening which is disposed in an area of the vertical frame 20B, the area facing the intermediate space layer P of the curtain wall unit 10B, on an upper area of the intermediate space layer P. The slit 20Ba penetrates the member 21, and communicates the outside area with the inside of the intermediate space layer P of the curtain wall unit 10B.

As can be seen from Figs. 2 and 5, the slit 30Ba is a first flow opening which is disposed in an area of the vertical frame 30B, the area facing the intermediate space layer P of the curtain wall unit 10B, on a lower area of the intermediate space layer P. The slit 30Ba penetrates the member 31, and communicates the outside area with the inside of the intermediate space layer P of the curtain wall unit 10B.

Herein, the slit 20Ba is disposed at a position higher than that of the slit 30Ba. The height difference between the slit

20Ba and the slit 30Ba is not particularly limited. However, since the air is allowed to flow out from the slit 20Ba with a buoyant force by the decrease in the air density, as described below, the height difference is preferably as large as possible.

An opening size of the slits 20Ba, 30Ba is the same as that of the above described slits 20Aa, 30Aa; thus descriptions thereof are omitted.

[0037] In the present embodiment, the intermediate horizontal frame 60 is configured to reach where it is exposed to the outdoor side, thereby disposing different glass panels (i.e. the outdoor side glass panel 70 and the spandrel section glass panel 80) in the first compartment area 11 and the second compartment area 12. However, the embodiment is not restricted to this: for example, as long as airtight/watertight states are ensured in the first compartment area and the second compartment area, the intermediate horizontal frame need not be exposed to the outdoor side, and the first compartment area and second compartment area may comprise one common outdoor side glass panel.

[0038] A configuration in which the above described curtain wall unit 10A, 10B is combined with another curtain wall unit 10A, 10B respectively is as follows.

A curtain wall unit 10A and another curtain wall unit 10A to be combined therewith in a lower-adjacent manner are well shown in an area indicated in Figs. 3 and 4. In specific, the protrusion portion 54 provided to the lower horizontal frame 50 of the curtain wall unit 10A disposed on the upper side engages with the engagement portion 44 provided to the upper horizontal frame 40 of the curtain wall unit 10A disposed on the lower side. Likewise,

as well shown in Figs. 5 and 6, the protrusion portion 54 provided to the lower horizontal frame 50 of the curtain wall unit 10B disposed on the upper side engages with the engagement portion 44 provided to the upper horizontal frame 40 of the curtain wall unit 10B disposed on the lower side.

[0039] On the other hand, the horizontally adjacent curtain wall units 10A, 10B are combined in the following manner, as shown in Fig. 7. In specific, to the member 24 of the vertical frame 20A of the curtain wall unit 10A, the member 34 of the vertical frame 30B of the curtain wall unit 10B adjacent thereto is attached firmly via a packing material. Likewise, to the member 25 of the vertical frame 20A, the member 35 of the vertical frame 30B of the curtain wall unit 10B adjacent thereto is attached firmly via a packing material. Further, the glass panel installation portion 23 and the glass panel installation portion 33 of the vertical frame 30B of the curtain wall unit 10B adjacent thereto are attached to each other firmly via a packing material.

At this time, a flow passage communicating with the intermediate space layer P, P, the slits 20Aa, 30Ba, and the outdoor is formed between the vertical frame 20A and the vertical frame 30B.

[0040] Likewise, as shown in Fig. 8, to the member 24 of the vertical frame 20B of the curtain wall unit 10B, the member 34 of the vertical frame 30A of the curtain wall unit 10A adjacent thereto is attached firmly via a packing material. Further, to the member 25 of the vertical frame 20B, the member 35 of the vertical frame 30A of the curtain wall unit 10A adjacent thereto is attached firmly via a packing material. Further, the glass

panel installation portion 23 and the glass panel installation portion 33 of the vertical frame 30B of the curtain wall unit 10B adjacent thereto are attached to each other firmly via a packing material.

At this time, a flow passage communicating with the intermediate space layer P, P, the slits 20Ba, 30Aa, and the outdoor is formed between the vertical frame 20B and the vertical frame 30A.

[0041] By the above described combination of the curtain wall units 10A, 10B and the slits 20Aa, 30Aa, 20Ba, 30Ba provided, the slits 20Aa and 30Ba being the first flow opening disposed at a lower position of the intermediate space layer P are provided to the vertical frames 20A, 30B combined in a manner facing each other, as shown in Fig. 2. On the other hand, the slits 30Aa and 20Ba being the second flow opening disposed at a higher position of the intermediate space layer P are provided to the vertical frames 30A, 20B combined in a manner facing each other.

[0042] According to the curtain wall formed on a building by way of the above curtain wall units 10A, 10B,..., the passage for air inflow and the passage for air outflow are disposed in the vertical frame, thus enabling preventing horizontal frame from becoming thick. Therefore, it is possible to configure a curtain wall which is also excellent in its external appearance.

For example, in cases where a single-skin curtain wall and a double-skin curtain wall are selectively used according to the direction that the outer wall of a building faces, the external appearances of the curtain walls can be unified with a desirable configuration that the frames are not too thick.

Further, preventing the frames from being thick also enables the frames to have few stains and or less noticeable stains, if any. Especially, since a conventionally available exposed large-sized back board member (a so-called louver) for air supply and exhaust is not needed, it is possible to prevent an unpleasing external appearance caused by the stains thereof. Additionally, the structures of the members and the flow openings are simplified, enabling providing a curtain wall at a low price.

[0043] According to the curtain wall comprising the curtain wall units 10A, 10B, ..., the air inside the intermediate space layer P is changed for ventilation in the following manner, which will be illustrated with reference to Figs. 1 to 8.

First, the outdoor side glass panel 70, indoor side glass panel 75, blind 13 etc. are warmed up by solar radiation or the like; and the air inside the intermediate space layer P is heated, therefore causing the air inside the intermediate space layer P to be warmed up and the density thereof to become small.

The air having a small density in this way goes up and the air inside the intermediate space layer P is allowed to flow out to the outside in such a manner as pushing out the air in sequence from the slits 20Ba, 30Aa being the second flow opening of the vertical frames 20B, 30A. At this point, the air flows from the intermediate space layer P to the outdoor, as shown by Q, Q, ... in Figs. 1, 3, 6 and 8.

[0044] On the other hand, along with the outflow of the air from the intermediate space layer P, the air flows from the slits 20Aa, 30Ba being the first flow opening of the vertical frames 20A, 30B into the intermediate space layer P in a manner being

drawn thereinto. This air flows from the outdoor to the intermediate space layer P, P, as shown by R, R in Figs. 1, 4, 5, and 7. The air let in is the external air and at least has a temperature lower than the air warmed up in the intermediate space layer P, P; therefore the outdoor side glass panel 70, indoor side glass panel 75, blind 13 etc. are cooled by that.

[0045] By continuously repeating the above described heating and traveling of the air, the inside of the intermediate space layer P, P, ... is stabilized at a lower temperature compared with a case when the traveling of the air does not occur, enabling prevention of degradation of the cooling efficiency on the indoor side.

[0046] Here, in the curtain wall formed of the curtain wall units 10A, 10B, ..., the flow passage for air inflow and the flow passage for air outflow are not present on the same line in an orthogonal direction (vertical direction), so the air having flown out from the intermediate space layer P does not flow back into the intermediate space layer P again. This can prevent a short circuit and can stabilize the air in the intermediate space layer P at a lower temperature.

Further, with regard to the flow passages present on the same line as well, since the second compartment area (spandrel section) is disposed between the first compartment areas in the vertically adjacent curtain wall units, a sufficient distance between these flow passages can be secured and occurrence of the short circuit can be prevented.

[0047] Furthermore, in the curtain wall units 10A, 10B, ... of the present embodiment, a water intrusion prevention device

90 is provided in order to prevent rainwater from entering the inside of the intermediate space layer P, P, ... from the slits 20Aa, 30Aa, 20Ba, 30Ba. Fig. 9 is used to describe the water intrusion prevention device 90. Fig. 9 is an enlarged view focusing on an area of the vertical frames 20A, 30B in Fig. 7.

[0048] The water intrusion prevention device 90 comprises a first component 91 and a second component 92. The first component 91 is a component having a substantially L-shaped cross section, as can be seen from Fig. 9. An installation member 91b is arranged on an end portion on a member 91a side in such a manner orthogonal to the member 91a, the member 91a being one part of the L shape of the first component 91. Further, a plurality of protrusions 91d, 91d, ... are arranged, in a standing manner, on a face on a member 91c side, the member 91c being the other part of the L shape of the first component 91. Furthermore, an end portion 91e of the member 91c is bent in the same direction as the member 91a side.

[0049] On the other hand, the second component 92 comprises three members 92a, 92b, 92c formed in a bent shape on its cross section.

[0050] The first component 91 and the second component 92 are disposed, as can be seen from Fig. 9, inside a space surrounded with members 21, 31, 24, 34, and glass panel installation portions 22, 32, at a time of combining the curtain wall units 10A, 10B. Details are as follows.

The first component 91 is installed to the vertical frame 30B; and at this time, the member 91a extends in the depth direction and the member 91c extends in a direction of the vertical

frame 20A of the adjacent curtain wall unit 10A. And, the protrusions 91d, 91d, ... of the member 91c are directed toward where the glass panel installation portions 22, 32 are disposed. As can be seen from Fig. 9, the member 91c is formed in a manner crossing the gap between the glass panel installation portions 22, 32 on the indoor side in the depth direction.

[0051] The second component 92 is installed to the vertical frame 20A, and at this time the member 92a is fixated to the indoor side face of the glass panel installation portion 22. Further, the member 92b extends in a direction of the vertical frame 30B of the adjacent curtain wall unit 10B in a manner inclining toward the indoor side. The member 92c extends from a top end of the member 92b further in a direction of the vertical frame 30B. The second component 92 is formed such that the member 92b and the member 92c thereof cross the gap between the glass panel installation portions 22, 32 on the indoor side in the depth direction.

[0052] According to the above described water intrusion prevention device 90, even if rainwater enters between the glass panel installation portions 22, 32 from a direction shown by T in Fig. 9, further intrusion of the rainwater can be inhibited by the second component 92. In addition, further intrusion of the rainwater can be inhibited by the first component 91 as well, thereby preventing intrusion of the rainwater from the slits 20Aa, 30Ba into the intermediate space layer P, P.

[0053] Herein, the member 91c of the second component 91 is provided with the protrusions 91d, 91d, ..., and also with an end portion 91e; therefore, the rainwater is prevented from moving

at this point, effectively preventing the intrusion of rainwater.

[0054] The water intrusion prevention device disposed between the vertical frame 20A and the vertical frame 30B has been illustrated herein; however, this water intrusion prevention device is also disposed between the vertical frame 30A and the vertical frame 20B, and likewise prevents water intrusion.

The water intrusion prevention device 90 is desirably disposed near the position where the slits 20Aa, 30Ba are provided. Therefore, the water intrusion prevention device 90 need not extend across the entire length of the vertical frames 20A, 30B; but desirably extends in a length that is from approximately the same as the size of the slits along the length of the vertical frames 20A, 30B, to 100 mm longer. By this, it is possible to reduce costs and to reduce ventilation resistance to a small degree compared with the case when the water intrusion prevention device extends across the entire longitudinal direction.

[0055] Figs. 10 to 12 are views for illustrating water intrusion prevention devices 190, 290, 390 in another embodiment, respectively. Figs. 10 to 12 are equivalent to Fig. 9.

[0056] The water intrusion prevention device 190 shown in Fig. 10 comprises a first component 191 and a second component 192. The first component 191 and the second component 192 have a shape symmetrical to each other; therefore, only the first component 191 will be described herein.

As can be seen from Fig. 10, the first component 191 is a component having a substantially L-shaped cross section with a short member 191a in the width direction and a long member 191b in the depth direction. The member 191a also serves as a member

to hold the outdoor side face of the side end portion of the outdoor side glass panel 70.

On the other hand, the member 191b extends on the indoor side, from the end portion of the member 191a to the inside of the space surrounded with the member 21, member 31, member 24, member 34 and glass panel installation portions 22, 32. Herein, the indoor side end portion of the member 191b is bent in the width direction toward the opposite side of the member 21. Further, among the faces of the member 191b, the face on the opposite side of the side facing the member 21 has a plurality of protrusions 191c, 191c, ... aligned in the depth direction.

[0057] According to the above described water intrusion prevention device 190, even if the rainwater enters between the glass panel installation portions 22, 32 from the direction shown by U in Fig. 10, further intrusion of the rainwater can be inhibited because a long narrow space is formed between the first component 191 and the second component 192 and thus because a flow passage resistance is large. In addition, water flow into the indoor is obstructed by the protrusions 191c, 191c, ..., 192c, 192c, ...; thereby effectively inhibiting intrusion of the rainwater. On the other hand, as apparent from Fig. 10, the air flow passage is secured; thus the air traveling through the intermediate space layer P, P is not obstructed.

[0058] The water intrusion prevention device 190 is desirably disposed near the position where the slits 20Aa, 30Ba are provided. Therefore, the water intrusion prevention device 190 need not extend across the entire length of the vertical frames 20A, 30B; but desirably has a length that is from approximately

the same as the size of the slits 20Aa, 30Ba along the length of the vertical frames 20A, 30B, to 100 mm longer. By this, it is possible to reduce costs and to reduce ventilation resistance to a small degree compared with the case when the water intrusion prevention device extends across the entire longitudinal direction.

[0059] The water intrusion prevention device 290 shown in Fig. 11 comprises a first component 291 and a second component 292. The first component 291 and the second component 292 have a shape symmetrical to each other; therefore, only the first component 291 will be described herein.

The first component 291 is a component arranged on an indoor side angle portion of the glass panel installation portion 22, to extend on the indoor side, as apparent from Fig. 11. Herein, an indoor side end portion of the first component 291 is bent in the width direction toward the opposite side of the member 21.

[0060] According to the above described water intrusion prevention device 290, even if the rainwater enters between the glass panel installation portions 22, 32 from the direction shown by V in Fig. 11, further intrusion of the rainwater can be inhibited because a long narrow space is formed between the first component 291 and the second component 292 and thus because a flow passage resistance is large. On the other hand, as apparent from Fig. 11, the air flow passage is secured; thus the air traveling through the intermediate space layer P, P is not obstructed.

[0061] The water intrusion prevention device 290 is

desirably disposed near the position where the slits 20Aa, 30Ba are provided. Therefore, the water intrusion prevention device 290 need not extend across the entire length of the vertical frames 20A, 30B; but desirably has a length that is from approximately the same as the size of the slits 20Aa, 30Ba along the length of the vertical frames 20A, 30B, to 100 mm longer. By this, it is possible to reduce costs and to reduce ventilation resistance to a small degree compared with the case when the water intrusion prevention device extends across the entire longitudinal direction.

[0062] The water intrusion prevention device 390 shown in Fig. 12 comprises a member 391 and a member 392. The member 391 is a member arranged on an outdoor side angle portion of the glass panel installation portion 32, to extend on the outdoor side, as can be seen from Fig. 12. And the member 392 is a member extending from an outdoor side top end portion of the member 391 in the width direction. Herein, the member 392 is arranged to cross between the glass panel installation portions 22, 32 on the outdoor side in the depth direction. Therefore, according to the water intrusion prevention device 390, the rainwater from the direction shown by W in Fig. 12 strikes against the member 392, and thus cannot enter between the glass panel installation portions 22, 32. On the other hand, as apparent from Fig. 12, the air flow passage is secured; thus the air traveling through the intermediate space layer P, P is not obstructed.

[0063] The water intrusion prevention device 390 is desirably disposed near the position where the slits 20Aa, 30Ba are provided. Therefore, the water intrusion prevention device

390 need not extend across the entire length of the vertical frames 20A, 30B; but desirably has a length that is from approximately the same as the size of the slits 20Aa, 30Ba along the length of the vertical frames 20A, 30B, to 100 mm longer. By this, it is possible to reduce costs and to reduce ventilation resistance to a small degree compared with the case when the water intrusion prevention device extends across the entire longitudinal direction.

However, because the water intrusion prevention device 390 is exposed to outdoor, in consideration of the external appearance, the water intrusion prevention device 390 may long extend along the longitudinal direction of the vertical frames 20A, 30B. By this configuration as well, the functions as the water intrusion prevention device 390 can be achieved.

[0064] The invention has been described above as to the embodiment which is supposed to be practical as well as preferable at present. However, it should be understood that the invention is not limited to the embodiment disclosed in the specification and can be appropriately modified within the range that does not depart from the gist or spirit of the invention, which can be read from the appended claims and the overall specification, and a curtain wall unit and a curtain wall having the curtain wall units disposed, with such modifications are also encompassed within the technical range of the invention.

Description of the Symbols

[0065]

10A, 10B curtain wall unit

15 frame body
20A, 30A, 20B, 30B vertical frame
20Aa slit (first flow opening)
20Ba slit (second flow opening)
30Aa slit (second flow opening)
30Ba slit (first flow opening)
40 upper horizontal frame (horizontal frame)
50 lower horizontal frame (horizontal frame)
60 intermediate horizontal frame (horizontal frame)
70 indoor side glass panel (first glass panel)
75 outdoor side glass panel (second glass panel)
90, 190, 290, 390 water intrusion prevention device

CLAIMS

1. A curtain wall unit to be disposed on an outer perimeter of a building, the curtain wall unit comprising:

a frame body which is formed of horizontal frames and vertical frames;

a first glass panel to be disposed inside a frame defined by the frame body; and

a second glass panel to be disposed inside a frame defined by the frame body such that a face thereof opposes to one face of the first glass panel with a predetermined spacing with the first glass panel,

wherein an intermediate space layer surrounded with the frame body, the first glass panel, and the second glass panel is formed;

one first flow opening leading to the intermediate space layer is arranged on one of the vertical frames of the frame body; and

one second flow opening leading to the intermediate space layer is arranged on the other vertical frame at a position higher than that of the first flow opening.

2. The curtain wall unit according to claim 1, wherein a water intrusion prevention device for preventing water from entering the intermediate space layer is provided to the vertical frame.

3. A curtain wall which is formed by arranging the curtain wall unit according to claim 1 or 2 horizontally and vertically along

an outer perimeter of a building,

wherein between the horizontally disposed curtain wall units, the vertical frames provided with the first flow opening are combined, and the vertical frames provided with the second flow opening are combined.