

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] The curtain wall unit has two types: 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 climates such as winter and can improve a heating efficiency on the indoor side. On the other

hand, in hot climates 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, 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 and 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 considered possible to prevent the horizontal frame to become thick and to reduce occurrence of the short circuit. However, since the air flow is generally on the same line in a vertical direction, there still remains the short circuit problem. Furthermore, in letting air flow in from the vertical frame, the air needs to be supplied from one vertical frame to the curtain wall units disposed on both sides thereof; thus, in order to secure a sufficient amount of air, the vertical frame needs to be formed large, sometimes causing the vertical frame area to appear thick when forming a curtain wall.

[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 (10, 10') 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 (20, 30); 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 (A) surrounded with the frame body, the first glass panel, and the second glass panel is formed; a flow opening (51a) leading to the intermediate space layer is arranged on one of the horizontal frames of the frame body; and a flow opening (21a, 31a) leading to the intermediate space layer is arranged on at least one of the vertical frames of the frame body.

[0014] A second aspect of the present invention is the curtain wall unit (10, 10') according to the first aspect, wherein in terms of a posture of the curtain wall unit to be installed to the building, the flow opening (21a, 31a) arranged on the vertical frame is positioned higher than the flow opening (51a) arranged on the horizontal frame.

[0015] A third aspect of the present invention is the curtain wall unit (10') according to the first or second aspect, wherein a water intrusion prevention device (90, 190, 290, 390) is provided to the vertical frame (20, 30).

[0016] A fourth aspect of the present invention is a curtain wall which is formed by arranging the curtain wall units (10, 10,..., 10', 10', ...) according to any one of the first to third aspects vertically and horizontally along an outer perimeter of a building, wherein a flow passage leading to the outside area from the flow opening (51a) arranged on the horizontal frame is formed between the vertically disposed curtain wall units; and

a flow passage leading to the outside area from the flow opening (21a, 31a) arranged on the vertical frame is formed between the horizontally disposed curtain wall units.

Effects of the Invention

[0017] According to the curtain wall unit and curtain wall of the present invention, the external appearance thereof can be made such that neither the horizontal frame nor the vertical frame is thick, enabling an excellent external appearance to be provided.

Further, 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.

Brief Description of the Drawings

[0018]

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

Fig. 2 is a cross-sectional view taken from line II-II in Fig. 1;

Fig. 3 is a cross-sectional view taken from line III-III in Fig. 1;

Fig. 4 is a view of a curtain wall according to a modification, the view being equivalent to Fig. 3;

Fig. 5 is a view illustrating a water intrusion prevention device 190;

Fig. 6 is a view illustrating a water intrusion prevention device

290;

Fig. 7 is a view illustrating a water intrusion prevention device 390.

Modes for Carrying Out the Invention

[0019] 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.

[0020] Fig. 1 shows 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 10, 10, ... to the building framework in vertical and horizontal alignment (for the purpose of easy understanding, only two horizontally adjacent curtain walls 10, 10 are shown by a solid line, and the other curtain walls are shown by a broken line.).

The curtain wall unit 10 comprises: a frame body 15; and an outdoor side glass panel 70, an indoor side glass panel 75 (see Fig. 2), a spandrel section glass panel 80, and a board 85 (see Fig. 2), which are disposed inside a frame defined by the frame body 15.

Fig. 2 is a cross-sectional view (vertical cross-sectional view) taken along line II-II in Fig. 1, and Fig. 3 is a cross-sectional view (horizontal cross-sectional view) taken along line III-III. In Fig. 2, 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. Further, in Fig. 3, the upper side of the sheet of paper represents the indoor side, and the lower side of the sheet of paper represents the outdoor side.

[0021] The frame body 15 is formed by combining, in a rectangular shape, a vertical frame 20, vertical frame 30, upper horizontal frame 40, lower horizontal frame 50 and intermediate horizontal frame 60, these three serving as a horizontal frame. More specifically, as well shown in Fig. 1, the vertical frames 20 and 30, 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 20, 30. 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 20, 30, intermediate horizontal frame 60, and lower horizontal frame 50, and the second compartment area 12 being defined by the vertical frames 20, 30, 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.

[0022] 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 Fig. 2 (it should be noted

that this upper horizontal frame 40 refers to an upper horizontal frame 40 of a curtain wall unit 10 which is disposed under the curtain wall unit 10 shown by the solid line in Fig. 1; 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 56 of the lower horizontal frame 50 of a curtain wall unit 10 which adjoins on this curtain wall unit 10.

[0023] 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 Fig. 2. 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.

The member 51 has a slit 51a (see Figs. 2 and 3) serving as a flow opening which penetrates the member 51, the slit 51a being arranged between the glass panel installation portion 52 and the glass panel installation portion 53 along a longitudinal direction of the lower horizontal frame 50. On the lower surface side of the member 51 there is provided a member 54 extending

downward relative to the slit 51a, on the outdoor side; and a member 55 extending downward relative to the slit 51a, on the indoor side. Accordingly, a flow passage leading to the slit 51a is formed by the member 54 and the member 55.

In addition, on the lower surface side of the member 51 there is further provided the protrusion portion 56 for engaging with the engagement portion 44 of the upper horizontal frame 40 of the lower-adjacent curtain wall unit 10.

[0024] 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 Fig. 2. 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.

[0025] The vertical frame 20 comprises a member 21 extending in the indoor/outdoor direction (depth direction), as the cross section thereof is shown in Fig. 3. 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 adjacent curtain wall unit side when the adjacent curtain wall unit 10 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.

Further, the slit 21a serving as a flow opening which penetrates the member 21 is arranged in an area within the member 21, the area between the glass panel installation portion 22 and the member 24 (see Fig. 3) and between the intermediate horizontal frame 60 and the lower horizontal frame 50 (see Fig. 2).

[0026] The position of the slit 21a is not particularly restricted. However, since the air is allowed to flow out from the slit 21a with a buoyant force by the decrease in the air density, as described below, the slit 21 a is preferably disposed as high as possible, that is, close to the intermediate horizontal frame 60.

[0027] Further, an opening area of the slit 21a is determined from a viewpoint of letting 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 (cm²); 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 $Q(\text{m}^3/\text{h})$ at a time of indoor/outdoor differential pressure $\Delta p = 1\text{mmAq}(9.8\text{Pa})$. 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.

[0028] The vertical frame 30 comprises a member 31 extending in the indoor/outdoor direction (depth direction), as the cross section thereof is shown in Fig. 3. 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 adjacent curtain wall unit side when the adjacent curtain wall unit 10 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

Further, the slit 31a serving as a flow opening which penetrates the member 31 is arranged in an area, within the member 31, the area between the glass panel installation portion 32 and the member 34 (see Fig. 3) and between the intermediate horizontal frame 60 and the lower horizontal frame 50 (see Fig. 2).

[0029] The position of the slit 31a is not particularly

restricted. However, since the air is allowed to flow out from the slit 31a with a buoyant force by the decrease in the air density, as described below, the slit 31a is preferably disposed as high as possible, that is, close to the intermediate horizontal frame 60. The slit 31a is preferably disposed at the same height as the above described 21a. This enables carrying out balanced heat release in the intermediate space layer A. However, this does not forbid changing the heights of the slit 21a and the slit 31a; the heights thereof may be different from each other depending on the necessity. The opening area of the slit 31a is the same as that of the slit 21a; thus descriptions thereof are omitted herein.

[0030] In the present embodiment, the vertical frames 20, 30 are provided with the slit 21a and the slit 31a respectively; however, a slit may be provided to only either of them. In the present embodiment, the slits 21a and 31a are arranged as a preferred embodiment for the reason that a large flow opening area is desirable and that a well balanced heat release distribution in the intermediate space layer A is desirable. Therefore, as long as the opening area of the slit is large enough and the balance of the heat release distribution in the intermediate space layer is within a permissible range, only either of the vertical frames may be provided with a slit.

[0031] 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. 1 to 3. 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 20, vertical frame 30, lower horizontal frame 50, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0032] 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. 1 to 3. 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 20, vertical frame 30, lower horizontal frame 50, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0033] 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. 1 and 2. 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 20, vertical frame 30, upper horizontal frame 40, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0034] 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 Fig. 2, to keep 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 20, vertical frame 30, upper horizontal frame 40, and intermediate horizontal frame 60 respectively, with an airtight/watertight state ensured.

[0035] The curtain wall unit 10 formed by the above described combination has the four sides in the first compartment area 11 surrounded with the vertical frame 20, vertical frame 30, intermediate horizontal frame 60, and lower horizontal frame 50; and has the intermediate space layer A formed with its indoor outer surface closed by the outdoor side glass panel 70 and the indoor side glass panel 75. Further, the intermediate space layer A is allowed to communicate with the outside area through the slit 21a of the vertical frame 20, the slit 31a of the vertical frame 30, and the slit 51a of the lower horizontal frame 50.

[0036] 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.

[0037] A configuration in which the above described curtain wall unit is combined with another curtain wall unit 10 is as

follows.

A curtain wall unit 10 and another curtain wall unit to be combined therewith in a lower-adjacent manner are well shown in an area indicated by B in Fig. 2. In specific, the protrusion portion 56 provided to the lower horizontal frame 50 of the curtain wall unit 10 disposed on the upper side engages with the engagement portion 44 provided to the upper horizontal frame 40 of the curtain wall unit 10 disposed on the lower side. At this time, a flow passage C is formed between the upper horizontal frame 40 and the lower horizontal frame 50 communicating the slit 51a with the outdoor by way of the member 54 and the member 55 of the lower horizontal frame 50.

[0038] On the other hand, the horizontally adjacent curtain wall units 10, 10 are combined in the following manner, as shown in Fig. 3. In specific, to the member 24 of the vertical frame 20, the member 34 of the vertical frame 30 of the curtain wall unit 10 adjacent thereto is attached firmly via a packing material. Likewise, to the member 25 of the vertical frame 20, the member 35 of the vertical frame 30 of the curtain wall unit 10 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 30 of the curtain wall unit adjacent thereto are attached to each other firmly via a packing material.

At this time, as shown by D, D in Fig. 3, flow passages D, D communicating the slits 21a, 31a with the outdoor are formed between the vertical frame 20 and the vertical frame 30.

[0039] According to the curtain wall formed on a building

by way of the above curtain wall units 10, 10,..., the passage for air inflow and the passage for air outflow are disposed separately in the horizontal frame and the vertical frame, thus enabling preventing either of the horizontal and vertical frames 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.

[0040] According to the curtain wall comprising the curtain wall units 10, 10, ..., the air inside the intermediate space layer A is changed for ventilation in the following manner, which will be illustrated with reference to Figs. 2 and 3.

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 A is heated, therefore causing the air inside the intermediate space layer A 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 A is allowed to flow out to the outside in such a manner as pushing out the air in sequence from the slits 21a, 31a of the vertical frames 20, 30. At this point, the air flows from the slits 21a, 31a through the passage formed between the vertical frames 20, 30, as shown by D in Figs. 2 and 3.

[0041] On the other hand, along with the outflow of the air from the intermediate space layer A, the air flows from the slit 51a of the lower horizontal frame 50 into the intermediate space layer A in a manner being drawn thereinto. This air flows through the passage formed between the upper horizontal frame 40 and lower horizontal frame 50 and between the members 54, 55, as shown by C in Fig. 3. The air flowing in is the external air and at least has a temperature lower than the air warmed up in the intermediate space layer A; therefore the outdoor side glass panel 70, indoor side glass panel 75, blind 13 etc. are cooled by that.

[0042] By continuously repeating the above described heating and traveling of the air, the inside of the intermediate space layer A 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.

[0043] Further, in the curtain wall comprising the curtain wall units 10, 10, ..., the air flows in from the lower horizontal frame 50, and the air flows out from the vertical frames 20, 30; therefore, it is possible to reduce to a large degree, the likelihood that the air having flown out from the intermediate

space layer A flows back into the intermediate space layer A again. This can prevent a short circuit and can stabilize the air inside the intermediate space layer A at a lower temperature.

Furthermore, it is possible to obtain a large flow opening of the horizontal frame across the entire length of the horizontal frame, and to arrange, on the vertical frame, a flow opening of the vertical frame corresponding thereto; therefore, a large effective flow opening area can be obtained.

[0044] In the present embodiment, the slit for the air inflow in the intermediate space layer A is arranged on the lower horizontal frame; and the slit for the air outflow is arranged on an area of the vertical frame disposed thereabove. However, in view of preventing the short circuit, the positions of the slits may be opposite. That is, the slit for the air inflow may be arranged on the lower part of the vertical frame in the intermediate space layer A; and the slit for the air outflow may be arranged on the intermediate horizontal frame to dispose an outflow passage.

In the present embodiment, the above described curtain wall unit 10 has been described as a preferred embodiment from the view point of discharging water entering the intermediate space layer A, as described below.

[0045] In the curtain wall units 10, 10, ..., even when rainwater enters the intermediate space layer A from the slits 21a, 31a of the vertical frames 20, 30, this rainwater drops out from the slit 51a of the lower horizontal frame, enabling prevention of accumulation of water inside the intermediate space layer A. And this can prevent generation of mold and stains inside

the intermediate space layer A.

The water having dropped out from the slit 51a moves on the member 41 of the upper horizontal frame 40 in a longitudinal direction of the member 41, and reaches between the horizontally adjacent curtain wall units (i.e. between the vertical frames). A water receiver (catch pan, not shown) is arranged between these vertical frames; and the water is discharged to the outside therefrom.

[0046] Fig. 4 is a view illustrating a curtain wall formed by the curtain wall units 10', 10' in accordance with a modification. Fig. 4 is equivalent to Fig. 3. The curtain wall units 10', 10' are different from the above described curtain wall units 10, 10 in that they are provided with a water intrusion prevention device 90. The other components are the same as those of the above curtain wall units 10, 10; therefore, the same reference numerals are given thereto, and the descriptions thereof are omitted.

[0047] 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, 4. 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.

[0048] On the other hand, the second component 92 comprises three members 92a, 92b, 92c formed in a bent shape on its cross section.

[0049] The first component 91 and the second component 92 are disposed, as can be seen from Fig. 4, inside a space surrounded with the vertical frame 20, vertical frame 30, members 24, 34, and glass panel installation portions 22, 32, at a time of forming the curtain wall by the curtain wall units 10', 10'. Details are as follows.

 The first component 91 is installed to the vertical frame 30; and at this time, the member 91a extends in the depth direction and the member 91c extends in a direction of the vertical frame 20 of the adjacent curtain wall unit 10'. 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. 4, 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.

[0050] The second component 92 is installed to the vertical frame 20, 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 30 of the adjacent curtain wall unit 10' in a manner inclining toward the indoor side. The member 92c extends from a top end of the member 92b further in the direction of the vertical frame 30 of the adjacent curtain wall unit 10'. 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.

[0051] 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 E in Fig. 4, 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 21a, 31a into the intermediate space layer A, A.

[0052] 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. On the other hand, as apparent from Fig. 4, the air flow passage is secured, so the air outflow from the intermediate space layer A, A is not obstructed.

[0053] The water intrusion prevention device 90 is desirably disposed near the position where the slits 21a, 31a are provided. Therefore, the water intrusion prevention device 90 need not extend across the entire length of the vertical frames 20, 30; but desirably extends in a length that is from approximately the same as the size of the slits 21a, 31a along the length of the vertical frames 20, 30, 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.

[0054] Figs. 5 to 7 are views for illustrating water

intrusion prevention devices 190, 290, 390 in another embodiment, respectively. Figs. 5 to 7 are equivalent to Fig. 4.

[0055] The water intrusion prevention device 190 shown in Fig. 5 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.

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 vertical frame 20, vertical frame 30, 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.

[0056] 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 F in Fig. 5, 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 side is obstructed by the protrusions 191c, 191c, ..., 192c, 192c, ...; thereby effectively inhibiting intrusion of the rainwater. On the other hand, as apparent from Fig. 5, the air flow passage is secured; thus the air outflow from the intermediate space layer A, A is not obstructed.

[0057] The water intrusion prevention device 190 is desirably disposed near the position where the slits 21a, 31a are provided. Therefore, the water intrusion prevention device 190 need not extend across the entire length of the vertical frames 20, 30; but desirably has a length that is from approximately the same as the size of the slits 21a, 31a along the length of the vertical frames 20, 30, 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.

[0058] The water intrusion prevention device 290 shown in Fig. 6 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. 6. 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.

[0059] 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 G in Fig. 6, 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. 6, the air flow passage is secured; thus the air outflow from the intermediate space layer A, A is not obstructed.

[0060] The water intrusion prevention device 290 is desirably disposed near the position where the slits 21a, 31a are provided. Therefore, the water intrusion prevention device 290 need not extend across the entire length of the vertical frames 20, 30; but desirably has a length that is from approximately the same as the size of the slits 21a, 31a along the length of the vertical frames 20, 30, 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.

[0061] The water intrusion prevention device 390 shown in Fig. 7 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. 7. 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 H in Fig. 7 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. 7, the air flow passage is secured; thus the air outflow from the intermediate space layer A, A is not obstructed.

[0062] The water intrusion prevention device 390 is desirably disposed near the position where the slits 21a, 31a are provided. Therefore, the water intrusion prevention device 390 need not extend across the entire length of the vertical frames 20, 30; but desirably has a length that is from approximately the same as the size of the slits 21a, 31a along the length of the vertical frames 20, 30, 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 20, 30. By this configuration as well, the functions as the water intrusion prevention device 390 can be achieved.

[0063] 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

[0064]

10	curtain wall unit
15	frame body
20	vertical frame
21a	slit (flow opening)
30	vertical frame
31a	slit (flow opening)
40	upper horizontal frame (horizontal frame)
50	lower horizontal frame (horizontal frame)
60	intermediate horizontal frame (horizontal frame)
70	outdoor side glass panel (first glass panel)
75	indoor 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;

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

a flow opening leading to the intermediate space layer is arranged on at least one of the vertical frames of the frame body.

2. The curtain wall unit according to claim 1, wherein in terms of a posture of the curtain wall unit to be installed to the building, the flow opening arranged on the vertical frame is positioned higher than the flow opening arranged on the horizontal frame.

3. The curtain wall unit according to claim 1 or 2, wherein a water intrusion prevention device is provided to the vertical

frame.

4. A curtain wall which is formed by arranging the curtain wall units according to any one of claims 1 to 3 vertically and horizontally along an outer perimeter of a building,

wherein a flow passage leading to the outside area from the flow opening arranged on the horizontal frame is formed between the vertically disposed curtain wall units; and

a flow passage leading to the outside area from the flow opening arranged on the vertical frame is formed between the horizontally disposed curtain wall units.