

A CURTAIN WALL

This invention relates to a unit type curtain wall, and more particularly to an apparatus for holding water-tight spaces between four curtain wall units arranged as two side-by-side upper units and two side-by-side lower units.

It is well known that connecting portions of not only a unit type curtain wall but also curtain walls are so constructed that a relative displacement between the curtain walls themselves or respective layers of a building (relative storey displacement) due to shocks of earthquake can be absorbed thereinto. On the contrary, it is little known that the connecting portions are held in water-tight. And, further, it is difficult in the unit type curtain wall to hold water-tight the crossed portion of the curtain wall units adjacent to top and bottom and left and right.

That is, portions between vertical frame units adjacent to left and right, between horizontal frame units adjacent to top and bottom and between the vertical frame unit and the horizontal frame unit have to be held water-tight, and therefore it is difficult to hold the crossed portion water-tight.

According to the present invention there is provided a curtain wall comprising two upper side-by-side rectangular curtain wall units arranged respectively immediately above two lower side-by-side rectangular curtain wall units, each said curtain wall unit comprising an upper horizontal frame member, a lower horizontal frame member and two side frame members respectively at the four sides of the curtain wall unit, four elongate vertical battens respectively mounted to the right-hand side frame members of the

two left-hand side frame members of the two right-hand curtain wall units, four elongate horizontal battens respectively mounted to the upper horizontal frame members of the two lower curtain wall units and to the lower horizontal frame members of the two upper curtain wall units, each frame member and its associated batten forming a respective frame unit, and a device to provide watertight sealing between the four curtain wall units, said device comprising a pair of packings interconnecting the righthand and lefthand vertical frame units respectively of the lefthand and righthand upper curtain wall units, another pair of packings interconnecting the righthand and lefthand vertical frame units respectively of the lefthand and righthand lower curtain wall units, the four packings each extending horizontally between their respective righthand and lefthand vertical frame units and being external to the respective frame members thereof, two elongate connecting members arranged horizontally, one between and interconnecting the lefthand upper and lower curtain wall units and the other between and interconnecting the righthand upper and lower curtain wall units, and a common connecting plate which interconnects the righthand and lefthand vertical frame units respectively of both the upper and the lower curtain wall units and which also interconnects the two elongate connecting members.

Preferably, said spaces are maintained watertight and yet in communication with the exterior so as to assume an atmospheric pressure equal to that of the exterior, said spaces being between the lower horizontal frame units of the upper curtain wall units on the one hand and the upper horizontal frame units of the lower curtain wall units on the other hand and between the righthand

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vertical frame units of the lefthand curtain wall units on the one hand and the lefthand vertical frame units of the righthand curtain wall units on the other hand.

5 Preferably, a further two packings are provided towards the insides of the respective vertical frame members, one such packing interconnecting the righthand and lefthand vertical frame members respectively of the righthand and lefthand upper curtain wall units, the other such packing interconnecting the righthand and lefthand vertical frame members respectively of the righthand and lefthand lower curtain wall units.

10 Preferably each said connecting member comprises an outwardly and downwardly slightly inclined upper wall, inner and outer walls which extend substantially vertically and downwardly from both inner and outer edges of said upper wall, a lower wall connected
15 between said inner and outer walls in an approximately intermediate portion therebetween, a protruded hook member formed in a substantially intermediate portion of said upper wall to engage an inside of the batten of said horizontal frame member, said an upper protruded member which extends vertically and upwardly from the inner edge
20 of said upper wall and is fitted into a mounting groove at a lower end of said upper horizontal frame unit through an elastic retainer, wherein said lower end of said inner wall is fitted vertically displaceably into a mounting groove at an upper end of said lower horizontal frame unit through an elastic retainer, and the lower
25 end of said outer wall is connected to an outer wall surface of the batten of said lower horizontal frame unit through a seal which allows air to pass through.

Preferably said connecting plate comprises an outwardly and downwardly slightly inclined upper wall portion which has a shape analogous in section to a shape which excludes the inner side wall, the lower wall and the protruded hook member, an upwardly directed piece which extends upwardly from the end edge internally of said upper wall portion, and a hanging piece which extends substantially vertically downwardly from the end edge externally of said upper wall portion, wherein each of said constituting elements are respectively closely attached to inner portions of similar corresponding portions of said connecting member.

Preferably said seal which allows air to pass through comprises mohair which is mounted on a recessed groove formed internally and downwardly of the outer wall of said connecting member.

Preferably the lower portion of the outer wall of said connecting member is a portion separated from the outer wall and has a hanging

piece mounted by means of a screw bolt.

The invention will be described by way of example with reference to the accompanying drawings, wherein:-

Fig. 1 is a front view showing only a skeleton of a
5 curtain wall;

Fig. 2 is an enlarged detailed view of a portion of Fig. 1 marked "II";

Fig. 3 is a sectional view taken on line III-III of Fig. 2;

10 Fig. 4 is a sectional view taken on line IV-IV of Fig. 3; and

Fig. 5 is a sectional view taken on line V-V of Fig. 2.

Reference is now made to Fig. 1 which is a front view
15 showing only a skeleton of a curtain wall. Curtain wall units Aa, Ab, Ac and Ad are mounted as two upper side-by-side units and two lower side-by-side units to constitute a unit type curtain wall. The curtain wall unit Aa is formed into a rectangular frame by means of a pair of vertical frame members 1a, 1b, an upper
20 horizontal frame member 2a, first and second intermediate frame members 2m₁, 2m₂ and a lower horizontal member 2c.

Fig. 2 is a detailed front view of a portion indicated at II (a crossed portion of top and bottom and left and right curtain wall units Aa, Ab, and Ad) in Fig. 1. Externally of
25 vertical frame members 1a to 1d and horizontal frame members 2a to 2d are connected vertical and horizontal battens 31, respectively, to constitute vertical frame units Ba, Bb,

Bc and Bd and horizontal units Ca, Cb, Cc and Cd.

Each of the vertical frame units Ba to Bd is constructed as shown in Fig. 3 which shows the units Bc and Bc. That is, a body 14 in the form of a hollow elongate member is composed of two longer side walls 10, 11 and two shorter side walls 12, 13. The shorter side wall 12 is formed with a mounting piece 15,

while another shorter side wall 13 is formed with a longitudinally continuous hollow portion 16 and a recess 17 open towards said longer side wall 10, said mounting piece 15 having a Z-shaped wall 15a formed with a first large mounting recess 18 and an end wall 15b perpendicular to said z-shaped wall 15a formed with second and third small mounting recesses 19, 20, said end wall 15b being formed with a shoulder 21, another side wall 15c and said shorter side wall 12 of the body 14 being formed with a shoulder 22, said shorter side wall 12 being integrally formed with a pair of locking projections 23, 24. A respective batten 31 is mounted on the end wall 15b of the mounting piece 15 by means of screw bolts 32 through a longitudinally continuous insulating material 30 of the vertical frame member 1c or 1d, the batten 31 having an outer end wall 31a integrally formed with a bent wall 31b in the form of a hook to form a fourth large recess 33, the wall 31b being formed with fifth and sixth recesses 34, 35 opposed to the second and third mounting small recesses 19, 20 of the mounting piece 15, the second small mounting recess 19 and the fifth recess

34 having connecting members 36, respectively, of a heat insulating material fitted therein to constitute the vertical frame unit Bc (or Bd, Ba or Bb).

Air-tight sealing members 38, 38 are mounted between the pair of locking projections 23, 24 and on a recess 37 formed in the outer end wall 31a of the batten 31, a panel 39 is held between the air-tight members 38, 38.

In the respective vertical frame units Bc, Bd (or Ba, Bb) of the curtain wall units Ac, Ad (or Aa, Ab) adjacent to left and right, their respective large mounting recesses 17, 18 and 33 are oppositely mounted as shown in Fig. 3, and a pair of outer packings 41, 42 and an inner packing 43 are fitted in and mounted between the opposed recesses to hold water-tight and connect the vertical frame units Bc, Bd (or Ba, Bb) adjacent to left and right.

In the vertical frame units Bb, Bd adjacent top and bottom, their respective vertical frame members 1b, 1d are formed with projections 1b', 1d', respectively, as shown in Fig. 4 said projections being connected each other by means of a flexible cylindrical member 3 such as, for example, bellows.

Since each of the horizontal frame units Ca to Cd has substantially the same shape as that of the vertical frame units Ba to Bd as shown in Fig. 5 in which the units Cb and Cd are illustrated, the elements thereof are indicated by the same reference numerals as those used in the vertical frame units and the description thereof will be omitted.

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Each pair of curtain wall units Aa and Ac or Ab and Ad adjacent one above the other are connected by means of a unit connecting member 50.

The unit connecting member 50 is provided with an upperwall 51, a lower wall 52, and inner and outer walls 53, 54 formed on each side of the upper and lower walls 51 and 52, the upper wall 51 being in a gradual descent outwardly and being integrally formed with an upward hook 55 at an approximately intermediate portion thereof, the inner wall 53 being integrally formed at its upper and lower portions with upper and lower projections 56, 57, and the outer wall 54 being integrally formed with a hanging piece 58.

It will be noted that the hanging piece 58 can be fixed by means of a screw separately from the outer wall 54.

The upper projection 56 is fitted and locked in the first large mounting recess 18 of the upper horizontal frame unit Cd through a downwardly directed C-shaped holding member 59 made of an elastic material, the upward hook 55 is locked in the recess 34 of the batten 31, and the upper portion of the unit connecting member 50 is locked and secured to the upper horizontal frame unit Cd. The lower projection 57 is fitted displaceably up and down into the first large mounting recess 18 of the lower horizontal frame unit Cb through an upwardly directed C-shaped holding member 59 of an elastic material, a seal material 80 such as,

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for example, mohair, through which air passes, mounted on the recess 79 formed in the hanging piece 58 is pressed against the outer wall 61a of the batten 61, and a space D formed between the pair of horizontal outer packings 41, 42 and the upper and lower frame units is in communication with outside.

By this, the unit type curtain wall

comprises a constant atmospheric pressure wall to positively prevent entry of rain water or the like into the interior.

The left and right unit connecting members 50, 50 extend up to the opposed walls of the vertical frame units Ba, Bb and Bc, Bd resulting in a discontinuity in left and right as shown in Fig.2 to produce a clearance between the left and right connecting members 50 and 50.

To cover this clearance, a connecting plate 70 is mounted over and between internal surfaces of the left and right unit connecting members 50 and 50 as shown in Figs. 2 and 4 to hold water-tight. said clearance.

The connecting plate 70 is configured to the connecting member 50 except the lower wall 52, inner wall 53 and the upward hook 55 to be in close contact with the inner surfaces of the upper projection 56, upper wall 51, outer wall 54 and hanging piece 58 of the unit connecting member 50 by an upwardly directed piece 71, an outwardly descended piece 71 and a hanging piece 73, the upwardly directed piece 71 having a longitudinal intermediate



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portion fitted into the first large mounting recesses 18, 18 of the upper vertical frame units Bc, Bd, respectively, so that it is pressed against the lower end 42a of one of the horizontal outer packings 41, 42, both
5 longitudinal ends thereof being fitted and locked together with the upper projection 56 within the holding member 59 of the left and right upper horizontal frame units Cc, Cd, and the hanging piece 73 being pressed through a seal material 74 against the outer surface 41a of the
10 other horizontal outer packing 41 of the lower vertical frame units Ba, Bb.



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CLAIMS:-

1. A curtain wall comprising two upper side-by-side rectangular curtain wall units arranged respectively immediately above two lower side-by-side rectangular curtain wall units, each said curtain wall unit comprising an upper horizontal frame member, a lower horizontal frame member and two side frame members respectively at the four sides of the curtain wall unit, four elongate vertical battens respectively mounted to the right-hand side frame members of the two lefthand curtain wall units and to the lefthand side frame members of the two righthand curtain wall units, four elongate horizontal battens respectively mounted to the upper horizontal frame members of the two lower curtain wall units and to the lower horizontal frame members of the two upper curtain wall units, each frame member and its associated batten forming a respective frame unit, and a device to provide watertight sealing between the four curtain wall units, said device comprising a pair of packings interconnecting the righthand and lefthand vertical frame units respectively of the lefthand and righthand upper curtain wall units, another pair of packings interconnecting the righthand and lefthand vertical frame units respectively of the lefthand and righthand lower curtain wall units, the four packings each extending horizontally between their respective righthand and lefthand vertical frame units and being external to the respective frame members thereof, two elongate connecting members arranged horizontally, one between and interconnecting the lefthand upper and lower curtain wall units and the other between and interconnecting the righthand upper and lower curtain wall units, and a common connecting plate which interconnects the righthand and lefthand



vertical frame units respectively of both the upper and the lower curtain wall units and which also interconnects the two elongate connecting members.

2. A curtain wall according to claim 1, wherein spaces are
5 maintained watertight and yet in communication with the exterior so as to assume an atmospheric pressure equal to that of the exterior, said spaces being between the lower horizontal frame units of the upper curtain wall units on the one hand and the upper horizontal frame units of the lower curtain wall units on the other hand
10 and between the righthand vertical frame units of the lefthand curtain wall units on the one hand and the lefthand vertical frame units of the righthand curtain wall units on the other hand.

3. A curtain wall according to claim 1 or 2 wherein a further two packings are provided towards the insides of the respective
15 vertical frame members, one such packing interconnecting the righthand and lefthand vertical frame members respectively of the right hand and lefthand upper curtain wall units, the other such packing interconnecting the righthand and lefthand vertical frame members respectively of the righthand and lefthand lower curtain wall
20 units.



4. A unit type curtain wall according to claim 1, 2 or 3,
characterized in that each said connecting member comprises an outwardly
5 and downwardly slightly inclined upper wall, inner and
outer walls which extend substantially vertically and
downwardly from both inner and outer edges of said upper
wall, a lower wall connected between said inner and outer
walls in an approximately intermediate portion therebetween,
10 a protruded hook member formed in a substantially
intermediate portion of said upper wall to engage an
inside of the batten of said horizontal frame member, and
an upper protruded member which extends vertically and
upwardly from the inner edge of said upper wall and is
15 fitted into a mounting groove at a lower end of said upper
horizontal frame unit through an elastic retainer, wherein
said lower end of said inner wall is fitted vertically
displaceably into a mounting groove at an upper end of
said lower horizontal frame unit through an elastic retainer,
20 and the lower end of said outer wall is connected to an
outer wall surface of the batten of said lower horizontal
frame unit through a seal which allows air to pass through.

5. A
unit type curtain wall according to Claim 1, 4, characterized
25 in that said connecting plate comprises an outwardly and
downwardly slightly inclined upper wall portion which has
a shape analogous in section to a shape which excludes the



inner side wall, the lower wall and the protruded hook member from said connecting member, an upwardly directed piece which extends upwardly from the end edge internally of said upper wall portion, and a hanging piece which
5 extends substantially vertically downwardly from the end edge externally of said upper wall portion, wherein each of said constituting elements are respectively closely attached to inner portions of similar corresponding portions of said connecting member.

10 6. A

unit type curtain wall according to Claim 5, characterized in that said seal which allows air to pass through comprises mohair which is mounted on a recessed groove formed internally and downwardly of the outer wall of said connecting member.

15 7. A

type curtain wall according to Claim 4 or 5, characterized in that the lower portion of the outer wall of said connecting member is a portion separated from the outer wall and has a hanging piece mounted by means of a screw bolt.

8. A curtain wall substantially as described with reference to and as illustrated in the accompanying drawings.
