

A CURTAIN WALL FOR HEATING OR COOLINGROOMS OF A BUILDING

This invention relates to a curtain wall for heating or cooling rooms of a building.

According to the present invention, there is provided a curtain wall for heating or cooling the rooms of a building, comprising a plurality of frames each having a substantially rectangular shape and including a plurality of horizontal frame members connected between left and right vertical frame members, and the said frames being arranged in a network or grid, characterized in that the said ^{vertical frame members} and the said horizontal frame members have hollow portions, respectively, which are air flow passages through which, in use, conditioned air flows and is blown into the rooms through air openings formed in said horizontal frame members and that respective hollow portions of the vertical frame members of adjacent upper and lower frames are connected with each other by the interposition of flexible cylindrical connecting members thereby forming vertically communicating air flowing ducts.

Preferably the said flexible cylindrical connecting members are fixedly secured to the vertical frame

members by means of bands.

5 Preferably the said hollow portions formed in the vertical frame members are allowed to communicate with at least one of the said hollow portions formed in the horizontal frame members, respectively.

Preferably the said one of the hollow portions of the horizontal frame members is in an intermediate transom.

10 Preferably the said vertical and horizontal frame members further comprises hollow portions which are passages through which heating or cooling medium flows and respectively formed to be adjacent to the said portions each serving as an air flow passage.

15 Preferably respective heating or cooling medium flow passages of one of the vertical frame members, an upper horizontal frame member, the other vertical frame member and a lower horizontal frame member communicate with one another so as to form a heating or cooling medium flow line.

20 Preferably one end of the said heating or cooling medium flowing line is connected through a pipe to a heating or cooling medium supply conduit, and the other end thereof is connected through another pipe to a heating or cooling medium return conduit.

Preferably a pair of vertical frame members in adjacent frames are connected with each other through packing bands fitted between and into recesses respectively formed in the said pair of vertical frame members, thereby enabling the absorbing of a relative displacement between adjacent frames.

Preferably the said air flow passages of the lowermost vertical frame members of the network or grid are connected to a blower.

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

Fig. 1 is a partial front view showing only the framework of a curtain wall;

Figs. 2, 3 and 4 are sectional views taken on line II-II, III-III and IV-IV, respectively, of Fig. 1;

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

Fig. 6 is a sectional view taken on line VI-VI of Fig. 5.

Fig. 1 is a partial front view showing only a framework of a curtain wall. The curtain wall has a construction

in which a plurality of frames are mounted in a network or grid. Each frame extends between a floor a and a ceiling b.

5 Each frame is rectangular and comprises a number of horizontal frame members, namely, an upper cross beam 2, an intermediate transom 3, a lower cross beam 4 and a lower frame member 5 horizontally connected between a pair of left and right vertical frame members 1a, 1b. The vertical frame members 1a, 1b of adjacent upper and
10 lower frames A_1 , A_4 are connected through connecting devices B. A supply conduit 6 for a heating or cooling medium such as hot or cold water and a return conduit 7 are laterally and continuously connected between the floor a and the ceiling b in each floor.

15 Fig. 2 is a sectional view taken on line II-II of Fig. 1. The vertical frame member 1a or 1b comprises an elongate hollow member composed of left and right longer side walls 10, 11 and inner and outer shorter side walls 12, 13 to form a hollow portion 14 serving as an air
20 flow passage, the inner shorter side wall 12 being formed with a small hollow portion 15, serving as a heating or cooling medium flowing passage, and a recess 16, while the outer wall 13 is formed with a recess 17.

Also, as shown in Fig. 3, the lower frame member 5 and
25 the upper cross beam 2 have substantially the same shape

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as that of the vertical frame member 1a or 1b and are disposed the one upside down to the other. Battens 24 are mounted on the outer shorter side wall 13 via a heat insulating material 22 and a connecting plate 23 of a heat insulating material, and the lower frame member 5 and a portion outside the room of the upper cross beam 2 and the battens 24, 24 are connected by flashing members 28 forming as a connecting plate.

In the intermediate transom 3, as shown in Fig. 4, an upwardly directed cover member 32 of an upward C-shape is connected to a body 32 of the intermediate transom 3 having substantially the same shape as that of the vertical frame member to form first and second hollow portions 3a and 3b one directly above the other. The second hollow portion 3b communicates at the longer side wall of the vertical frame member 1a or 1b with the hollow portion 14, serving as the air flow passage of the vertical frame member 1 through an opening 3e provided at a position opposite to the second hollow portion 3b. The second hollow portion 3b communicates with the first hollow portion 3a via a hole 3c, while the first hollow portion 3a is open to the room through air outlet openings 3d.

As shown in Figs. 5 and 6, the small hollow portion 15 serving as the heating medium flow passage, the recess 16 and the recess 17 are cut away in the shorter side



5 wall portions of upper and lower ends of the vertical member 1a or 1b, but the inner and outer shorter side walls 12, 13 are left. As a result, the left and right longer side walls 10, 11 and the inner and outer shorter side walls 12, 13 constitute an outer peripheral wall 100 having a substantially rectangular section, and a flexible cylindrical connecting member 18 is fastened by means of fastening bands 19, 19 between the adjacent upper and lower outer peripheral walls 100, 100 to maintain air-tight the hollow portion 14 which may suffer relative displacement between the upper and lower vertical frame members 1a, 1b (or 1a, 1a) and serves as the air flow passage.

15 That is, the cylindrical connecting member 18 and the fastening bands 19, 19 constitute the connecting device B.

20 With this arrangement, air can flow between the vertical frame members 1b, 1b or 1a, 1a of the adjacent upper and lower frames A_1 , A_4 and relative displacement between the vertical frame members can be absorbed.

Returning now to Fig. 2, the adjacent left and right vertical frame members 1a, 1b are connected through packing bands 20, 21, 26 respectively fitted between respective pairs of opposite recesses 16, 16; 17, 17 and

25, 25. The horizontally adjacent frames A_1 , A_2 can absorb relative displacement by movement of the bands into and out of the portion where the packing bands are fitted.

5 It should be noted that if the cross-sectional area of the hollow portion 14 serving as the air flow passage of the vertical frame member 1a or 1b is less than that required for feeding air to each of the floors, the cross section of the vertical frame member 1a or 1b can
10 be made larger to increase the cross-sectional area of the hollow portion 14 serving as the air flow passage. This is also beneficial in that the strength of the vertical frame member increases to increase the strength of the curtain wall.

15 In Fig. 1, the cross beam 2, the intermediate transom 3, the lower cross beam 4 and the lower frame 5 have substantially the same shape as that of the vertical frame member and are respectively connected at both their respective ends to the vertical frame members 1a
20 and 1b. As shown in Fig. 4, the hollow portion 14 serving as the air flow passage of the vertical frame member 1a or 1b and the hollow portion 3a serving as the air flow passage of the intermediate transom 3 are brought into communication with each other through an
25 opening 3e of one of said vertical frame members 1a, 1b. The hollow portion 3a of the intermediate transom 3

is open into the room via air outlet openings 3d. The hollow portions 15, 15 serving as the heating or cooling medium flow passages of the vertical frame members 1a, 1b are in communication with both ends of the hollow portion 215 serving as the heating or cooling medium flow passage of the upper cross beam 2, while the hollow portion 15 serving as the heating cooling medium flow passage of one vertical frame member 1a is in communication with the heating or cooling medium flow passage 315 of the intermediate transom 3, and the hollow portion 15 serving as the heating or cooling medium flow passage of the other vertical frame member 1b is in communication with the hollow portion (not shown) serving as the heating or cooling medium flow passage of the lower cross beam 4. Further, upper and lower sides of the hollow portions 15, 15 serving as the heating or cooling medium flow passages of the vertical frame member 1a, 1b may be blocked by means of plugs, not shown, and the other end of the hollow portion serving as the heating or cooling medium flow passage of the intermediate transom 3 and the lower cross beam 4 is also blocked.

That is, the respective heating or cooling medium flow passages for the intermediate transom 3, one vertical frame member 1a, the upper cross beam 2, the other vertical frame member 1b and the lower cross beam 4 are in communication to constitute a continuous heating or

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cooling medium flow line in each frame, as shown by full line arrows in Fig. 1.

5 The heating or cooling medium flow passage of the intermediate transom 3 is connected to and communicates with the supply conduit 6 via a pipe 8, and the heating or cooling medium flow passage of the lower cross beam 4 is connected to and communicates with the return conduit 7 via a pipe 9. The air flow passages of the lowermost vertical frame members 1a, 1b are connected to
10 communicate with a blower or the like.

The heating or cooling medium supplied from the supply conduit 6 heats or cools, in turn, the respective vertical and horizontal frame members 3, 1a, 2, 1b and 4 during the time the medium is flowing through said
15 heating or cooling medium flow passage to control temperatures in the rooms by radiation effects from the vertical and horizontal frame members, and at the same time, conditioned air which has been cleaned and adjusted in temperature and humidity is fed into the air flow passages 3b, 3a of the horizontal frame members
20 such as the intermediate transom 3 from the hollow portion 14 serving as the air flow passage of the vertical frame members 1a, 1b, and the air is then blown into the room from the air outlet openings 3d provided
25 along the intermediate transom 3 to provide said radiation effect and to ideally control temperature over

the whole the room right from the window.

Also, the heating or cooling medium can heat or cool the vertical frame members 1a, 1b and the intermediate transom 3 and also can heat or cool the conditioning air which flows through the air flow passages of the intermediate transom 3 and the vertical frame members 1a, 1b.

In Figs. 2 and 5, the adjacent left and right vertical frame members 1a, 1b are connected and sealed by the inner and outer packing bands 20, 21 which allow for movement thereof into and out of the portions between the opposed recesses 16, 16 and 17, 17. Further, battens 24 are mounted on the outer shorter side wall 13 of each vertical frame member 1a or 1b through a heat insulating member 22 and a heat insulating connecting plate 23. A packing band 26 is fitted between the recesses 25 of the opposed battens 24 in a manner similar to the first mentioned packing band, and a heat insulating panel 27 is mounted between the vertical frame member 1a or 1b and the batten 24. The flashing members 28 are mounted between upper and lower panels 27, 27, the horizontally adjacent flashing members 28, 28 being interconnected by means of a back plate 29.

As described above, in accordance with the present invention, the vertical frame members 1a, 1b and the

horizontal frame members 2, 3 and 4 which constitute each frame can be utilized to control temperature of the room. Therefore, the piping within the body of the building may be minimized. And, in addition, assembly of the air-conditioning ductwork is achieved by mere assembly of the curtain wall itself, which is very simple. Furthermore, ideal air conditioning can be effected at the window or from the wall surfaces, and the floor area of the room can be effectively used without being restricted by any air conditioning unit.

Moreover, in the case of four vertical frame members constituting a mullion-like portion, in that they are arranged in two side-by-side pairs with one pair directly above the other pair, the four hollow portions thereof forming respective air flow passages are individually or separately connected to respective horizontal air flow passages by means of the flexible cylindrical connecting members and are only interconnected with each other vertically end-to-end, not side-by-side, and are not integral with each other. Therefore, even if relative storey displacement or other relative displacement which is unavoidable occurs between the interconnected frames due to earthquakes, errors in execution or thermal expansion and contraction or the like resulting from a difference between the temperature of the open air and that of the interior of a room, in respect of the connections in a vertical

direction between the frames the vertical and horizontal displacements can be absorbed by the said connected portions so as not to influence one movement on the other. Further, even in the case of the horizontally adjacent frames movement of one frame will not influence the other so that the displacement between the frames can be absorbed without impairing air-tight communication between the upper and lower hollow portions serving as the air flow passages of the vertical frame members while avoiding occurrence of any air leak or the like even if the earthquake occurs. In addition, the upper and lower hollow portions, which are the respective air flow passages of the aforesaid four vertical frame members constituting a mullion-like portion can be vertically positively brought into air tight communication by means of the two, simple, cylindrical connecting members which are juxtaposed.

The horizontally adjacent vertical frame members of the mullion-like portion constitute respective individual hollow air flow passage and are made continuous only vertically and therefore, when the partitioning wall is built at the mullion-like portion in the indoor to feed cooled air or hot air into the adjacent rooms with said partitioning wall being a boundary, such air can be distributed and fed into the adjacent rooms since the air flow passages of the horizontally adjacent vertical frame members in the mullion-like portion are

individually opposite respective rooms. Because of this, more cold air or hot air than that required will never be used, and a damper device or the like need not be provided to supply and distribute cold or hot air in
5 the mullion-like portion but supplying of such air can be simply accomplished.

Accordingly, where a partitioning wall is provided in a room within a building while adjusting to adjacent vertical frame members which constitute the mullion-like
10 portion, thereby forming adjacent rooms with the partitioning wall being a boundary, it is possible to supply and distribute cold or hot air to the rooms in a simple and adequate manner.

Claims:-

1. A curtain wall for heating or cooling the rooms of a building comprising a plurality of frames each having a substantially rectangular shape and including a plurality of horizontal frame members connected between left and right vertical frame members, and the said frames being arranged in a network or grid, characterized in that the said vertical frame members and the said horizontal frame members have hollow portions, respectively, which are air flow passages through which, in use, conditioned air flows and is blown into the rooms through air openings formed in said horizontal frame members, and that respective hollow portions of the vertical frame members of adjacent upper and lower frames are connected with each other by the interposition of flexible cylindrical connecting members thereby forming vertically communicating air flowing ducts.

2. A curtain wall according to Claim 1 wherein the said flexible cylindrical connecting members are fixedly secured to the vertical frame members by means of bands.

3. A curtain wall according to Claim 1 or 2 wherein the said hollow portions formed in the vertical frame members are allowed to communicate with at least one of



the said hollow portions formed in the horizontal frame members, respectively.

5 4. A curtain wall according to Claim 3 wherein the said one of the hollow portions of the horizontal frame members is in an intermediate transom.

5. A curtain wall according to any preceding Claim wherein the said vertical and horizontal frame members further comprise hollow portions which are passages through which heating or cooling medium flows.

10 6. A curtain wall according to Claim 1 or 5 wherein respective heating or cooling medium flowing passages of one of the vertical frame members, an upper horizontal frame member, the other vertical frame member and a lower horizontal frame member communicate with one
15 another so as to form a heating or cooling medium flowing line.

20 7. A curtain wall according to Claim 6 wherein one end of the said heating or cooling medium flowing line is connected through pipe means to a heating or cooling medium supply conduit, and wherein the other end thereof is connected through another pipe means to a heating or cooling medium return conduit.

8. A curtain wall according to any preceding Claim



wherein a pair of vertical frame members in adjacent frames are connected with each other through packing band means fitted between and into recesses respectively formed in the said pair of vertical frame members,

5 thereby enabling the absorbing of a relative displacement between adjacent frames.

9. A curtain wall according to any preceding Claim wherein respective air flow passages of the lowermost vertical frame members of the network or grid are

10 connected to blower means.

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



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