

BUILDING FRAMEWORK WITH COOLING AND

HEATING AIR JET MEANS

This invention relates to a building framework provided with cooling and heating air jet means. The invention may be applied to an interior or exterior structure such as a curtain wall, room partition or the like, for example, and more particularly, a cooling and heating air jet device provided on a framework including vertical and horizontal hollow shaped wall support members (the members will be simply referred to as "vertical member" and "horizontal member", respectively, hereinbelow) of the curtain wall, room partition or the like.

Heretofore, a cooling and heating air jet device provided on a framework including vertical and horizontal hollow shaped members of the curtain wall has been known, as shown, for example, in U.K. Patent No. 2023277. The air jet device of this U.K. Patent includes the framework of hollow vertical and horizontal wall support members through which cooling or heating water is circulated. An air duct comprising a framework of hollow vertical and horizontal members is positioned parallel to, and in contact with, the framework of wall support members for heat exchanging with the same. A series of air jet openings is provided in the horizontal member for cooling or heating the interior of the building.

In this air jet device, however, as the same sized air jet openings are provided along the horizontal member of the air duct and the air jet is directly spouted from the

air duct, the discharge of the air is not distributed uniformly in the longitudinal direction of the horizontal member. For example, if air is supplied through the horizontal member from one end thereof toward the other end of the same, the discharge of the air is a maximum at one end, but it is a minimum at the other end. Fig. 5 of the accompanying drawings is a graph showing, inter alia, the pressure distribution in this prior art device. If air is supplied through the horizontal member from both ends thereof as shown in Fig. 5, the discharge of air is maximum at both ends, but minimum in the central area as shown by line A in Fig. 5. Therefore, uniform cooling or heating of the room along the air duct cannot be effected in this known air jet device.

According to the present invention there is provided a building framework of hollow vertical and horizontal wall support members forming an interior or exterior structure and provided with cooling and heating air jet means, said framework of hollow wall support members forming an air duct through which cooling or heating air is passed, a selected one of said wall support members being formed with a plurality of air jet openings spaced in the longitudinal direction of the same, the hollow interior of said selected wall support member is divided into two adjacent and parallel chambers by a partition wall having a plurality of communication holes spaced in the longitudinal direction of the same, one of said chambers forms a part of said air duct and a first pressure equalizing chamber and the other of

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said chambers forms a second pressure equalizing chamber, and said plurality of air jet openings are formed in a side wall of said second pressure equalizing chamber, characterized in that of each said vertical and horizontal wall support members
5 is provided in the hollow interior thereof with an air flow passaged forming said air duct and a heat medium flow passage, said heat medium flow passage in said selected wall support member is integrally formed with said support member and is provided in said second pressure equalizing chamber, said
10 plurality of air jet openings are positioned substantially centrally of said side wall in the width direction of the same, said plurality of communication holes are offset towards the exterior side of said partition wall and said heat medium flow passage is inside of said selected wall support member.

15 With a preferred form of the above-mentioned construction and arrangement of the components, when an adjusted air is supplied through the selected one wall support member, the adjusted air is first supplied to the first pressure equalizing chamber where the pressure
20 distribution of the air is slightly equalized, then the pressure-equalized air is passed through the communica-

cation holes in the partition wall into the second pressure equalizing chamber and then spouted through the air jet openings in the second pressure equalizing chamber whereby the pressure distribution in the air is further equalized to improve cooling or heating efficiency

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

Fig. 1 is a schematic front elevational view of a curtain wall embodying the invention incorporated therein as seen from the interior side thereof;

Fig. 2 is a fragmentary perspective view of the curtain wall as seen from the interior side thereof showing the air jet openings;

Fig. 3 is a cross-sectional view taken along the line III-III of Fig. 1;

Fig. 4 is a cross-sectional view taken along the line IV-IV of Fig. 1; and

Fig. 5 is a graph showing the pressure distribution along the horizontal member in the device embodying the present invention together with that of the prior art for purposes of comparison.

Figs. 1 to 4 show the cooling and heating air jet device embodying the invention as being provided on a curtain wall which constitutes a building exterior wall. The curtain wall comprises a plurality of identical curtain wall units each including vertical and horizontal hollow wall support members 1 and 2, 2', connected together to provide a framework for supporting members such as adiabatic panels 3 and pairs of glass sheets 4 on the outside of the framework.

The curtain wall units are secured to the support portion of the building by means of fasteners or the like. In Fig. 1, reference numerals 5 and 6 denote the floor and ceiling boards of the building, respectively.

5 Each of the vertical and horizontal members 1 and 2, 2' is provided in the hollow interior thereof with an air flow passage 7 to provide an air duct and a heat medium flow passage 8 the latter of which is optional. These passages 7 and 8 may be formed integrally or separately. As shown by
10 the broken arrows in Fig. 1, clean air, the temperature and moisture of which has been adjusted, is introduced into the air flow passages 7 and a portion of the air is passed within the hollow intermediate horizontal member 2' provided in the intermediate position between the floor board 5 and
15 the ceiling board 6 and is spouted through air jet openings 9 formed in the intermediate horizontal member into the interior of the room to thereby effect direct cooling and heating of the room. In Fig. 1, reference numeral 10 denotes a cylindrical expansible joint for communicating
20 between the adjacent vertical members 1 in each curtain wall unit.

On the other hand, a heat medium such as cool water or warm water at a suitable temperature is supplied into the heat medium flow passages 8 to provide a cooling or heating
25 effect to the air flow within passage 7 by the radiation heat of the medium. That is, the heat medium supplied from a supply conduit 11 is cycled through the passages 8 formed within the vertical and horizontal members 1, 2 and 2' as

shown by the solid lines in Fig. 1 and returned to a return conduit 12.

Fig. 3 shows the details of the arrangement of Fig. 1 along the line III-III of Fig. 1 and it will be seen that a first chamber 13, as a portion of the air duct and a first pressure equalizing chamber, and a second chamber, as a second pressure equalizing chamber 14, are formed in adjacent and parallel relationship to each other by a partition wall 16 within the interior of the intermediate horizontal member 2' and in the illustrated embodiment, an additional heat medium flow passage 8 is provided at the room side in the first chamber. The first chamber 13 is in communication with an opening 15 in the side wall of the air flow passage 7 in the associated vertical member 1 and a portion of the adjusted air supplied to the vertical member 1 is passed through the opening 15 into the first chamber 13 in the horizontal member 2'.

The partition wall 16 which separates the first and second chambers 13, 14 from each other is provided with a plurality of communication holes 17 spaced in the longitudinal direction of the wall whereby the pressure distribution in the adjusted air is first slightly equalized in the first pressure equalizing chamber 13 due to the existence of pressure within the chamber 14 and the air is further passed through the communications holes 17 in the partition wall 16 into the second pressure equalizing chamber 14 from where the air is spouted in a substantially uniform pressure distribution through the air jet openings 9 in the side wall

of the second pressure equalizing chamber 14 (the upper side wall as seen in Fig. 3). That is, if the first and second pressure equalizing chambers 13, 14 are not provided and air is instead directly spouted through openings 9 from the hollow interior of the intermediate horizontal member 2', the pressure of the air is not distributed uniformly in the longitudinal direction of the horizontal member 2' as shown by line A in Fig. 5 and thus, there is the problem that uniform cooling and heating along the horizontal member 2' cannot be effected. However, the device of the present invention solves the problem and the pressure of the spouted air is uniformly distributed as shown by line B in Fig. 5. The opening area of the communication holes 17 communicating between the first and second pressure equalizing chambers 13, 14 is determined by the amount of air required in the room and other factors.

A cylindrical member having a plurality of openings spaced in the longitudinal direction thereof is rotatably provided in each of the associated air jet openings 9 and as the cylindrical member rotates, the orientation of the openings in the member is varied to thereby adjust the direction of the air jet spouted through the air jet openings 9. In Figs. 2 and 3, reference numeral 18 denotes an air amount adjustment board movable upwardly and downwardly along the associated vertical member 1 and by manipulating the board 18, the opening area of the above-mentioned opening 15 in the vertical member 1 is adjusted to thereby adjust the amount of the adjusted air to be supplied to the

first pressure equalizing chamber 1 in the intermediate horizontal member 2'.

In order not to damage the heat insulating system of the curtain wall, at the time of the attachment of the
5 intermediate horizontal member 2', adiabatic panel 3 and pair glass sheet 4, the intermediate horizontal member 2' as an indoor member and a holding edge member 19 as an outdoor member are connected together by means of a screw 21 with an adiabatic block 20 interposed therebetween.

10 Fig. 4 is a cross-sectional view taken along the line IV-IV of Fig. 1 and as shown in this Figure, a plurality of adiabatic packing bands 22 are interposed in the joint between the adjacent curtain wall units of the curtain wall on both the interior and exterior sides of the curtain wall
15 unit in order to assure heat insulation between the interior and exterior sides of the curtain wall.

Although description has been made of the case in which the air jet device is provided on the intermediate horizontal member 2' of the framework of wall support
20 members in the unit type curtain wall, the description is equally applicable to an indoor partition and the like. Although the air jet device is preferably provided in the intermediate position between the floor board and the ceiling board from the view point of the efficiency of cooling
25 and heating, the device can be also provided on the vertical or horizontal member in any other position.

As shown in Fig. 3, the heat medium flow passage 8 in wall support member 2' is integrally formed therewith in the second pressure equalizing chamber 14, inside wall support member 2'. The air jet openings 9 are positioned substantially
5 centrally of the upper side wall as seen in Fig. 3 in the width direction thereof. The communication holes 17 are offset towards the exterior side of the partition wall 16.



CLAIMS:-

1. A building framework of hollow vertical and horizontal wall support members forming an interior or exterior structure and provided with cooling and heating air jet means, said framework of hollow wall support members forming an air duct through which cooling or heating air is passed, a selected one of said wall support members being formed with a plurality of air jet openings spaced in the longitudinal direction of the same, the hollow interior of said selected wall support member is divided into two adjacent and parallel chambers by a partition wall having a plurality of communication holes spaced in the longitudinal direction of the same, one of said chambers forms a part of said air duct and a first pressure equalizing chamber and the other of said chambers forms a second pressure equalizing chamber, and said plurality of air jet openings are formed in a side wall of said second pressure equalizing chamber, characterized in that each of said vertical and horizontal wall support members is provided in the hollow interior thereof with an air flow passage forming said air duct and a heat medium flow passage, said heat medium flow passage in said selected wall support member is integrally formed with said support member and is provided in said second pressure equalizing chamber, said plurality of air jet openings are positioned substantially centrally of said side wall in the width direction of the same, said plurality of communication holes are offset towards the exterior side of said partition wall and said heat medium flow passage is inside of said selected wall support member.



2. A building framework as claimed in Claim 1, in which said selected one wall support member is any one of said vertical and horizontal wall support members.

3. A building framework as claimed in Claim 1, in which said
5 framework includes a horizontal intermediate member positioned intermediate between a floor and a ceiling board, said selected wall support member being said horizontal intermediate member.

4. A building framework as claimed in Claim 3, in which said
10 first chamber is in communication with an opening in the side wall of its associated vertical wall support member, and the opening area of said opening is adjustable by an air amount adjustment board movably provided along said associated vertical wall support member.

5. A building framework as claimed in any one of Claims 1 to 4,
15 in which a cylindrical member having a plurality of openings spaced in the longitudinal direction thereof is rotatably provided in each of said air jet openings.

6. A building framework substantially as described with reference to and as illustrated in the accompanying drawings.
