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~~[Title:]~~ THERMALLY INSULATED WINDOW WITH VENTILATION
DUCTS

~~[Description:]~~

The present invention relates to thermally
5 insulated windows for use in a curtain wall of a
housing or building, and more particularly to such a
thermally insulated window having ventilation ducts.

Thermally insulated windows composed of metallic
shapes or sections, such as extruded aluminum shapes
10 are known, in which a window sash or frame comprises
interconnected interior and exterior pairs of such
metallic shapes and thermally insulating connectors of
synthetic resin or rubber interposed between the
interior and exterior frame pieces, and panes of glass
15 or other thermally insulating panels are mounted within
the window frame.

The known thermally insulated window has a
drawback in that where a ventilation duct is provided
in the window frame for communication between the room
20 interior and the outside air, the thermal insulation in
the vicinity of the duct becomes insufficient. This is
because the duct which extends between the metallic
interior and exterior shapes tends to break a thermally
insulated relation between the interior and exterior
25 shapes and hence to make a thermal path therebetween.
With the thermal path thus completed, a considerable
amount of heat energy is transferred from the room

interior to the outside air through such thermal path, thereby lowering the room air conditioning efficiency. Furthermore, during winter season when cold outside air is introduced through the duct into the heated room interior, the interior shapes are wet
5 with dew which will reduce the thermal insulating properties of the window. In order to avoid air exchange through the duct when the ventilation is not effected, there may be provided on the exterior side of the duct a pivotable valve or damper which is actuatable to open and close the duct through a power transmitting
10 mechanism such as a link mechanism composed of a plurality of metallic links. In assembling such metallic links with the duct, care must be taken not to damage a thermal insulation between the interior side of the window and the exterior side of the window.

According to the present invention, there is provided
15 a thermally insulated window for a building, comprising: a thermally insulated window frame and a thermally insulated panel element supported within said window frame, said window frame including a pair of interconnected interior and exterior frame pieces and thermally insulating connectors interposed between said interior
20 and exterior frame pieces; a pair of intake and discharge ducts mounted on said frame and extending between said interior and exterior frame pieces for communication between outside atmospheric air and inside air of the building, said intake and discharge ducts being made of a thermally insulating material and having
25 intake and discharge openings facing the outside atmospheric air; a pair of dampers made of a thermally insulated material and pivotably mounted on said intake and discharge ducts, respectively, adjacent to said intake and discharge openings to open and close the latter;

a pair of power transmitting mechanisms disposed in said intake and discharge ducts, respectively, and operatively connected to said dampers to pivot the latter, said power transmitting mechanisms being actuatable from the inside of the building.

5 It is believed possible by means of the present invention to provide a thermally insulated window having ducts which overcome or substantially eliminate the drawbacks with the prior comparable windows.

10 It is further believed possible by means of the present invention to provide a thermally insulated window having intake and discharge ducts which is mounted in the window without deteriorating the thermal insulating properties of the entire window and which is adapted to be open and closed by dampers provided on the exterior side of the ducts.

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

Figure 1 is a vertical cross-sectional view of a portion of a thermally insulated window embodying the invention, the view showing a transom and a ventilation duct mounted therein;

5 Figure 2 is a schematic front elevational view, on reduced scale, of the thermally insulated window, the view showing the window as seen from the interior of a room;

 Figure 3 is a view similar to Figure 2, showing
10 the thermally insulated window as seen from the exterior of the room;

 Figure 4 is a vertical cross-sectional view of the ventilation duct shown in Figure 1, the view illustrating the operation of a damper actuation
15 mechanism mounted within the duct;

 Figure 5 is an enlarged horizontal cross-sectional view of the duct, with parts omitted for clarity; and

 Figure 6 is an enlarged vertical cross-sectional
20 view taken in a plane perpendicular to the plane of Figure 4.

Referring now to the drawings, wherein like reference characters designate identical or corresponding parts throughout several views, and more

particularly to Figures 2 and 3, there is shown a thermally insulated window W embodying the present invention.

The thermally insulated window W includes an open rectangular window frame F mounted in an opening of a building (not shown).

- 5 The window frame F includes top and bottom horizontal frame members 1, 2 connected at opposite ends with left and right vertical frame members 3, 3, and an intermediate horizontal frame member or a transom 4 extending between the vertical frame members 3, 4 to define a pair of upper and lower openings within the window frame F.
- 10 The transom 4 is positioned more closely to the bottom horizontal frame member 2 than to the top horizontal frame member 1. A pane of glass 5 is mounted within the upper opening, and a thermally insulated panel 6 is mounted within the lower opening, the glass pane 5 and the panel 6 each constituting a thermally insulated
- 15 panel element. A ventilator 7 is supported within the window frame F. The ventilator 7 has a built in heat-exchanging element or rotor (not shown) which is capable of exchanging both sensitive heat and latent heat at the same time, see for example our British Patent Applications Nos. 83 , 83 and 83 (Serial
- 20 Nos. 2 , 2 and 2) references 230P50126, 230P50127 and 230P50128.

Consumed room air is sucked into the ventilator 7 as indicated by the arrows a in Figure 2 and then it is discharged from an outlet (not shown) to the outside atmosphere as indicated

25 by the arrows d in Figure 3. Fresh atmospheric air is sucked from an inlet (not

shown) into the ventilator 7 as indicated by the arrows c in Figure 3 and then it is discharged from the transom 4 to the room interior as indicated by the arrows b in Figure 2. The fresh atmospheric air and the consumed room air are brought into heat-exchange relationship as they flow through the heat-exchanging rotor in the ventilator 7.

As shown in Figure 1, the transom 4 comprises a pair of interior and exterior frame pieces 4a, 4b interconnected with connectors 10, 11 interposed therebetween. The frame pieces 4a, 4b are made of extruded aluminum shapes or sections while the connectors 10, 11 are made of a thermally insulating material such as a synthetic resin or rubber. Thus, the transom 4 has a thermally insulated construction. Although not shown, the top and bottom horizontal frame members 1, 2 and the vertical frame members 3, 3 also have a thermally insulated construction and each include a pair of interior and exterior frame pieces of extruded aluminum shapes interconnected with thermally insulating connectors interposed therebetween. As described above, the glass pane 5 and the thermally insulated panel 6 are mounted within the window frame F as thermally insulated panel elements. Thus, the window W as a whole has a thermally insulated construction.

The transom 4 has a pair of intake and discharge

ducts 8 (only one being shown) juxtaposed in a longitudinal direction of the transom. These ducts have the same construction and only the discharge duct 8 is described below. The duct 8 has a generally inverted L-shape and extends through the interior and exterior frame pieces 4a, 4b. The duct 8 is made of a thermally insulated material, such as a synthetic resin so that it does not adversely influence the thermal insulating properties of the window W as a whole. The duct 8 has an interior end portion 8a connected with the ventilator 7 and an discharge opening 8b which is closed and opened by a valve means or damper 9 pivotably mounted on the duct 8 adjacent to the opening 8b. The damper 9 is made of a thermally insulating material such as a synthetic resin and is actuated through a power transmitting mechanism described below.

As shown in Figures 4 to 6, the power transmitting mechanism comprises a link mechanism M disposed within the duct 8 and actuatable to open and close the damper 9 in response to reciprocation of an actuator rod 12 which is operatively connected to a select switch (not shown) adapted to be actuated by an occupant of the room. The link mechanism M includes a pair of parallel spaced rocking levers 13, 13 centrally pivoted by a pin 15 to a pair of support plates 14, 14 secured to the interior end portion 8a of the duct 8.

The rocking levers 13, 13 have lower end portions pivotably connected by a pin (not designated) to the actuator rod 12 so that they are pivotally movable in vertical planes, respectively, in response to the reciprocation of the actuator rod 12. The link mechanism M also includes a horizontal shaft 16 rotatably mounted in and extending transversely through the duct 8, the shaft 16 lying in a plane parallel to the plane of the window. The shaft 16 has a rocking pin 17 extending perpendicularly therethrough and received at opposite ends thereof in arcuate guide slots 18 which are formed in the upper end portions of the respective rocking levers 13, 13. The arcuate guide slots 18, 18 are vertically offset or staggered from one another. With this pin-and-slot connection, a pivotal motion of the levers 13, 13 is converted to a rotary motion of the shaft 16 and driving power is transferred between two non-intersecting, non-parallel axes. A connecting lever 19 is secured at one end thereof to one end of the shaft 16 for pivotal movement in a vertical plane which is perpendicular to the vertical planes of the movement of the levers 13, 13. A pair of actuation links 20, 21 is connected to the connecting lever 19 and the damper 9. Stated more specifically, the lever 20 is pivotably connected at one end to the upper end of the connected lever 19 and at the other end to a lower end of the damper 9. The

lever 21 is pivotably connected at one end to an intermediate portion of the connecting lever 19 and at the other end to the upper end of the damper 9.

Although not shown, a connecting lever and a pair of links are disposed in the duct 8 in opposite relation to the corresponding elements 19, 20, 21.

With the link mechanism M thus constructed, when the damper 9 is to be opened, the actuator rod 12 is operated to move leftwardly in Figure 6, whereupon the rocking levers 14, 14 pivot clockwise. This pivotal motion causes the shaft 16 to turn counter-clockwise in Figure 4 whereupon the link 20 is urged outwardly from the discharge opening 8b of the duct 8. Thus, the damper 9 pivots to an open position indicated by phantom lines in Figure 4. The damper 9 moves to the closing position indicated by solid lines in this figure in response to the movement of the actuator rod 12 toward the rightward direction in Figure 6.

The thermally insulated window thus constructed has various advantages. The ducts and the dampers are made of a thermally insulated material such as a synthetic resin. The dampers are actuated by power transmitting mechanisms such as link mechanisms which are disposed in the respective ducts and are adapted to be actuated from the room interior side of the window. The ducts, dampers and power transmitting mechanisms do not reduce the thermal insulating properties of

the window as a whole with the result that an increased degree of room air conditioning efficiency is attainable.

It is possible to modify the window frame to have double glazing, to improve thermal insulation.



CLAIMS:

1. A thermally insulated window for a building,
comprising:

- (a) a thermally insulated window frame and at least one
5 thermally insulated panel element supported within said
window frame, said window frame including a pair of
interconnected interior and exterior frame pieces and
thermally insulating connectors interposed between said
interior and exterior frame pieces;
- 10 (b) a pair of intake and discharge ducts mounted
on said frame and extending between said interior and
exterior frame pieces for communication between outside
atmospheric air and inside air of the building, said
intake and discharge ducts being made of a thermally
15 insulating material and having intake and discharge
openings facing the outside atmospheric air;
- (c) a pair of dampers made of a thermally
insulated material and pivotably mounted on said intake
and discharge ducts, respectively, adjacent to said
20 intake and discharge openings to open and close the
latter;
- (d) a pair of power transmitting mechanisms
disposed in said intake and discharge ducts,
respectively, and operatively connected to said dampers
25 to pivot the latter, said power transmitting mechanisms
being actuatable from the inside of the building.

2. A thermally insulated window according to



claim 1, said ducts and said dampers being made of a synthetic resin.

3. A thermally insulated window substantially as described with reference to and as illustrated in the accompanying drawings.
