

- [54] INSULATING DEVICE FOR RESTRICTING
THE ACCUMULATION OF MOISTURE AND
ICE ON WINDOWS

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[52] U.S. Cl..... 52/171, 52/455, 52/741

[51] **Int. Cl.**..... **E06b 7/12**

[58] **Field of Search**..... 52/171, 172, 454,
52/741; 62/248

[56] **References Cited**

UNITED STATES PATENTS

3,573,149 3/1971 Tibble..... 52/171

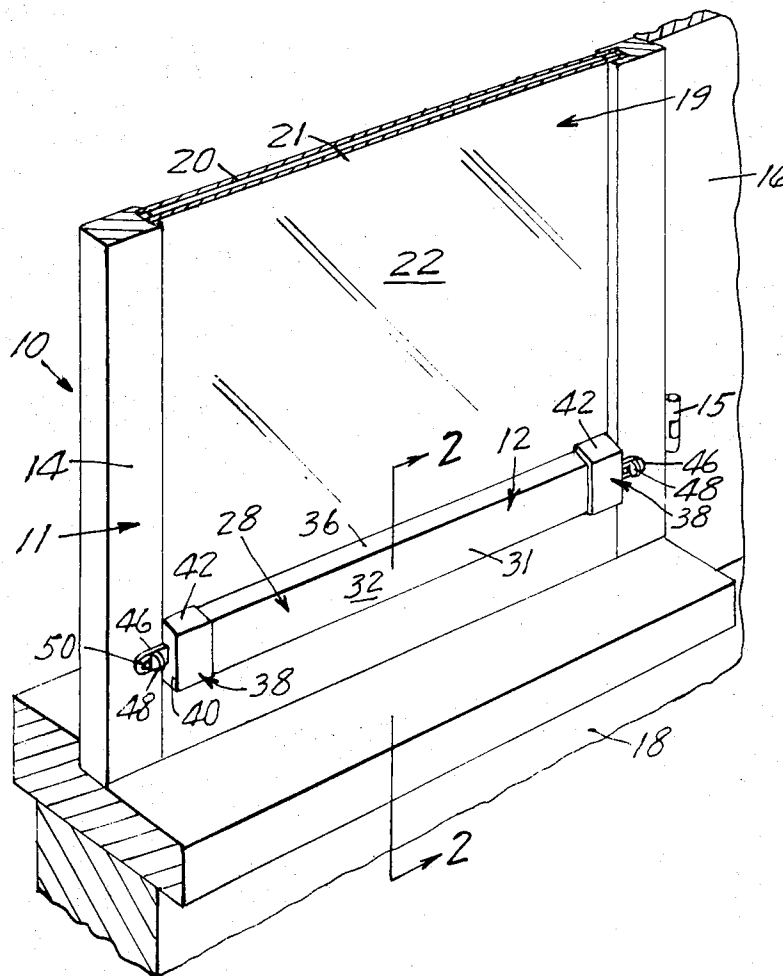
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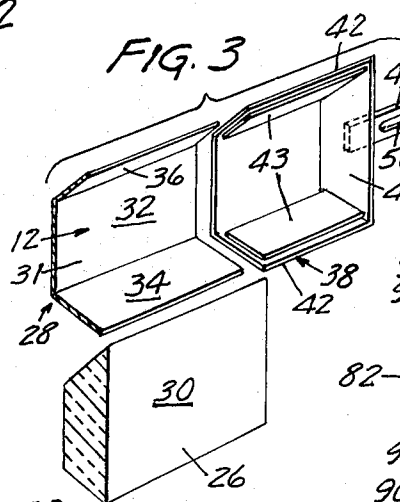
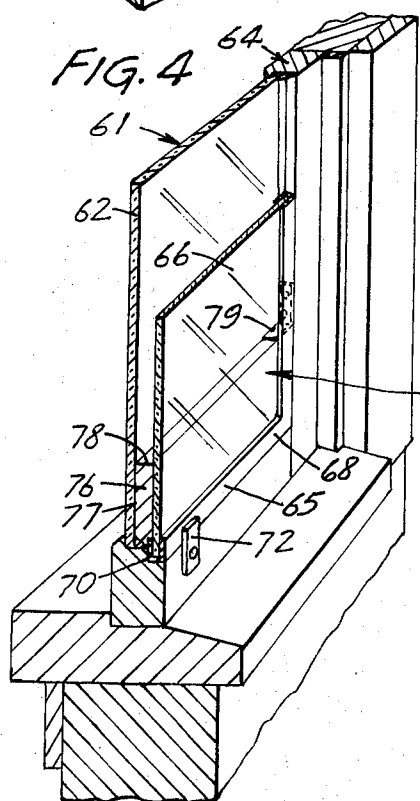
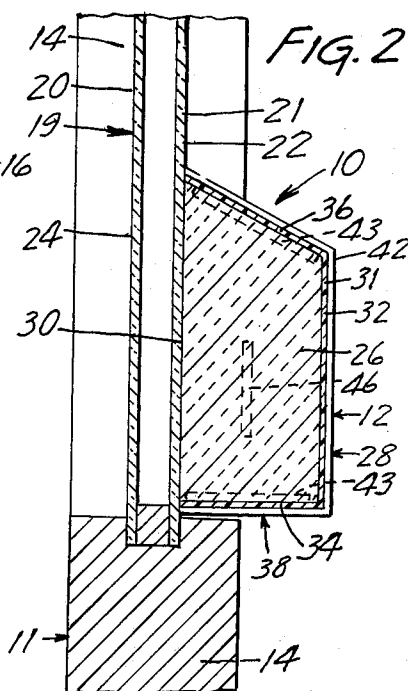
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[57] **ABSTRACT**

A method and device for restricting the accumulation of moisture and ice on the inner surface of a window glass unit during the winter months when the window glass unit separates low temperature air from warm humidified room air. A thermal insulating device approximately the width of the window glass unit and less than about one tenth its height is mounted on the outside of the window across the lowest portion of the window glass unit to restrict heat transfer through the window adjacent the device.

10 Claims, 5 Drawing Figures





INSULATING DEVICE FOR RESTRICTING THE ACCUMULATION OF MOISTURE AND ICE ON WINDOWS

BACKGROUND OF THE INVENTION

This invention relates to a method and device for restricting the accumulation of moisture and ice on the surface of a window glass unit, and in one aspect to a method and device for restricting such accumulation on the glass unit of a vertical window separating warm humidified air at room temperature from low temperature outside air.

Particularly in the northern states, moisture and ice accumulations on the internal surface of windows during the winter months is a severe problem. In winter, moisture is typically added to heated inside air via a humidification system to afford breathing comfort for the occupants and to restrict damage to wooden structures and furniture. When the outside temperature drops into the sub freezing range, the inner surfaces of the window glass units are typically at a temperature substantially below room temperature. Humidified room air contacting the inner surface of the window glass units will be cooled, and apparently tends to fall along the surface of the window. As the falling air is cooled by the surface of the window glass units, its relative humidity increases until it reaches 100 percent. Continued cooling of the air causes moisture to condense on the surface of the window glass units in increasing quantities toward the lowest portion of the window. If the outside temperature is sufficiently low, the moisture will freeze. In any event, the moisture eventually will run down upon the frame and window sill, causing potential damage to the finish and rotting of the wood.

The prior art discloses several approaches to combating this problem. U.S. Pat. Nos. 1,894,205 and 2,446,356 disclose means for providing a flow of heated air upwardly along the surface of a window glass unit. The devices disclosed in these patents, however are complex, would require extensive modification to afford their use on existing windows, and require a special heat source. U.S. Pat. No. 683,588 discloses means to vent air under the lower edge of the window to equalize the temperature on opposite sides of the window glass unit and thereby prevent the accumulation of moisture. This, however, is impractical for addition on existing windows due to the type of modifications that would be required, and is generally impractical due to the heat loss that would result. Thus, heretofore there has not been known a practical, simple and effective method to restrict moisture and ice accumulation on the inner surface of a window.

SUMMARY OF THE INVENTION

The present invention provides a practical, simple and effective method for restricting the accumulation of moisture and ice on the inner surface of a window during the winter months, and an inexpensive insulating device for use in practicing the method.

Surprisingly, it has been found that the accumulation of ice and moisture on a window separating humidified room air from air below 32 degrees Fahrenheit may be effectively restricted by applying a relatively small thermal insulating device across the lowest portion of the window glass unit on the side opposite the inner surface to restrict heat transfer through the glass in the area adjacent the insulating device. The change that the insu-

lating device effects in the air temperature at the lower inner surface of the window is able by conduction or convection to effect the inner surface of the window at and above the insulating device and effectively restrict the accumulation of moisture and ice.

As the insulating device according to the present invention covers only a small area across the bottom of the window glass (typically below 5 percent), it does not significantly reduce the light transmitting area of the window.

Additionally, conventional windows may be easily modified to accept a thermal insulating device in accordance with the present invention, and the insulating device includes means for releasable attachment to a window for which it is adapted so that it may be easily removed when its function is not required as during the summer months.

The use of an insulating device in accordance with the present invention allows humidity levels in a heated building during the winter which afford human comfort and restrict drying of wooden structures and furniture, while not exposing wooden window frames and sills to moisture accumulated by the glass window units.

According to the present invention, there is provided a method for restricting the accumulation of moisture and ice on a window comprising at least one vertically oriented window glass unit and a surrounding window frame, when a first surface of said glass unit is exposed to air of an ambient temperature below 32 degrees Fahrenheit and a second opposite surface of the glass unit is exposed to air of a higher ambient temperature so that the temperature of the glass unit at the second surface is between the ambient air temperatures, and the higher ambient temperature air has a humidity ratio (e.g. pounds of water vapor per pound of dry air) exceeding the humidity ratio of air at 100% relative humidity at the temperature of the second surface.

The method includes providing an insulating device having a planar contact surface of a length generally equal the exposed width of the glass unit, a height of less than about one tenth the exposed height of the glass unit, and having a predetermined high thermal insulating value in a direction normal to the contact surface; and attaching the insulating device at the lowest portion of the glass unit on the side of the glass opposite the second surface with the contact surface adjacent and parallel to the first surface and the length of the device extending across the glass to restrict heat transfer through the glass unit in the area adjacent the insulating device.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be further described with reference to the accompanying drawing, wherein like numbers refer to like parts in the several views, and wherein:

FIG. 1 is a perspective view partially in section of a first type of casement window assembly including a first embodiment of an insulating device according to the present invention;

FIG. 2 is a fragmentary enlarged vertical sectional view taken approximately along the lines 2—2 of FIG. 1;

FIG. 3 is a fragmentary exploded elevational perspective view of the insulating device shown in FIGS. 1 and 2;

FIG. 4 is a fragmentary perspective view partially in section of a second type of casement window assembly illustrating the use of a second alternate embodiment of the insulating device according to the present invention; and

FIG. 5 is a fragmentary perspective view partially in section of a double hung window assembly illustrating the use of a third alternate embodiment of the insulating device according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2 there is shown a window assembly according to the present invention, generally designated by the number 10. The window assembly 10 includes a window 11, and means to restrict the accumulation of moisture and ice on the inner surface of the window 11 comprising a first embodiment of an insulating device according to the present invention generally designated by the number 12.

The window 11 illustrated is a casement window of the type including a window frame 14 mounted via hinges 15 for pivotal movement in an outer frame 16 attached to a building structure 18, and having a glass unit 19 including two vertically oriented parallel glass sheets 20 and 21 with dry air sealed therebetween mounted in parallel spaced relationship about their periphery within the window frame 14 to define an exposed area of glass. During the cold winter months, an outer surface 22 of the glass unit 19 may be exposed to temperatures below 32 degrees Fahrenheit, while the inner surface 24 of the glass unit 19 may be exposed to warm humidified air at room temperature. Under such conditions, the heat transferred through the window glass unit 19 will reduce the temperature at the inner surface 24 of the glass unit 19 and cause moisture from the room air to condense, and at very low outside temperatures, to freeze on the surface 24.

Referring now to FIGS. 1, 2, and 3, the insulating device 12 according to the present invention for restricting the accumulation of moisture and ice on the surface 24 comprises an insulating bar 26 of thermal insulating material mounted within a housing 28 with a first generally planar surface 30 exposed to afford intimate contact with the surface 22 of the glass unit 19. The insulating bar 26 has a sufficient thickness at right angles to the planar surface 30 to provide a predetermined high thermal insulating value for restricting heat transfer through the glass unit 19 in the area adjacent the insulating device 12.

Generally, in insulating devices according to the present invention, the size of the planar surface and the thickness of the insulating bar may vary depending upon the size and type of window glass unit for which it is designed and the temperatures to which the glass unit is exposed. In its preferred embodiment the planar surface has a width generally equal to that of the exposed area of the window glass unit to which it is to be applied. The height of the planar surface is selected at a minimum value which will adequately restrict the accumulation of moisture and ice on the window for the service intended for the insulating device to afford the maximum light passage through the window glass unit when the insulating device is in place. Generally, the required height is below about 10 percent of the height of the window unit, with a preferred height for windows

of the size normally found on homes being about two and one quarter inches.

While the insulating bar in the insulating device according to the present invention may be formed of any good insulating material, preferably the insulating bar is formed of a closed cell foamed polymeric material which provides a relatively low thermal conductivity while restricting the absorption of water under inclement conditions, such as a foamed polystyrene.

As may best be seen in FIG. 3, the housing 28 of the insulating device 12 includes a generally U-shaped housing member 31 having three planar walls adapted to receive and contact three corresponding surfaces of the insulating bar 26. The planar walls of the housing member 31 include a rear wall 32, and a lower wall 34 and an upper wall 36 projecting from opposite edges of the rear wall 32. The housing 28 also includes a pair of end caps 38. Each end cap 38 has an end wall 40 having a guide wall 42 projecting at right angles therefrom with an inner surface shaped to contact the outer surface of the housing member 31, and a pair of projections 43 spaced parallel to the guide wall 42 to define slots to frictionally receive and hold the ends of the upper and lower wall members 36 and 34 of the housing member 31.

The distal edge surfaces of the lower and upper walls 34 and 36, and the corresponding edge surfaces of the end walls 40 define a common plane, coplanar with the surface 30 of the insulating bar 31 positioned within the housing 28 to form a flat rectangular contact surface for the insulating device 12 which affords intimate contact between surface 30 and the surface 22 of the glass unit 19, and between the edge surfaces of the walls 34, 36 and 40 and the glass unit 19 to restrict moisture from the insulating bar 26 during inclement weather. The upper wall 36 forms an included angle of less than 90 degrees with the contact surface to allow moisture to drain from the top of the housing 28 during inclement weather. The housing member 31 and the end caps 38 may be formed of any suitable hard plastic resin material.

The means illustrated to releasably attach the insulating member to the window unit comprise a tab 46 projecting from the end wall 40 of each end cap 38. A pair of elongated buttons 48 are adapted to be rotatably mounted as by a wood screw on the window frame 14 in a predetermined position for proper location of the insulating device 12. Each tab 46 is formed with an elongated opening 50 shaped to receive one of the buttons 48 which may then be rotated across the opening 50 to releasably retain the insulating device 12 on the window 11.

The following is an example of the effectiveness of an insulating device 12 according to the present invention. On a day on which the outside temperature was a minus 20 degrees Fahrenheit, and the indoor temperature was about 72 degrees Fahrenheit with a relative humidity of about 20 percent, an insulating device according to the present invention was attached across the lower outside portion of a 50 inch high by 18 inch wide window glass unit in a casement window of the type shown in FIGS. 1 and 2. The insulating bar 26 was formed of a closed cell polymeric foam, and was about 1 inch thick and 2¼ inch high. The insulating device 12 when attached across the lowest portion of the outside surface of the window unit was found to eliminate essentially all mois-

ture and ice accumulation on the inner surface of the window glass unit.

FIG. 4 illustrates the use of a second alternate embodiment of an insulating device according to the present invention generally designated by the number 60. The insulating device 60 is adapted for use on a casement type window 61 similar to the window 11 of FIGS. 1 and 2, but having a window glass unit comprising only a single glass sheet 62 mounted in a window frame 64. The window 61 includes a removable storm window 65 comprising a glass sheet 66, a metal or plastic U-shaped frame 67 about the edge of the glass sheet 66, and means for locating and attaching the frame 68 to the window frame 64 including a groove 70 in the window frame 64 and rotatable attaching members 72.

The insulating device 60 comprises an insulating bar 76 which performs the same function as the insulating bar 26 of the first embodiment, and has a planar surface 77 to afford intimate contact with the surface of the glass 62.

The insulating bar 76 may be enclosed by a housing 78 of either a rigid or flexible polymeric material for protection from damage or dirt, and/or to provide a desired aesthetic appearance such as a desired color or wood grain appearance. The housing 78 may be attached to the insulating bar 76 by a suitable adhesive. Preferably the housing 78 does not extend across the planar surface 77 to afford intimate contact between the planar surface 77 of the insulating bar 76 and the glass 62.

On a window 61 of the type illustrated in FIG. 4, the present invention may be practiced by inserting the insulating device 60 between the window glass unit 62 and the storm window 65. Means for attaching the insulating device 60 may be provided by selecting its thickness for a slight compression fit between the window glass unit 62 and the storm window 65. Alternatively, the insulating device 60 may be attached to provide intimate contact between the planar surface 77 and the window glass unit 62 by means including a pair of opposed L-shaped locating brackets 79 (only one of which is shown) attached to vertical members of the window frame 64 by spacing the brackets 79 from the upper surface of the lower member of the window frame 64 to afford a friction fit of the insulating device 60 therebetween.

FIG. 5 illustrates the use of a plurality of insulating devices according to the present invention made according to a third alternative embodiment generally designated by the number 80. The insulating devices 80 are adapted for use on a double hang window 82, which may, as illustrated, be comprised of a series of small glass sheets or window glass units 84 arrayed in a window frame 86, with the window frame 86 being spaced from a conventional storm window 88.

Each insulating device 80 includes an insulating bar 90 which performs the same function as the insulating bars 26 and 76 of the first and second embodiments, and has a planar surface 91 to afford intimate contact with the surface of the window glass unit 84.

Like the insulating bar 76 of the second embodiment, the insulating bar 90 may be enclosed by a rigid or flexible polymeric housing 92 for protection from damage or dirt, and/or to provide a desired aesthetic appearance, with the planar surface 91 preferably remaining uncovered to afford intimate contact with an outer surface 93 of each window glass unit 84.

With windows of the type illustrated in FIG. 5 the storm window 88 protects the outer surface 89 of the glass window units 84 from inclement weather, so that the insulating devices 80 may be attached by double coated tape, or a friction fit between the closely spaced members of the window frame 86.

As typically with windows of the type illustrated in FIG. 5 the moisture and ice accumulation on the window glass units 84 decreases on each successively higher row of window glass units 84, it is anticipated that the height and/or thickness of the insulating device 80 for each higher row of glass units 84 may be correspondingly decreased.

Having thus described the invention, what is claimed is:

1. A method for restricting the accumulation of moisture and ice on the surface of a window comprising at least one vertically oriented window glass unit and a surrounding window frame when a first surface of said glass unit is exposed to air of a low ambient temperature below 32 degrees Fahrenheit, and a second opposite surface of the glass unit is exposed to air of a higher ambient temperature so that the temperature of the glass unit at the second surface is between said ambient air temperatures, and the higher ambient temperature air has a humidity ratio exceeding the humidity ratio of air at one hundred percent relative humidity at the temperature of the second surface, said method comprising:

providing an insulating device having a contact surface of a length generally equal the exposed width of the glass unit and a height no greater than one tenth the exposed height of the glass unit, and having a predetermined high thermal insulating value in a direction normal to the contact surface; and attaching the insulating device at the lowest portion of the exposed surface of the glass unit on the side of the glass unit opposite the second surface with the contact surface adjacent and parallel to the first surface and the length of the strip extending across the glass unit to restrict heat transfer through the glass unit in the area adjacent the insulating device.

2. The method of claim 1 wherein said attaching step includes the steps of:

providing attaching means including a first portion adapted for attachment to the window frame, a second portion coupled to the insulating device, and means for providing releasable engagement between the first and second portions; attaching the first portion to the window frame; and engaging the first and second portions to releasably attach the insulating device to the window.

3. A window assembly restrictive to the accumulation of moisture and ice when said window assembly separates air of a low ambient temperature below 32 degrees Fahrenheit, and air of a higher ambient temperature having a humidity ratio exceeding the humidity ratio of air at 100 percent relative humidity at the temperature of said low ambient temperature air, said assembly comprising:

a window frame; at least one vertically oriented window glass unit mounted about its periphery within said window frame to define an exposed area of said window glass unit having a first surface adapted to be contacted by said air of a low ambient temperature below 32 degrees Fahrenheit, and a second oppo-

site surface adapted to be contacted by said air of a higher ambient temperature;

an insulation device having a contact surface with a length generally equal to the exposed width of said glass, a height no greater than one tenth the exposed height of said glass, and having a predetermined high thermal insulating value in a direction normal to said contact surface; and

means for attaching said insulating device at the lowest portion of the exposed portion of said glass unit on the side opposite said second surface with the contact surface adjacent and parallel to said first surface and the length of said strip extending across the width of said exposed glass portion to restrict heat transfer through the glass unit in the area adjacent said insulating device.

4. The window assembly of claim 3 wherein said insulating device comprises:

an insulating bar of thermal insulating material, said bar having a planar surface defining the major portion of said contact surface; and

a housing, and wherein said housing comprises a rear wall, and four generally planar wall members including an upper wall, a lower wall and two end walls projecting from said rear wall to form an enclosure, with the distal ends of said upper, lower and end walls defining a common plane, said bar of insulating material being oriented in said housing with said planar surface essentially coplanar with said common plane to define with said distal ends said contact surface of said insulating device, and said upper wall member forms an included angle of less than 90 degrees with said contact surface.

5. A window assembly according to claim 3 wherein said housing comprises a first housing member including said rear wall, and said upper and lower walls attached at one edge along opposing edges of said rear wall; and two end caps, each said end cap comprising a said end wall, and means for engaging said end caps with said first housing member to form said housing, and wherein said attaching means includes a first portion adapted for attachment to said window frame, a second portion coupled to said end caps, and means for providing releasable engagement between said first and second portions to afford releasable attachment of said insulating device to said window.

6. A window assembly according to claim 3 wherein the material of said insulating bar is a closed cell foamed polymeric material, said bar has a thickness of about 1 inch, and said contact surface is about two and one quarter inches high.

7. An insulating device adapted for restricting the accumulation of moisture and ice on a window comprising at least one vertically oriented glass unit, and a surrounding window frame when a first surface of said

glass unit is exposed to air of a low ambient temperature below 32 degrees Fahrenheit, and a second opposite surface of said glass unit is exposed to air of a higher ambient temperature having a humidity ratio exceeding the humidity ratio of air at 100 percent relative humidity at the temperature of said low ambient temperature air, said insulating device comprising:

an insulating bar of thermal insulating material having a planar surface of a length generally equal the exposed width of a said glass unit, a height no greater than one tenth the exposed height of said glass unit and having a predetermined high thermal insulating value in a direction normal to said contact surface;

a housing formed about said insulating bar; and attaching means adapted for attaching said housing to a said window assembly to position said bar at the lowest exposed portion of said glass unit on the side opposite said second surface with said planar surface parallel to and adjacent the first surface of said glass unit and the length of the strip extending across the glass to restrict heat transfer through the glass in the area adjacent the insulating device.

8. An insulating device according to claim 7 wherein said housing comprises a rear wall, and four generally planar wall members including an upper wall, a lower wall and two end walls projecting from said rear wall to form an enclosure with the distal ends of said upper, lower and end walls defining a common plane, said bar of insulating material is oriented in said housing with said planar surface essentially coplanar with said common plane to define with said distal ends a contact surface for said insulating device, and said upper wall member forms an included angle of less than 90 degrees with said contact surface.

9. An insulating device according to claim 8 wherein said housing comprises a first housing member including said rear wall and said upper and lower walls attached at one edge along opposing edges of said rear wall; and two end caps, each said end cap comprising a said end wall, and means for engaging said end caps with said first housing member to form said housing, and wherein said attaching means includes a first portion adapted for attachment to a said window frame, a second portion coupled to said end caps, and means for providing releasable engagement between said first and second portion to afford releasable attachment of said insulating device to a said window unit.

10. An insulating device according to claim 8 wherein the material of said insulating bar is a closed cell foamed polymeric material, said bar has a thickness of about one inch, and said contact surface is about two and one quarter inches high.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,762,118Dated October 2, 1973Inventor(s) David Leonard Sanders

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 12, change "67" to -- 68 --.

Claim 1, line 17, change "no greater than" to -- less than about --.

Claim 3, line 20 (Column 7, line 5), change "no greater than" to -- less than about --.

Claim 7, lines 14 and 15 (Column 8, lines 10 and 11), change "no greater than" to -- less than about --.

Add following new claim 11:

11. A window assembly restrictive to the accumulation of moisture and ice when said window assembly separates air of a low ambient temperature below 32 degrees Fahrenheit, and air of a higher ambient temperature having a humidity ratio exceeding the humidity ratio of air at one hundred percent relative humidity at the temperature of said low ambient temperature air, said assembly comprising:

a window frame;

at least one vertically oriented window glass unit mounted about its periphery within said window frame to define an exposed area of said window glass unit having a first surface adapted to be contacted by said air of a low ambient temperature below 32 degrees Fahrenheit, and a second opposite surface adapted to be contacted by said air of a higher ambient temperature;

an insulation device having a contact surface with a length generally equal to the exposed width of said glass, a height of about two and one quarter inches, and having a predetermined high thermal insulating value in a direction normal to

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CERTIFICATE OF CORRECTION

Patent No. 3,762,118

Dated October 2, 1973

Inventor(s) David Leonard Sanders

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

said contact surface; and

means for attaching said insulating device at the lowest portion of the exposed portion of said glass unit on the side opposite said second surface with the contact surface adjacent and parallel to said first surface and the length of said strip extending across the width of said exposed glass portion to restrict heat transfer through the glass unit in the area adjacent said insulating device.

Signed and sealed this 9th day of April 1974.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

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Commissioner of Patents

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