United States Patent [19]

Ingemansson et al.

[11] **3,897,580**

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[54] **MULTIPLE-PANE BUILDING-PANEL**

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[30] **Foreign Application Priority Data**

Jan. 28, 1971 France 71.02883

[52] **U.S. Cl.** **428/34**

[51] **Int. Cl.**[2] **B32B 1/04**

[58] **Field of Search** 161/1, 45; 156/99, 107

[56] **References Cited**

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Attorney, Agent, or Firm—Fred Philpitt

[57] **ABSTRACT**

A multi-pane building-panel comprising first and second panes that are disposed in essentially parallel face-to-face relationship and spaced less than two millimeters from each other and at least one other pane spaced from the closest face of said first and second panels by a distance greater than two millimeters.

4 Claims, 8 Drawing Figures

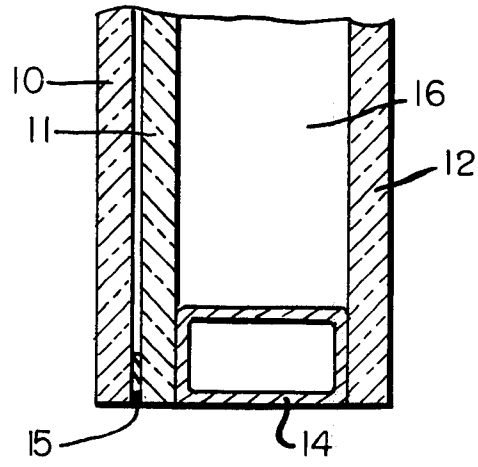


FIG. 1.

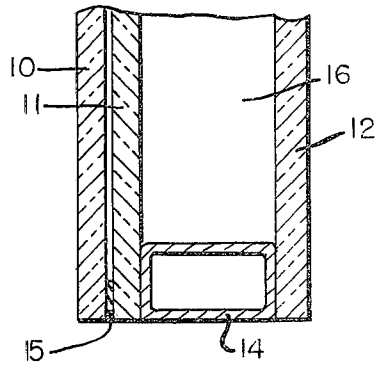


FIG. 2.

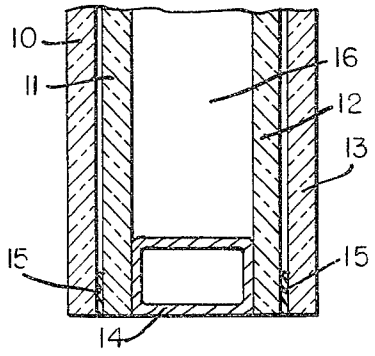


FIG. 3.

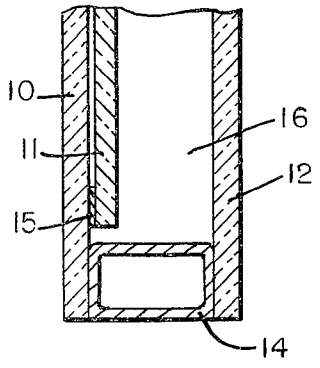


FIG. 4.

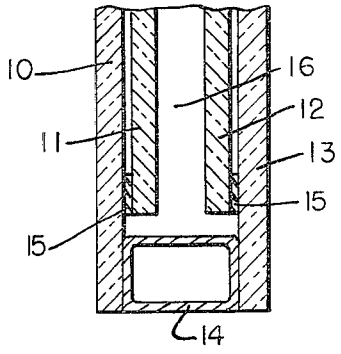


FIG. 5.

I_a = 31 dB

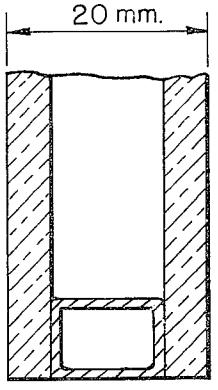


FIG. 6.

I_a = 32 dB

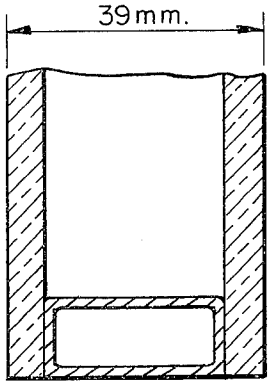


FIG. 7.

I_a = 36 dB

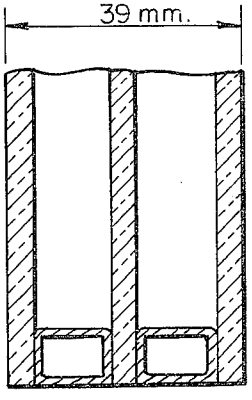
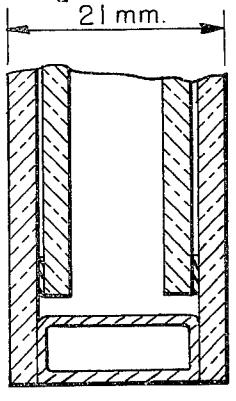


FIG. 8.

I_a = 36 dB



MULTIPLE-PANE BUILDING-PANEL

It is an object of the invention to provide a building-panel of the type mentioned above which in addition to good heat insulating properties has very much improved sound insulating properties. The invention is based on the discovery that where in such panels a good heat insulation requires a comparatively large distance between adjacent panes, say 20 millimeters or more, a very much improved sound insulation can be obtained already by selecting a very small distance, less than 2 millimeters, provided that the closely spaced panes are held together at their edges by a continuous or discontinuous elastic connection.

The invention consists therein that in a multiple pane building-panel at least two of the panes are held together resiliently at their edges at a mutual distance less, and preferably considerably less, than 2 millimeters and are spaced from a single pane or a second group of closely spaced panes a conventional rather large distance, thereby securing without appreciably increasing the overall thickness a heat insulating building-panel having very much improved sound insulating properties when compared with conventional multiple pane building-panels.

In large building-panels the flexibility of the comparatively thin glass plates introduces the risk of the plates touching each other under the influence of an external force, e.g. wind pressure. In a preferred embodiment of the invention this risk has been eliminated by providing a hermetical seal along the edges of the plates, for instance by holding the plates together at their edges with an uninterrupted strip of a suitable adhesive. In this manner a definite amount of air or other gas will be entrapped between the plates, and the compression of said very small amount caused by the bulging-in of one of the plates under the action of wind pressure or the like will reduce the volume of the entrapped gas, thereby increasing the pressure of gas to an extent sufficient to balance the effect of the wind, so that the two plates will never touch each other.

The operation of glueing together the closely spaced glass plates at their edges is most conveniently effected with the plates in a horizontal position. To secure the same deformation of both plates under the action of gravity, the lowermost plate should be supported at its edges only.

The air or other gas entrapped between two closely spaced plates must, of course, be dry to avoid condensation of moisture on the inside of the plates at low temperture.

Measurements have shown that a group of two closely spaced glass plates elastically held together at their edges provides for about the same sound insulation as an ordinary double-pane window in which the panes are spaced several centimeters apart. This means that the application of the invention to secure improved sound insulation will not materially increase the overall thickness of the complete heat insulating building-panel.

The invention will now be described more in detail having reference to the accompanying drawings.

FIG. 1 is a partial cross section through a first embodiment of a heat and sound insulating building-panel according to the invention,

FIG. 2 is a partial cross section through a second embodiment,

FIG. 3 is a partial cross section through a third embodiment, and

FIG. 4 is a partial cross section through a fourth embodiment,

FIGS. 5 to 8 show results of comparative sound insulation measurements.

According to FIG. 1 the building-panel is composed of one single glass plate or pane **12** spaced to a group of two panes **10** and **11** by a considerable distance, say 20 millimeters or more, for example by means of a panel frame **14**, to provide for good heat insulating properties of the panel. The two plates **10** and **11** are positioned very close together, the distance between the plates being at any rate less than 2 millimeters, the two plates in this group being held together by a continuous strip **15** of a not-hardening adhesive close to the edge of the plates forming a hermetic seal between the plates.

Because of the very small amount of gas entrapped between the plates **10** and **11**, the increase or decrease of volume due to temperature changes with resultant changes of pressure will cause only a slight and quite permissible bulging of the plates, in that the plates will never contact each other at low temperatures. The gas space **16** between the single plate **10** and the group of plates **12,13** may be in direct communication with the atmosphere by narrow channels, not shown, and there may be provided in the space, in known manner, some moisture absorbing material which keeps the air within the space dry.

The single glass plate **12** is preferably positioned at the outside surface of the panel and could be thicker than the other plates in order to better withstand wind pressure.

The embodiment illustrated in FIG. 2 differs from the one illustrated in FIG. 1 only therein that the single glass plate **12** has been substituted by a group of two closely spaced plates **12** and **13**. A bulging-in of the outermost plate **13** in the outer group of plates **12,13** due to wind pressure will cause a considerable pressure rise in the very small quantity of gas entrapped between the plates, so that the bulging will be partly transmitted to the inner plate **12**, so that in spite of the very small distance between them the two plates **12** and **13** will never touch each other.

The embodiments according to FIG. 3 and FIG. 4 differ from those illustrated in FIG. **1** and **2**, respectively, only therein that the inner plates **11** and **12** are positioned within the spacer frame **14**.

The most important improvement by the panels made according to the present invention is that the total thickness required for a certain degree of sound insulation of a panel made according to common principles, can be essentially reduced. This is shown by comparing the airborne sound insulation index I_a (according to ISO document R 717) measured for the constructions shown in FIGS. **5–8**. FIGS. **5**, **6** and **7** show known constructions available on the market, whereas FIG. **8** represents a building-panel made according to the invention.

What we claim is:

1. A multi-pane buliding panel comprising in combination:

a. first and second glass panes each having a thickness so as to be self-supporting in its horizontal position when supported at its edges only, said panes being disposed in essentially parallel face-to-face

relationship with each other with an undivided space between said panes,

b. said first and second glass panes being held together resiliently adjacent their edges,

c. the adjacent parallel faces of said first and second glass panes being spaced less than 2 millimeters from each other by air,

d. at least one other glass pane,

e. means for spacing said at least one other glass pane in parallel face-to-face relationship with said first and second panes,

f. said at least one other glass pane being spaced from the closest face of said first and second glass panes by a distance considerably greater than 2 millimeters by air

thereby securing, without appreciably increasing the overall thickness, a heat insulating building panel having greatly improved sound-insulating properties.

2. A panel according to claim **1** wherein said first and second panes are held together by a continuous string of elastic material which hermetically seals the gas space between said first and second panes.

3. A panel according to claim **1** wherein said at least one other pane is spaced from the closest face of said first and second panes by a distance of at least 20 millimeters.

4. A panel according to claim **1** wherein said at least one other pane comprises third and fourth panes that

a. are disposed in essentially parallel face-to-face relationship with each other

b. are held together resiliently adjacent their edges and

c. are spaced less than 2 millimeters from each other.

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