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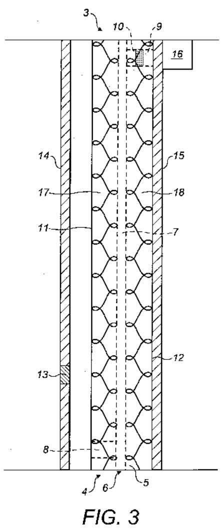

FIG. 3

(57) Abstract: The present invention concerns a dynamic insulation panel (3), said panel having a posterior surface (11) and an anterior surface (12), and at least one ventilation passage (6), said at least one ventilation passage having a portion (7) extending internally within the panel substantially parallel to at least one of the posterior or the anterior surfaces, the ventilation passage further having air flow regulation means (8, 9).

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Cladding Panel

[001] The present invention relates to the field of cladding and in particular an improved dynamic insulation panel that provides insulation and also facilitates a ventilation air supply or exhaust for use in a building envelope or other similar structure.

[002] Important functions of building cladding include the provision of shelter, insulation from the vagaries of the outdoor environment, privacy and security. Modern building cladding systems rely on thermal insulation to reduce heat loss and/or gain, thereby helping to improve energy efficiency and conserve fuel.

[003] By way of example, a wall (or floor, or roof) comprising a number of timber studs will typically be provided with insulation bats of sheets between the timber studs made of fibrous materials such as fiberglass, rock and slag wool, or plastic foams e.g. polystyrene, polyurethane and polyisocyanurate. Two schematic representations of such insulation panels 1 are provided in Figures 1a and 1b. In these examples, the temperature on the inside of the building is higher than that on the outside. Energy escaping through the insulation

panel 1 is known to be dependent on its material properties and thus the temperature gradient 2, as presented schematically in Figures 1(a) and 1(b).

[004] The steeper the temperature gradient 2 across the insulation panel 1 the greater the heat flow. The standard method to reduce this gradient is to make the insulation panel 1 thicker so reducing the temperature gradient 2 by having the same temperature drop over a longer path, as presented schematically in Figure 1 (b). Such an approach is however known to be limited by the available cavity width within the walls. An alternative approach would be to adopt a material that provides a higher thermal resistivity.

[005] The above described thermal insulation panels 1 are useful for achieving thermal comfort for occupants of a building since they can reduce unwanted heat loss, or gain, and thus decrease the energy demands of associated heating and cooling systems. They do not however facilitate the provision of ventilation to the occupants of the interior of the building.

[006] There are examples in the prior art of dynamic insulation wall elements that provide thermal insulation and also supply air

through the wall element. These include US 5,561,958, WO 03/057470 A1 and others. The present invention supersedes the prior art in four important respects. It is simpler in concept, potentially of lower cost compared to anything currently available and, importantly, the design incorporates novel airflow regulation and control features that are an integral part of the design. Notably, the concept incorporates pressure drop regulation to control and optimise the airflow. Also of note, the design is applicable for both the supply and exhaust of ventilation air.

[007] According to a first aspect of the present invention there is provided a dynamic insulation panel, said panel having a posterior surface and an anterior surface, and at least one ventilation passage, said at least one ventilation passage having a vent portion extending internally within the panel substantially parallel to at least one of the posterior or the anterior surfaces, the ventilation passage further having air flow regulation means.

[008] The incorporation of the internal ventilation passage facilitates an air flow through the cladding panel. As this air flow is orientated substantially parallel to at least one of the posterior or the anterior surfaces, it significantly reduces the

thermal losses through the cladding system, in supply mode. In the exhaust mode, exhaust air moves through the channel and it loses heat but acts to prevent conductive heat flowing into the wall (or other building element) from the interior space.

[009] It is preferable for the posterior and anterior surfaces to be parallel.

[0010] The ventilation passage preferably further comprises an entrance conduit that provides a means for fluid communication between the posterior surface and the vent portion of the ventilation passage.

[0011] Optionally, the entrance conduit is perpendicularly oriented to the posterior surface.

[0012] The ventilation passage preferably further comprises an exit conduit that provides a means for fluid communication between the vent portion of the ventilation passage and the anterior surface.

[0013] Optionally, the exit conduit is perpendicularly oriented to the anterior surface.

[0014] The entrance conduit and the exit conduit are preferably located at opposite ends of the vent portion of the internal ventilation passage. By making the spatial separation between the entrance conduit and the exit conduit as large as possible this increases the volume of the internal ventilation passage employed by the cladding panel and hence the portion of a building envelope covered by this dynamic element.

[0015] Conveniently, the panel further comprises an inlet plenum and/or an outlet plenum provided at opposite ends of the vent portion of the ventilation passage.

[0016] Achieving uniform flow over the entire area of the panel is required to ensure best thermal performance. It is because of this that a further novel aspect of the present invention is the presence of an inlet plenum adjacent to the inlet conduit and an outlet plenum adjacent to the outlet conduit that, in tandem, serve as distribution and collection points within the panel. The cross-sections of these plenums are such that they act as contraction and expansion zones at the start and end of the vent portion of the ventilation passage.

[0017] The ventilation passage may further comprise at least one filter and this may be located within the exit conduit as this facilitates it cleaning and or removal.

[0018] The ventilation passage preferably comprises a substantially rectangular and longitudinal channel extending within the interior of the panel.

[0019] Conveniently, the ventilation passage has air flow straighteners extending longitudinally therein.

[0020] The ventilation passage may also have air flow restrictors provided therein.

[0021] Used in conjunction with intermediate flow straighteners within the main flow channel and (optionally) pressure drop zones, the plenums help to ensure uniform air flow across the main body of the dynamic insulation panel.

[0022] Depending on the pressure drop requirements through the wall (or roof or floor) length/height can be controlled to a specific pressure drop. This is required to provide some resistance to aid the even flow of air but allowing it to be collected easily. At the same time this must not be so great as to restrict the ability to ventilate at the required level.

[0023] The ventilation passage may comprise an undulating channel. In other words, the surfaces of the channel may define an undulating route for the air flow passing there-through.

[0024] Preferably, the vent portion of the ventilation passage has a sinusoidal profile. As such, air flow through the channel is directed around a sinusoidal path.

[0025] The profile of the vent portion of the ventilation passage may be adjustable. In this regard, the vent portion of the ventilation passage can be formed between opposing surfaces, the surfaces being movable relative to one another to alter the characteristics of the passage formed between them.

[0026] In this connection, opposing surfaces of the vent portion may preferably have a corresponding sinusoidal profile. By moving the surfaces longitudinally relative to one another, the characteristics of the ventilation passage can be altered. Alternative profiles may include providing the opposing surfaces with matching inclined surfaces such that relative movement of the surfaces can open or close the opening there-between. The opposing surfaces could in this regard take the form of simple wedge profiles.

[0027] According to a further aspect of the present invention there is provided a building envelope comprising a cavity and at least one cladding panel as described above, wherein the cladding panel is located within the cavity such that the internal ventilation passage facilitates an air flow through the building envelope.

[0028] Preferably, the entrance conduit provides a means for fluid communication between an area outside of the building envelope to the vent portion of the ventilation passage.

[0029] Conveniently, the exit conduit provides a means for fluid communication between the vent portion of the ventilation passage and an area located inside of the building envelope. In this way, the air flow which has propagated through the internal ventilation passage can be supplied to or extracted from the interior of the building so facilitating ventilation of the building.

[0030] Preferably, a heat exchanger, a fan or a ducted air handling system is located between the ventilation passage and the area located inside of the building envelope. This provides an option in a tightly controlled, high efficiency structure.

[0031] The building envelope preferably comprises a wall and the panel is located within a wall cavity such that the vent portion of the ventilation passage facilitates a substantially vertical air flow through the panel. The building envelope may also comprise a roof or floor.

[0032] Embodiments of the second aspect of the invention may comprise the preferred or optional features of the first aspect of the invention or vice versa.

[0033] According to a further aspect of the present invention there is provided a method for insulating a building envelope wherein the method comprises the step of locating at least one panel as defined above within a cavity of the building envelope such that the ventilation passage facilitates an air flow through the building envelope.

[0034] The step of locating the at least on cladding system may further comprise arranging for the entrance conduit to be in fluid communication with an area outside of the building envelope.

[0035] The step of locating the at least on cladding system may further comprises arranging for the exit conduit to be in fluid communication with an area inside of the building envelope.

[0036] The building envelope can comprise a wall and the vent portion of the ventilation passage facilitates a substantially vertical air flow through the panel.

[0037] Embodiments of the third aspect of the invention may comprise features to implement the preferred or optional features of the second aspect of the invention or vice versa.

[0038] Aspects and advantages of the present invention will become apparent upon reading the following detailed description of example embodiments and upon reference to the following drawings in which:

[0039] Figures 1a and 1b present schematic representations of a temperature gradient across two prior art insulation panels;

[0040] Figures 2a, 2b and 2c present schematic views of a dynamic insulation panel system in accordance with an embodiment of the present invention;

[0041] Figure 3 presents a schematic representation of the cladding system of Figure 2 incorporated within a standard wall cavity;

[0042] Figure 4 presents a schematic representation showing an internal plenum having intermediate air flow straighteners of the dynamic insulation panel;

[0043] Figure 5 presents a schematic representation showing an internal plenum having air flow restrictors that spread the air in the dynamic insulation panel;

[0044] Figures 6a and 6b present two schematic representations of the internal plenum with fluctuating path that can spread the air and provide pressure drop regulation in the dynamic insulation panel;

[0045] Figure 7 presents a schematic representation of energy transfer across a short section of the insulating cladding system of Figure 2; and

[0046] Figure 8 presents a comparison of theoretical results for the thermal insulating properties of the insulating panel of Figure 1 and the insulating cladding system of Figure 2 for different thicknesses of the dynamic insulation panel.

[0047] In the description which follows, like parts are marked throughout the specification and drawings with the same reference numerals. The drawings are not necessarily to scale and the proportions of certain parts have been exaggerated to better illustrate details and features of embodiments of the invention.

[0048] In order to provide understanding of the various aspects of the present invention an exemplary cladding system 3 will now be described with reference to Figures 2a, 2b, 2c and Figure 3.

In particular, Figure 2 presents schematic side and rear representations of a preferred embodiment of the cladding system 3 while Figure 3 presents a schematic representation of the preferred panel deployed within a standard wall cavity 4. In the following description the temperature on the inside of the building is assumed to be higher than that on the outside of the building.

[0049] The cladding system 3 can be seen to comprise an insulation panel 5 through which is located a ventilation passage or conduit 6. The function of the ventilation conduit 6 is to provide a means of fluid communication between the outside and inside of a building. In the presently described embodiment, the ventilation passage 6 comprises a main internal vent portion 7 that is a hollowed volume that allows for fluid communication between an entrance conduit 8 and an exit conduit 9. Typically, the cladding system 3 has an overall thickness between 20 mm and 200 mm depending on the performance required. The vent portion 7 has a thickness between 5 mm and 50 mm to control airflow and more preferably between 5 to 15 mm in short span applications.

[0050] The ventilation conduit 6 may further comprise a disposable filter 10 that provides a means for removing particulate and/or other pollutants matter from the air flow which is employed to ventilate the building. In the presently described embodiment, the filter 10 is located within the exit conduit 9 so as to facilitate its cleaning and/or replacement. Alternatively, or in addition, filters may be located within the entrance conduit 8 or the internal vent portion 7.

[0051] In the embodiment of Figures 2a, 2b and 2c, the internal vent portion 7, the entrance conduit 8 and the exit conduit 9 are all cuboid shaped. It will be appreciated that in alternative embodiments these elements may comprise alternative regular, or irregular, shapes and/or may be profiled. The internal vent portion 7 is arranged to provide a channel that runs, in most cases, in a parallel sense to a posterior surface 11 (the surface to be deployed towards the outside of the building) and/or an anterior surface 12 (the surface to be deployed towards the inside of the building) of the insulation panel 5.

[0052] The entrance conduit 8 and the exit conduit 9 may be arranged perpendicular to these posterior 11 and anterior surfaces 12, and hence substantially perpendicular to the orientation of the internal vent portion 7. It is also preferable for the spatial separation between the entrance conduit 8 and the exit conduit 9 to be as large as possible so increasing the surface coverage of internal vent portion 7.

[0053] As can be seen from Figure 3, when the cladding system 3 is located within the wall cavity 4 the entrance conduit 8 has a substantially horizontal orientation and so allows for air passing through one or more air bricks 13 in an external wall 14 to pass through into the internal vent portion 7. The exit conduit 9 also has a substantially horizontal orientation and provides a means for air to exit from the cladding system 3 into the interior of the building via an aperture in an internal wall 15. In an alternative embodiment the passing of the air to the interior of the building may be via a fan or a ducted HVAC air handling system 16.

[0054] Significant to the operation of the cladding system 3 is the fact that the internal vent portion 7 is now orientated substantially vertically within the wall cavity 4 such that the heat transfer through the cladding system 3 is substantially perpendicular to the orientation of the internal vent portion 7. In cool climates, cool ventilation air is thus routed through the insulation panel 5 which effectively splits the insulation into two zones, an outer section 17 and an inner section 18, as presented schematically in Figure 3. As this ventilation air is drawn from the outside environment its temperature T_{vent} is initially close to that temperature i.e. $T_{outside}$. The temperature T_{vent} then increases by absorbing heat transferred through the inner section 18 as it moves through the internal vent portion 7. As the air is exhausted and depending on the flow velocity it will enter the cavity at a temperature approaching T_{inside}. As a result there will be very little temperature difference between the inside and the cavity so the heat moving out the building is largely the heat that is in the air that would have been exhausted anyway. The process is substantially similar in hot climates, except that the incoming ventilation air captures coolth as it flows through the dynamic insulation panel into the building.

[0055] As a result of this arrangement the temperature gradient 2a on the outer section 17 is seen to be very flat at the lower end of the internal vent portion 7 and gradually increases as the temperature T_{vent} increases, as represented by temperature gradient 2b. The presence of the internal vent thus acts to significantly reduce the heat transferred out through the cladding system 3 since the heat loss across the outer section 17 is equivalent to a much thicker insulation layer. The heat propagating out of the building is picked up by the ventilation air as it travels through the internal vent portion 7 and then returned to the inside of the building.

[0056] Confirmation of these effects have been achieved by theoretical modeling of the cladding system, the results of which are presented in Figure 8. In this regard, Figure 7 presents a schematic representation of energy transfer across a short section of the insulating cladding system of Figure 2. E represents energy transfer, U is the u-value, A is the area of wall, T is temperature, m is mass and C is heat capacity. As shown T_{vent} becomes $T_{vent} + (E_1-E_2)/mC$.

[0057] When there is no air flow within the internal vent portion 7 the insulating properties of the cladding systems 3 are seen to be comparable with the insulating properties of the corresponding insulation panels 1. However, as the volumetric air flow rates increase the u-value equivalent values rapidly fall and the insulating properties of the cladding systems 3 significantly outperform the static insulating properties of the corresponding insulation panels 1 for all of the calculated thicknesses.

[0058] The introduction of a cold air flow through the cladding system 3 effectively increases the thermal insulation properties beyond what can be achieved statically. This is as a result of the combined effects of the air flow changing the temperature gradient across the cladding system 3 together with the fact that heat propagating from inside the building is picked up by the air flow and re-circulated to the inside of the building. This only works if the pre-tempered air is used to ventilate the interior of the building.

[0059] The deployment of the cladding system 3 is not limited to use with wall cavities 4. It will be appreciated by those skilled in the art than the cladding systems 3 may be deployed within any part of the building envelope e.g. within floor and ceiling cavities.

[0060] It will also be appreciated by those skilled in the art that the described cladding system 3 also works in a hot to cold transfer and can also be made to work when air is being exhausted. This involves the orientation of conduits to be altered to allow the easiest air flow path. Importantly however, is the fact that the direction of the air flow does not alter the dynamic insulating properties of any of the above described embodiments.

[0061] The dynamic insulation panel is a simpler, potentially lower cost product design than those prior art systems that also facilitate ventilation.

[0062] The reliance on air channels to effect heat transfer and air flow simplifies the air flow path and so also makes the dynamic insulation panel simpler to install.

[0063] As the cladding panel predominantly comprises insulation it exhibits energy losses very close to solid insulation panels of corresponding thicknesses when there is no air flow through the internal vent. However, in the presence of an air flow the insulation rating of the cladding system can significantly improve on the insulating rating of the prior art insulation panels and/or be used over a larger proportion of the building envelope.

[0064] It is envisaged that the cladding system will operate effectively over a large portion of a structural envelope at standard airflow rates.

[0065] The ventilation passage within the cladding may be provided with internal guide means to direct and/or disperse air there within as required. In this respect, as shown in Figure 4, an internal plenum of the cladding may also include intermediate air flow straighteners 20. These can assist to guide and thereby enhance the passage of air through the cladding.

[0066] Figure 5 shows an internal plenum having air flow restrictors 21 that assist to spread the air in the dynamic insulation panel.

[0067] Figures 6a and 6b present two schematic representations of the internal plenum with fluctuating path that can spread the air and provide pressure drop regulation in the dynamic insulation panel. The basic structure comprises a first base face 30 having a fluctuating or undulating profile in the air flow path 31 and a second closing face 32 having a similar fluctuating or undulating profile. The air path 31 provided between these two faces therefore comprises a fluctuating channel.

[0068] As shown in Figure 6b, with the faces 30 and 32 being movable relative to one another, the flow volume and phase control of the air flow can be adjusted to suit requirements. For example, by sliding the faces longitudinally relative to one another, areas of air contraction 33 and air expansion 34 are developed which can be highly advantageous in dynamic insulation arrangements.

[0069] Alternative configurations are possible for varying the characteristics of the flow path through the ventilation passage. For example, the opposing faces can be simple inclined surfaces or wedges so that their relative longitudinal or sliding movement can either open or close the gap there-between.

[0070] The foregoing description of the invention has been presented for purposes of illustration and description and is not intended to be exhaustive or to limit the invention to the precise form disclosed. The described embodiments were chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilise the invention in various embodiments and with various modifications as are suited to the particular use contemplated. Therefore, further modifications or improvements may be incorporated without departing from the scope of the invention as defined by the appended claims.

Claims

1. A dynamic insulation panel, said panel having a posterior surface and an anterior surface, and at least one ventilation passage, said at least one ventilation passage having a vent portion extending internally within the panel substantially parallel to at least one of the posterior or the anterior surfaces, the ventilation passage further having air flow regulation means.

2. A panel as claimed in claim 1, wherein the posterior surface is parallel to the anterior surface.

3. A panel as claimed in claim 1 or 2, wherein the ventilation passage further comprises an entrance conduit that provides a means for fluid communication with the posterior surface.

4. A panel as claimed in any of the preceding claims, wherein the ventilation passage further comprises an exit conduit that provides a means for fluid communication with the anterior surface.

5. A panel as claimed in claim 3, wherein the entrance conduit is perpendicularly oriented to the posterior surface.

6. A panel as claimed in claim 4, wherein the exit conduit is perpendicularly oriented to the anterior surface.

7. A panel as claimed in claim 4 when dependent upon claim 3, wherein the entrance conduit and the exit conduit are located at opposite ends of the vent portion of the ventilation passage.

8. A panel as claimed in any of the preceding claims, wherein the ventilation passage further comprises at least one filter.

9. A panel as claimed in claim 7, wherein the filter is located within the exit conduit.

10. A panel as claimed in any preceding claim, wherein the vent portion of the ventilation passage comprises a substantially rectangular and longitudinal channel extending within the interior of the panel.

11. A panel as claimed in any preceding claim, wherein the vent portion of the ventilation passage has air flow straighteners extending longitudinally therein.

12. A panel as claimed in any preceding claim, wherein the vent portion of the ventilation passage has air flow restrictors provided therein.

13. A panel as claimed in any preceding claim, wherein the vent portion of the ventilation passage comprises an undulating channel.

14. A panel as claimed in claim 13, wherein the vent portion of the ventilation passage has a sinusoidal profile.

15. A panel as claimed in any preceding claim, wherein the profile of the vent portion of the ventilation passage is adjustable.

16. A panel as claimed in claim 15, wherein the vent portion of the ventilation passage is formed between opposing surfaces, the surfaces being movable relative to one another to alter the characteristics of the passage formed between

them.

17. A panel as claimed in claim 16, wherein the opposing surfaces have a corresponding sinusoidal profile.

18. A panel as claimed in any preceding claim, further comprising an inlet plenum and/or an outlet plenum provided at opposite ends of the vent portion of the ventilation passage.

19. A building envelope comprising a cavity and at least one cladding panel as claimed in any of claims 1 to 18, wherein the cladding panel is located within the cavity such that the vent portion of the ventilation passage facilitates an air flow through the building envelope.

20. A building envelope as claimed in claim 19, wherein the entrance conduit provides a means for fluid communication between an area outside of the building envelope to the vent portion of the ventilation passage.

21. A building envelope as claimed either of claims 19, wherein the exit conduit provides a means for fluid

communication between the vent portion of the ventilation passage and an area located inside of the building envelope.

22. A building envelope as claimed in any one of claims 19 to 21, wherein a heat exchanger, a fan or a ducted air handling system is located between the ventilation passage and the area located inside of the building envelope.

23. A building envelope as claimed in any of claims claim 19 to 22, wherein the building envelope comprises a wall and the panel is located within a wall cavity such that the vent portion of the ventilation passage facilitates a substantially vertical air flow through the panel.

24. A method for insulating a building envelope wherein the method comprises the step of locating at least one panel as claimed in any of claims 1 to 18 within a cavity of the building envelope such that the ventilation passage facilitates an air flow through the building envelope.

25. A method for insulating a building envelope as claimed in claim 24, wherein the step of locating the at least on cladding system further comprises arranging for the entrance

conduit to be in fluid communication with an area outside of the building envelope.

26. A method for insulating a building envelope as claimed in either of claims 24 or 25, wherein the step of locating the at least on cladding system further comprises arranging for the exit conduit to be in fluid communication with an area inside of the building envelope.

27. A method for insulating a building envelope as claimed in any of claims 24 to 26, wherein the building envelope comprises a wall and the vent portion facilitates a substantially vertical air flow through the panel.

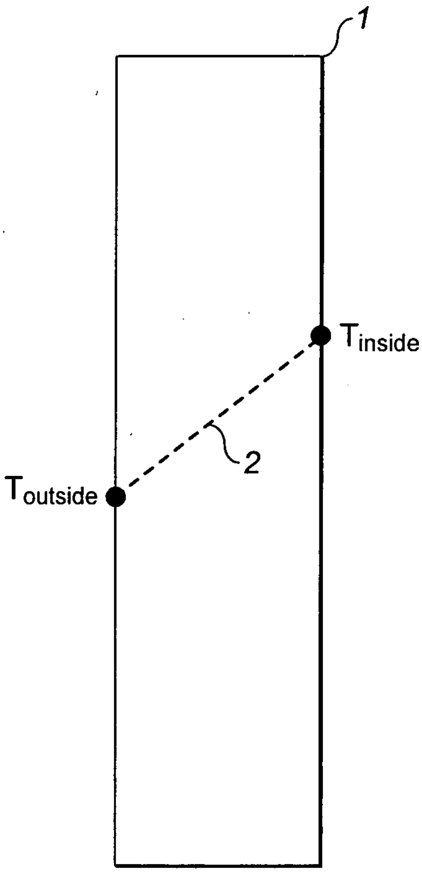

FIG. 1a

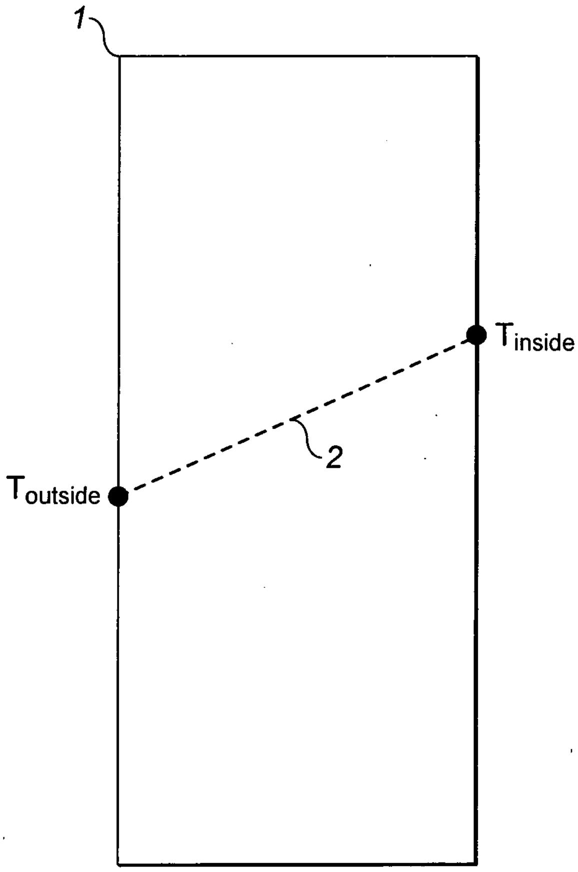

FIG. 1b

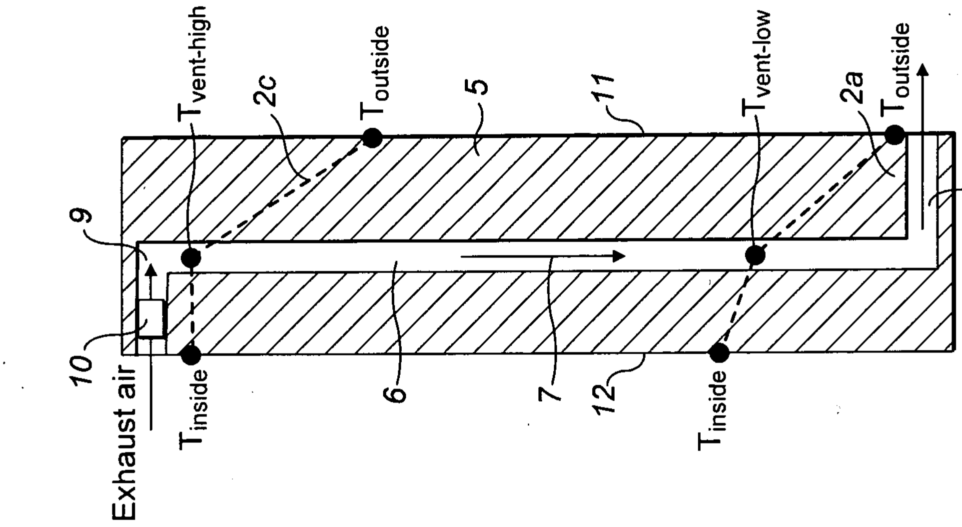

FIG. 2c

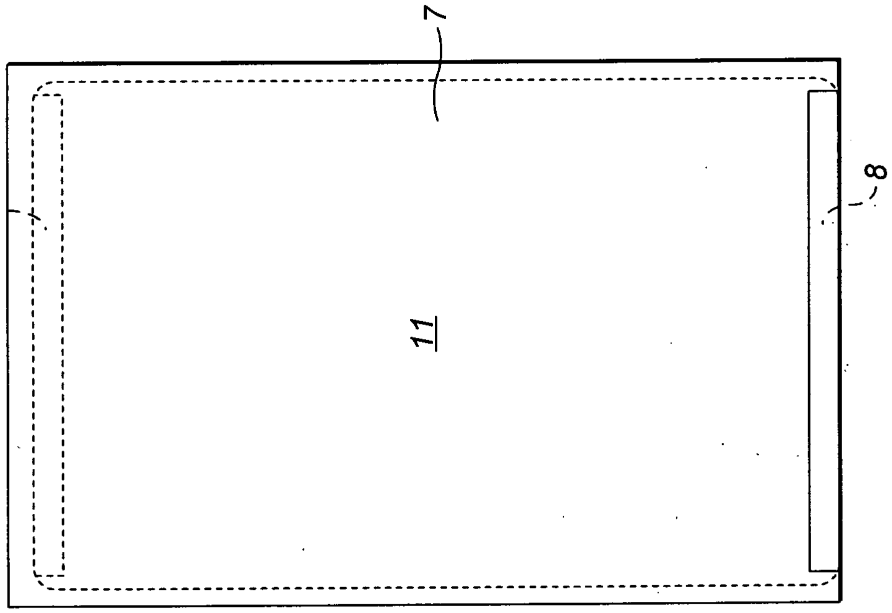

FIG. 2b

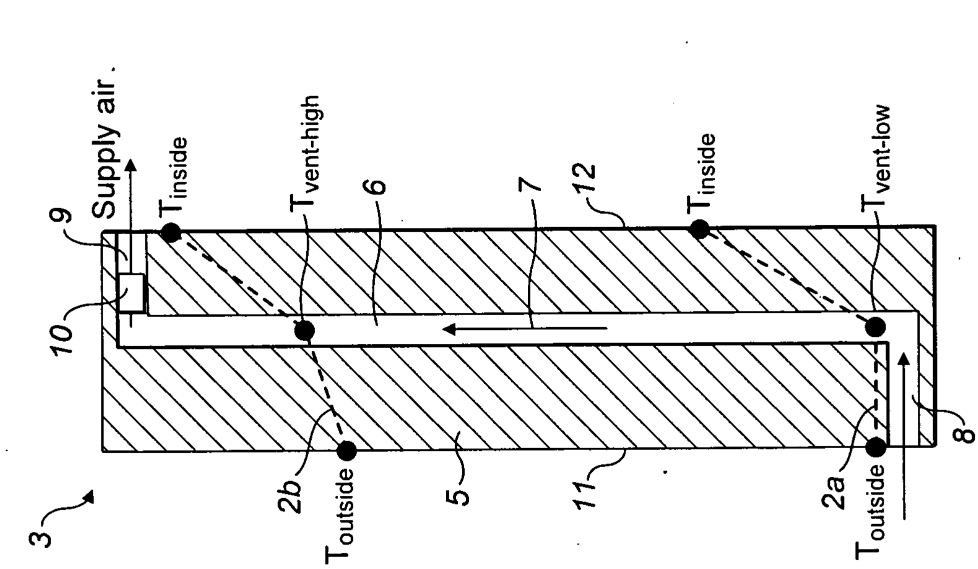

FIG. 2a

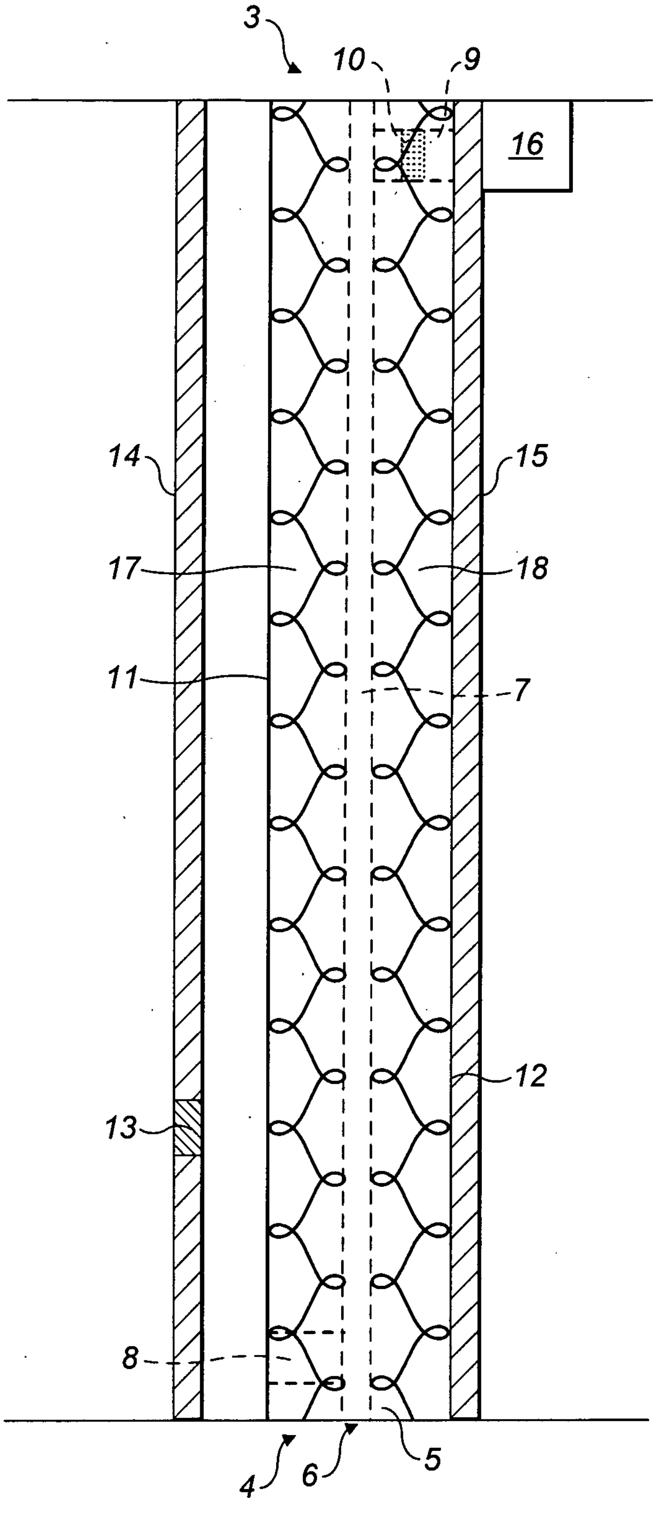

FIG. 3

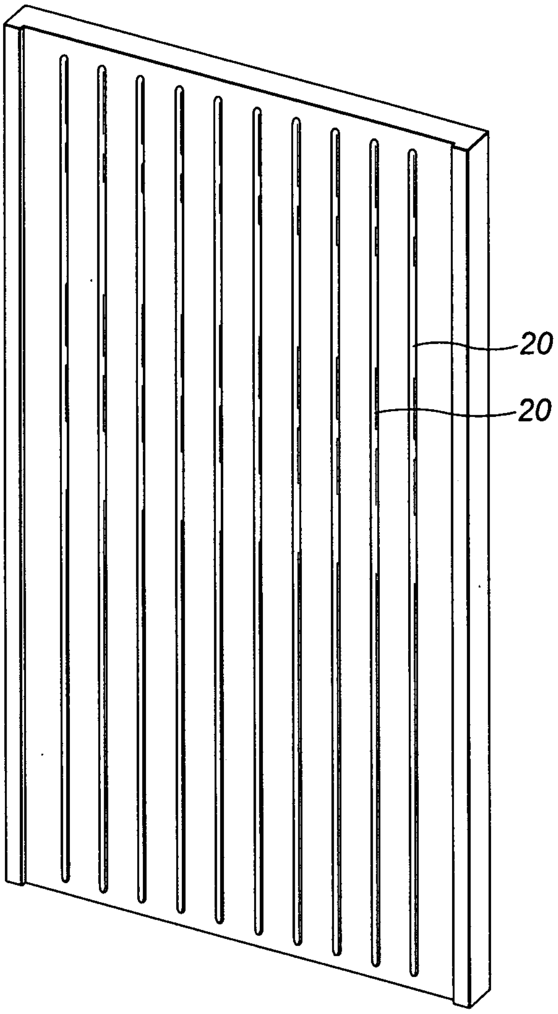

FIG. 4

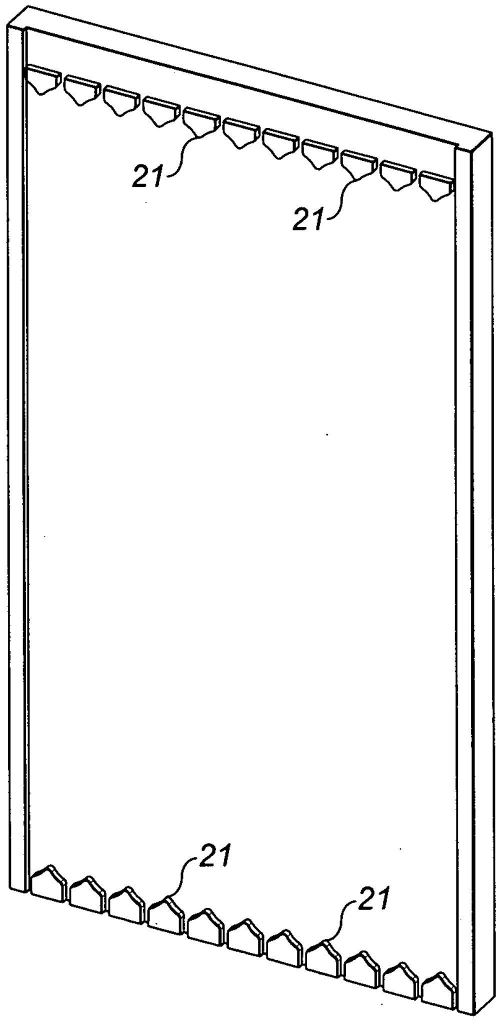

FIG. 5

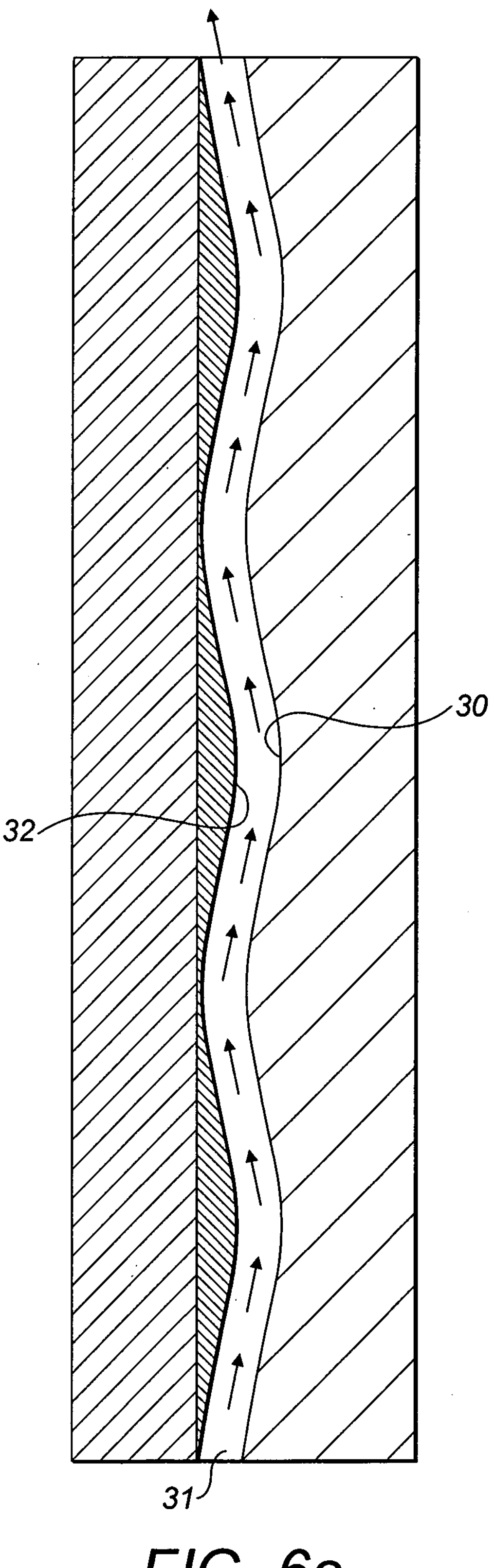

FIG. 6a

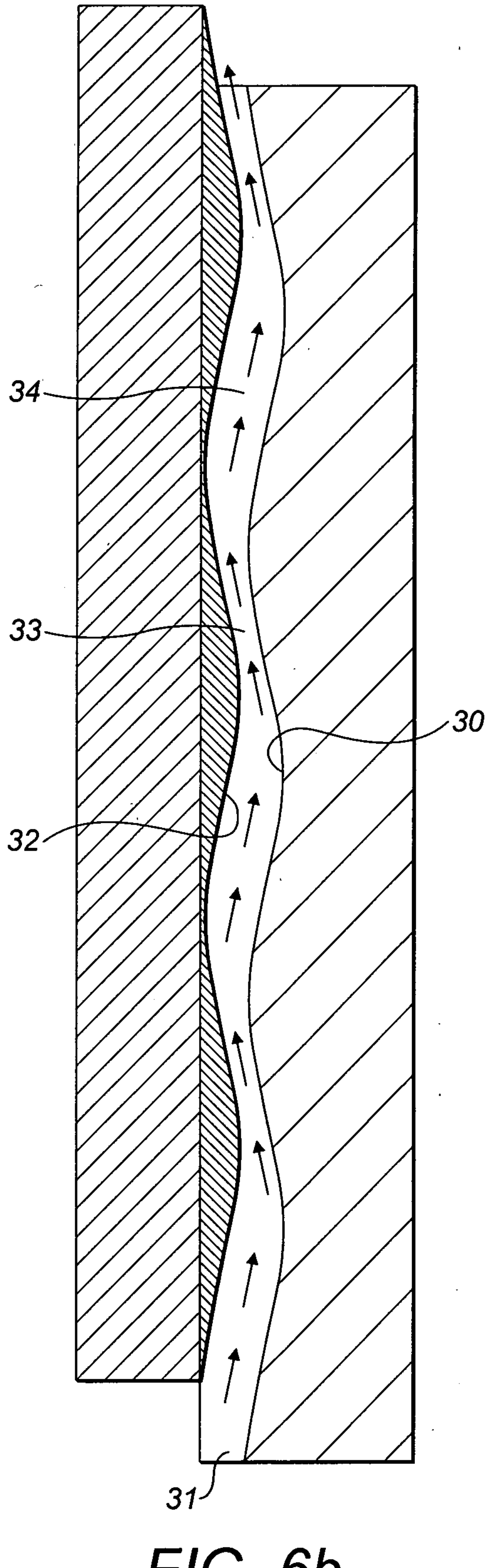

FIG. 6b

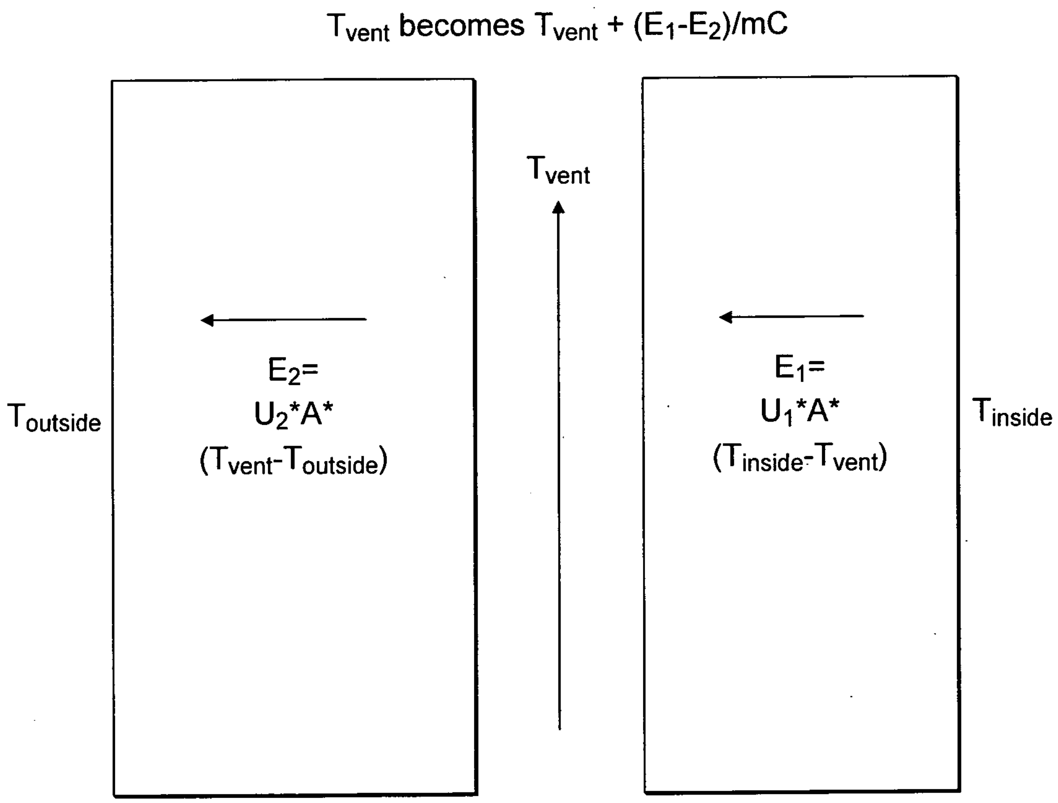
T_{vent} becomes T_{vent} + $(E_1-E_2)/mC$
T_{vent}
$T_{outside}$
E_2=
U_2*A*
(T_{vent}-$T_{outside}$)
E_1=
U_1*A*
(T_{inside}-T_{vent})
T_{inside}

FIG. 7

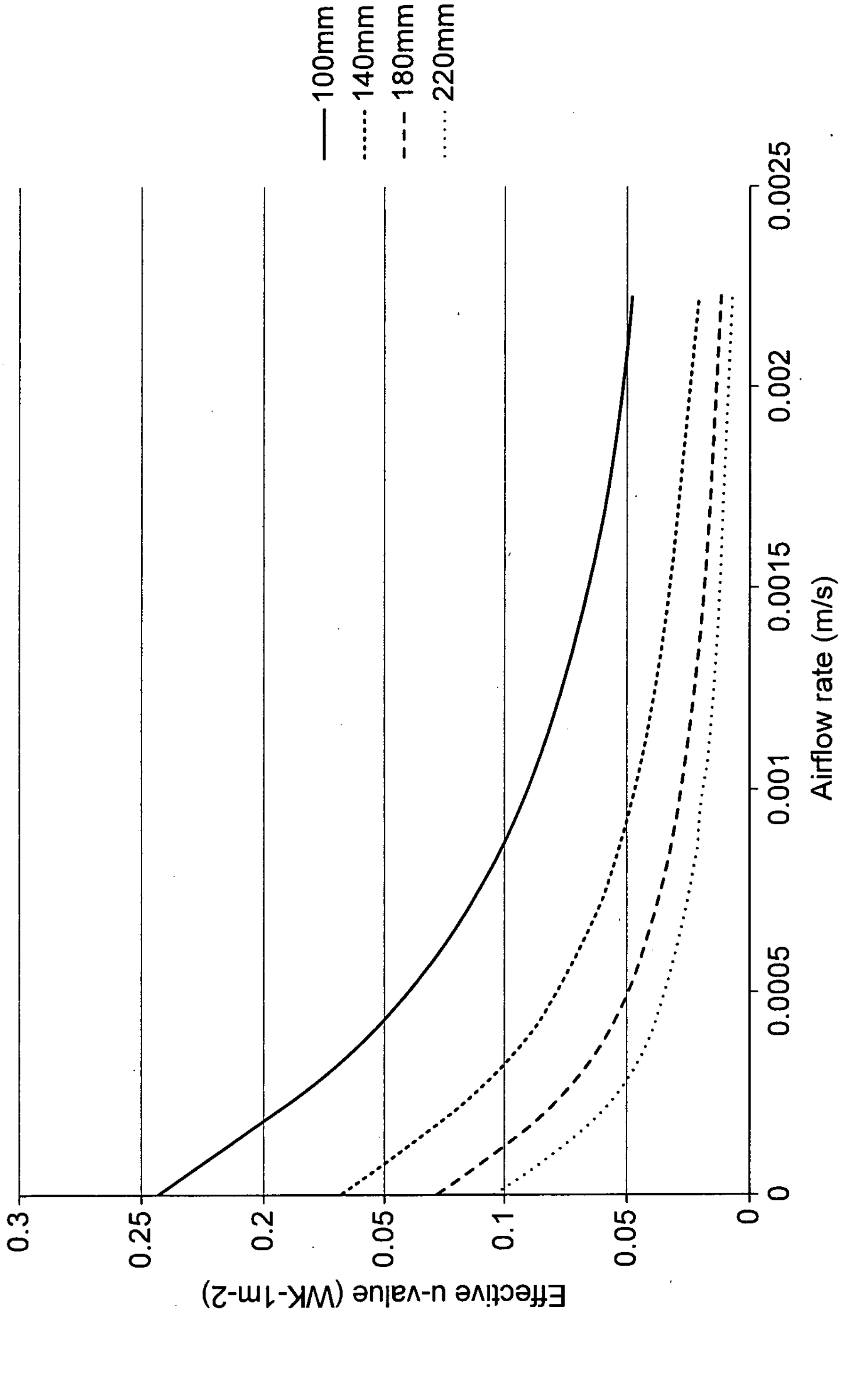
Effective u-value (WK-1m-2)
0.3
0.25
0.2
0.05
0.1
0.05
0
0
0.0005
0.001
0.0015
0.002
0.0025
Airflow rate (m/s)
100mm
140mm
180mm
220mm

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2010/050669

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04B1/76 E04B1/80 E04C2/52
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/111621 A1 (PALAY ALEXANDRE [FR]) 26 October 2006 (2006-10-26) page 1, lines 4-6 page 3, lines 26-28 page 10, lines 4-24 page 14, lines 9-14; figures 7-12 14 21	1-7,10, 11,13,14
X	US 4 237 865 A (LORENZ PETER J [US]) 9 December 1980 (1980-12-09) column 2, line 53 - column 7, line 46; figures	1-7, 10-12,18
X	US 4 641 466 A (RANINEN JAAKKO [FI] ET AL) 10 February 1987 (1987-02-10) column 2, line 64 - column 3, line 68; figure 1 3 4	1-5,7-12

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 September 2010	22/09/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Stern, Claudio

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2010/050669

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 325 881 A1 (VERCELLETTO MICHEL [FR]) 22 April 1977 (1977-04-22) page 3, line 16 - page 4, line 9; figure 1 -----	1,2,8, 12,18
X	DE 42 18 709 A1 (RAPP ALBERT BRUNO [DE]; STRICKER ROLF DIPL ING [DE]) 9 December 1993 (1993-12-09) column 3, line 18 - column 4, line 20; figure 1 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2010/050669

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
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			DE	3004364	A1	11-09-1980
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FR 2325881	A1	22-04-1977	NONE			
DE 4218709	A1	09-12-1993	NONE			