

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
20 September 2001 (20.09.2001)

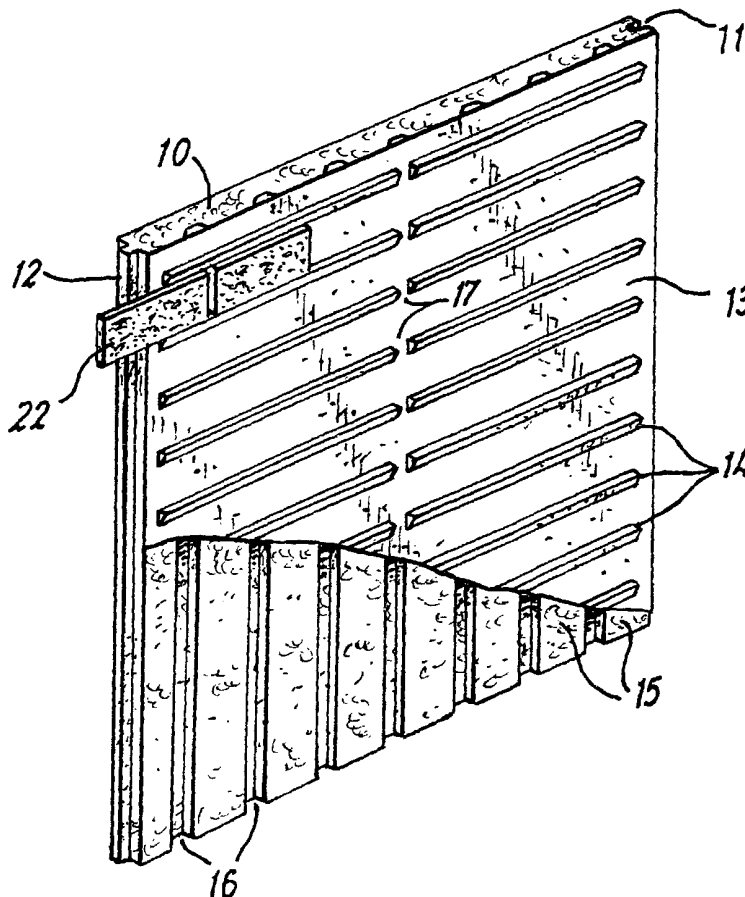
PCT

(10) International Publication Number  
**WO 01/69005 A1**

- (51) International Patent Classification<sup>7</sup>: **E04F 13/14**, 13/08
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- (21) International Application Number: **PCT/GB01/01202**
- (22) International Filing Date: 19 March 2001 (19.03.2001)
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- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
0006335.4 17 March 2000 (17.03.2000) GB
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
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- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian

[Continued on next page]

(54) Title: PANEL



(57) Abstract: A building panel including a permeable sheet of insulating material (10) fastened to an impermeable sheet of material (13) and having one or more conduits (16) formed in the insulating material and/or channels formed in a surface of the impermeable sheet (13) to allow fluid to escape from between the two sheets of material. The insulating material may be a foam material, and a plurality of substantially parallel, substantially straight, spaced apart channels (16) may be formed in a surface of the sheet of insulating material adjacent the impermeable sheet. The impermeable material may be a plastics material or metal. The impermeable sheet may define a plurality of ribs (14) for supporting building blocks. The two sheets may be bonded together with an adhesive.

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patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

— *with international search report*

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PANEL

The present invention relates to a building panel.

A building panel is proposed in GB 2346393A comprising a closed cell extruded polystyrene foam sheet to which is bonded a building block support panel vacuum moulded from a high impact polystyrene sheet. The building block support panel comprises a plurality of hollow ribs for supporting building blocks. The hollow ribs are open towards the foam sheet. In use such a panel is used to form the outside of a building. The panel is positioned with the foam sheet directed towards the inside of the building and the building block support panel towards the outside of the building.

The foam sheet provides thermal insulation, and brick slips, or the like, may be supported on the building block support panel to give the appearance of a conventional brick, or other block, wall to the outside of the building.

Closed cell polystyrene foam is permeable, whereas high impact polystyrene sheet is not. This gives rise to a problem.

A function of the outside wall of a building is to separate the environmental conditions outside the building from those inside the building. At least during part of the year in many countries it is desired to maintain the temperature inside a building higher than that outside the building.

Typically the air inside a building is maintained at a temperature of

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around 21°C, and has a relative humidity of around 55%. During winter months at least the outside air temperature in many countries (typically Northern Europe and America) remains below 10°C, and the outside air humidity is variable. As a consequence the water vapour pressure inside a building is almost always higher than that outside. This causes water vapour inside a building to end to move through the walls of a building to reach the outside of the building. It can be that as a consequence of this movement that condensation occurs on or within the outside walls of the building.

10           Where the outside walls of a building are formed from panels of the type disclosed in GB 2346393A and the water vapour pressure is higher in the building than outside the building there is a tendency for water vapour to pass from the inside of the building through the permeable foam layer of the panel and to condense on the cold inside surface of the brick support panel. As a consequence there is a significant risk of build-up of water at the interface between the foam insulation layer and the high impact polystyrene layer (building block support panel). Since water is not readily absorbed by extruded closed cell polystyrene foam it tends to accumulate in the hollow ribs of the building block support panel. As condensation continues the pressure of water in the hollow ribs increases, and may reach a level where it begins to force the building block support panel away from the foam sheet, potentially leading to separation of the two. This is

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undesirable. Although this problem might be reduced or avoided by using an absorbent insulating material, any build up of water in the insulating material would impair its insulating performance. This is also undesirable.

5 The present invention has been made in consideration of the above problems.

According to the present invention there is provided a building panel comprising a permeable sheet of insulating material fastened to an impermeable sheet of material characterised by one or more conduits formed in the sheet of insulating material and/or one or more channels  
10 formed in a surface of the impermeable sheet of material adjacent to the permeable sheet of insulating material arranged to allow fluid to escape from in between the two sheets of material.

Provision of drainage conduits and/or channels allows any fluid, such as water, to drain from between the two sheets of material reducing the risk  
15 of delamination of those sheets.

Preferably a plurality of spaced apart channels are formed in a surface of the permeable sheet of insulating material adjacent to the impermeable sheet of material. The sheet of insulating material is preferably thicker than the sheet of impermeable material and accordingly it is more convenient for  
20 channels to be formed in the surface of the insulating material.

In one embodiment a plurality of substantially parallel, substantially straight, spaced apart channels are formed in a surface of the sheet of

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insulating material. Preferably at least one of these channels extends to an edge of the insulating material. More preferably each channel extends to an edge of the sheet of material and still more preferably each channel extends between two opposite edges of the sheet of material. In use the panel is preferably installed so that the channels extend in an upright direction.

The insulating material preferably comprises a foam material, particularly an extruded polystyrene foam. The insulating material preferably resists absorption of water. The impermeable material preferably comprises a plastics material, for example high impact polystyrene, or a metal, for example zinc coated steel.

The two sheets of material comprised in the panel are preferably bonded together with an adhesive. In this case the conduits and/or channels aid bonding of the two sheets by allowing any air or solvent from an adhesive trapped between the sheets to escape.

The impermeable sheet preferably defines a plurality of ribs for supporting building blocks. These ribs may be hollow and preferably extend generally horizontally in use. Further channels or hollow ribs may extend between the horizontal ribs to allow for drainage of water.

In order that the invention may be more clearly understood embodiments thereof will now be described, by way of example, with reference to the accompanying drawings in which:

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- Figure 1 shows a perspective, part cut away view of a panel according to the invention;
- Figure 2 shows an enlarged cross-sectional view of part of the panel of Figure 1; and
- 5 Figure 3 shows an exploded view of an alternative embodiment of a panel according to the invention.

Referring to Figures 1 and 2 a building block support panel comprises a permeable closed cell extruded polystyrene insulating foam sheet 10 one end of which includes a slot 11 and the opposite side of which includes a

10 tongue formation 12 which is arranged to fit snugly within the slot of another panel. This allows large areas to be covered effectively with multiple panels. The tongue and groove arrangement makes the resulting structure more stable than a simple butt joint and helps prevent cold bridging.

15 An impermeable block support panel 13 is formed by vacuum forming a sheet of high impact polystyrene sheet to produce a series of hollow ribs 14 on the surface of the sheet. The panel 13 is bonded to the foam sheet 10 with an SBR adhesive 15.

The surface of the foam sheet 10 includes a plurality of upright

20 substantially parallel, substantially straight, generally evenly spaced apart channels 16 each extending between opposite upper and lower edges of the sheet. The terms 'upright', 'upper' and 'lower' are used in relation to the

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panel when oriented as illustrated, which is the orientation in which it is intended to be installed. The channels 16 allow any water accumulating between the foam sheet 10 and block support panel 13 to drain away. This prevents build up of water pressure between the foam sheet 10 and block support panel 13, particularly in the hollow ribs 14, and thus reduces the risk of delamination of the block support panel 13 and foam sheet 10.

The channels also allow for escape of any air or solvent (from the adhesive 15) that may become trapped between the block support panel 13 and foam sheet when the panel is assembled. This is advantageous as any trapped air or solvent could impair formation of a satisfactory bond between the sheet 10 and panel 13.

The block support ribs 14 extend laterally across the panel in substantially parallel and evenly spaced vertical relation to one another. A margin is provided down each edge of the panel, that is the ribs do not extend all the way to the edge of the panel. When two panels are joined there will therefore be a break in the ribs 14 between panels. An additional break 17 is provided approximately mid-way along each rib. These breaks 17 allow any moisture that may become trapped between blocks and the panel to drain away. Having a gap in the ribs 14 between panels helps to negate the effect of any misalignment between adjacent panels, although this should preferably be avoided.

The ribs 14 are of hollow and generally triangular cross-section, but

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with one side being open since they are formed by deforming a single sheet of material. Each rib 14 has an upper surface 18 for supporting blocks which extends substantially perpendicularly outwardly from the plane of the support panel 13. Each rib 14 also has a lower guide surface 19 which  
5 extends outwardly and upwardly from the plane of the support panel 13 forming an obtuse angle 20 with the plane. The guide surface 19 strengthens the ribs, acting, to some extent, as a strut.

The spacing of the ribs 14 is greater than the nominal size of the blocks 21 intended for mounting on the panel. The embodiment illustrated  
10 is designed for use with brick slips of nominal height 65mm. The distance between the support surface of one rib and the underside of the rib immediately above is 70mm. The distance between the upper and lower surfaces of each rib is 15mm, therefore the ribs have a pitch of 75mm. Thus, when using 65mm bricks there will be a standard 10mm mortar bed.  
15 Different brick styles could also be used with different mortar bed sizes.

The surface of the support panel 13 other than where there are ribs is embossed with a relief pattern (not shown) to aid adhesion of blocks. Any suitable pattern can be used.

The panel may be affixed to another structure using any suitable  
20 technique, for example fasteners may be passed through the panel and into an underlying structure. Ways in which building block support panels may be affixed to a surface are well known and will therefore not be described

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in any further detail.

Building blocks may be affixed to the panel either before, or after, it has been secured to another structure. First, a suitable adhesive 21 for example a flexible polyurethane adhesive with good "grabbing" properties is applied to the surface of the panel between ribs 14. It is preferred that adhesive is not applied in the region of the drainage gaps 17 as this can impair drainage. Building blocks may then be applied to the adhesive. Figure 2 shows a brick slip 22 bonded to the surface of the block support panel 13 between two ribs 14. When the slip 22 is inserted between the ribs 14 and pushed home the guide surface on the underside of the upper rib helps to ensure that the brick slip is moved towards the support surface of the lower rib.

The spacing of the ribs is such that, when properly seated, there is some clearance between the top of the brick slip 22 and the next rib. This allows brick slips which exceed their nominal size to be fitted onto the support. Were an exceptionally large or incorrectly sized brick slip to be offered up to the support so that, even when seated on a brick support, the top of the slip rested on the guide surface 19 not only would it be immediately apparent that the brick slip was oversized but there would be no risk of the brick becoming wedged between adjacent ribs. This could potentially damage the panel.

Once brick slips are secured in place with the adhesive 21 the spaces

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between the bricks can be filled with mortar 23, polymer modified mortar being preferred, to give the completed panel the appearance of a conventional brick wall. To ensure good keying of the mortar it is desirable that the thickness of the brick slip exceeds the height of the ribs 14. When  
5 the ribs 14 are of generally triangular cross-section this provides a better key for the mortar than, say, a rectangular cross-section.

In an alternative embodiment the block support panel 13 is formed from metal, for example zinc coated steel.

Figure 3 shows an alternative embodiment of a panel comprising a  
10 65mm thick sheet of extruded polystyrene foam 31 of density about 35Kg/m<sup>3</sup>, sandwiched between two zinc coated 0.7mm thick steel sheets 32. The steel sheets 32 are bonded to the foam sheet 31 with a two-part polyurethane adhesive. A suitable adhesive is sold by Akzo-Nobel, under the designation 8243PUR.

15 The sides of the foam sheet 31 to which the steel sheets 32 are bonded include a plurality of spaced apart substantially parallel, substantially straight channels 34 each running between opposite upper and lower edges of the sheet 31.

The channels 34 allow any water that accumulates between the steel  
20 32 and foam sheets 31 to drain away, and also any air or solvent trapped between the foam 31 and steel 32 sheets to escape during assembly of the panel.

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A high impact polystyrene vacuum moulded building block support sheet 35 is bonded to the outside surface of one of the steel sheets 32 with an adhesive. A similar adhesive as used to bond the steel sheets 32 to the foam sheet 31 is suitable. Prior to bonding the building block support sheet 35 to the metal sheet 31 the building block support sheet is preferably corona arc discharge treated. This results in better adhesion to the metal sheet 31.

The building block support 35 comprises a sheet having a series of substantially parallel evenly spaced apart projecting ledges 36 extending laterally across its surface, but not all the way to the lateral edges of the sheet. As such, when two panels are placed adjacent to each other there is an upright gap in the ledges between the panels. One or more additional gaps 37 are provided along the length of each ledge to allow any trapped moisture to drain away. Having a gap in the ledges between panels helps to negate the effect of any misalignment between panels, although this is preferably avoided. The ledges themselves are provided by ribs of substantially triangular cross-section, but with one side open as they are formed by deforming a single sheet of material. Each rib has an upper surface for supporting building blocks which extends substantially perpendicularly outwardly from the plane of the sheet 35. The exposed surface of the sheet, other than where there are blocks, includes a relief pattern (not shown) to aid adhesion of building blocks thereto.

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In use 20mm thick brick slips are supported on the ledges of the building block support sheet 35, and bonded to the building block support with an adhesive.

5 In an alternative embodiment the steel sheet 32 remote from the block support panel is deleted.

The above described embodiments exhibit a considerably reduced risk of delamination due to accumulation of water compared to prior panels.

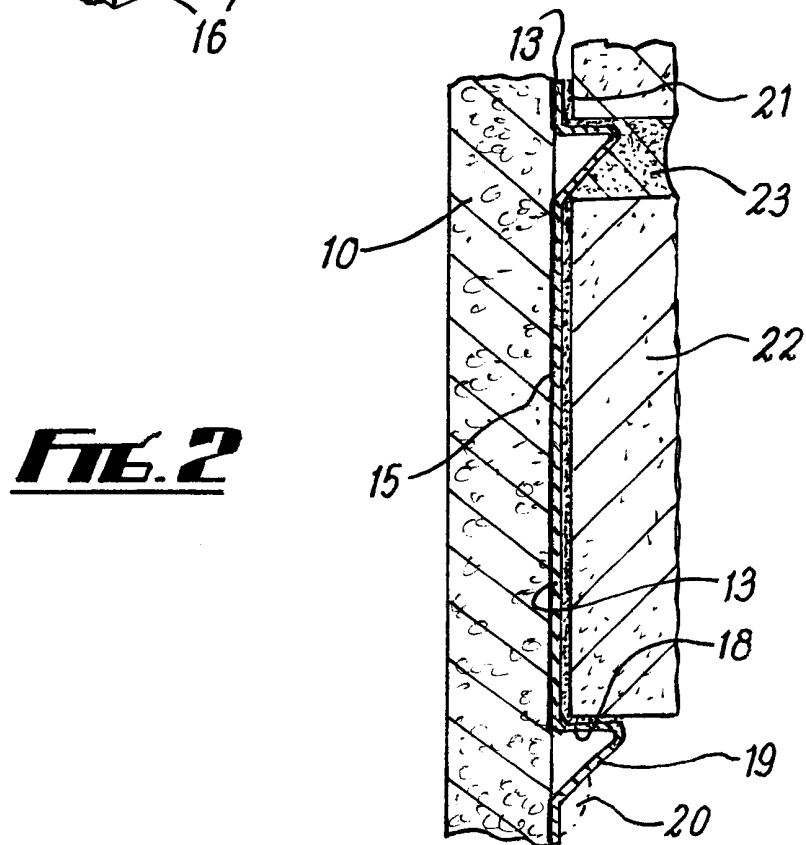
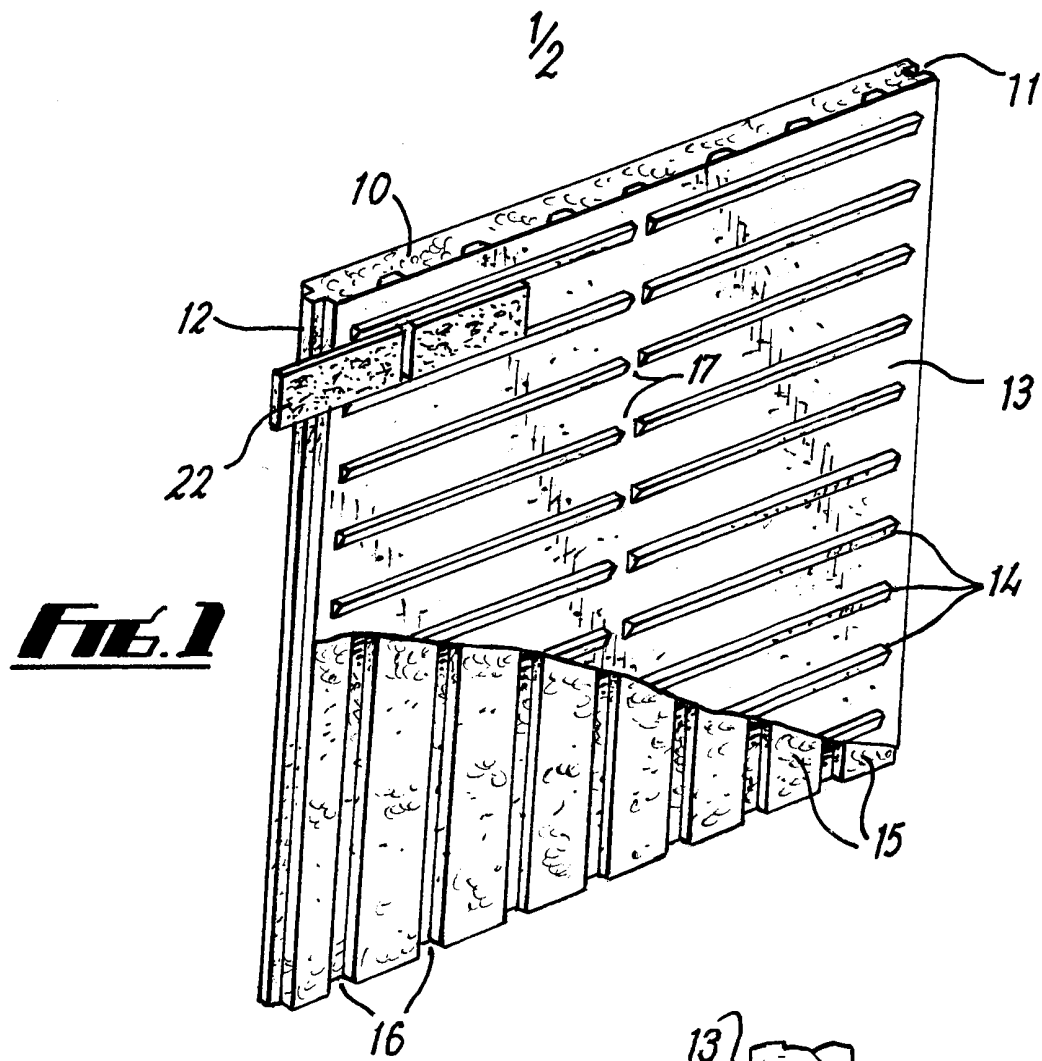
The above embodiments are described by way of example only. Many variations are possible without departing from the invention.

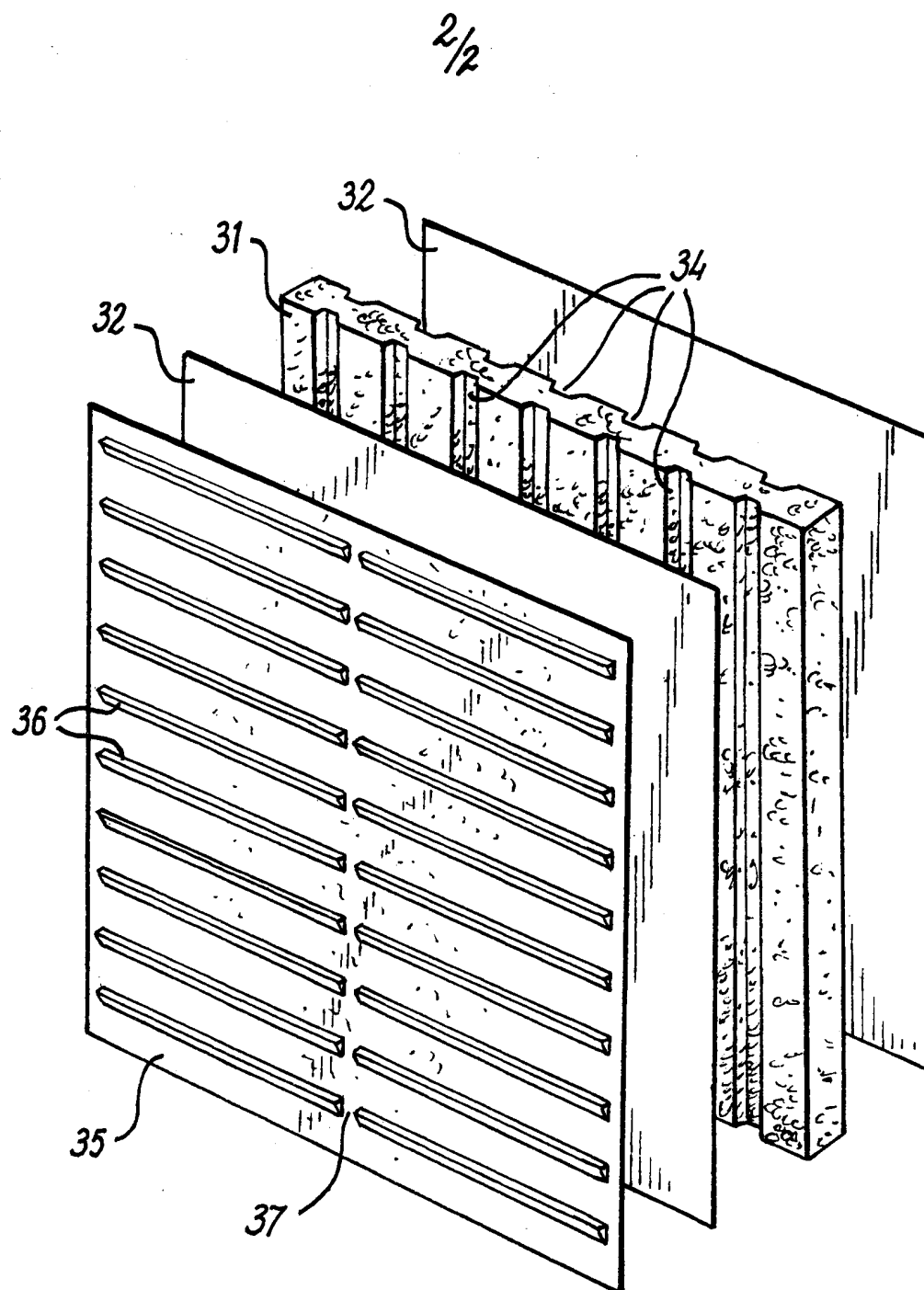
CLAIMS

1. A building panel comprising a permeable sheet of insulating material fastened to an impermeable sheet of material characterised by one or more conduits formed in the sheet of insulating material and/or one  
5 or more channels formed in a surface of the impermeable sheet of material adjacent to the permeable sheet of insulating material arranged to allow fluid to escape from in between the two sheets of material.
2. A panel as claimed in claim 1, wherein a plurality of spaced apart  
10 channels are formed in a surface of the permeable sheet of insulating material adjacent to the impermeable sheet of material.
3. A panel as claimed in claim 2, wherein the channels formed in the permeable sheet of insulating material are substantially parallel.
4. A panel as claimed in any of claims 1 to 3, wherein at least one  
15 channel formed in the surface of either sheet of material extends to at least one edge of that sheet.
5. A panel as claimed in any preceding claim, wherein the permeable material comprises a foam material.
6. A panel as claimed in any preceding claim, wherein the impermeable  
20 material comprises a plastics material or a metal.
7. A panel as claimed in any preceding claim, wherein two sheets of material are bonded together with an adhesive.

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8. A panel as claimed in any preceding claim, wherein the sheet of impermeable material defines a plurality of ribs for supporting building blocks.
9. An installation comprising a panel as claimed in either claim 1 or 2 or  
5 any of claims 3 to 8 when appendant to either claim 1 or 2, wherein at least one channel in either the impermeable or permeable sheet extends in an upright direction.





**FIG. 3**

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 01/01202

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E04F13/14 E04F13/08

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)

IPC 7 E04F

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, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                 | Relevant to claim No. |
|------------|--------------------------------------------------------------------------------------------------------------------|-----------------------|
| X          | EP 0 152 399 A (RAKENNUSVALMISTE OY)<br>21 August 1985 (1985-08-21)<br>page 5, line 3 -page 7, line 9; figures 1,2 | 1-7,9                 |
| Y          | ---                                                                                                                | 8                     |
| Y          | EP 0 275 360 A (U.S. BRICK)<br>27 July 1988 (1988-07-27)<br>column 3, line 30 -column 8, line 21;<br>figures 1-6   | 8                     |
| A          | -----                                                                                                              | 1,5-7                 |



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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- \*E\* earlier document but published on or after the international filing date
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Date of the actual completion of the international search

20 June 2001

Date of mailing of the international search report

27/06/2001

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 01/01202

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                                                    | Publication<br>date                                                                                                                      |
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