

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
23 December 2010 (23.12.2010)

(10) International Publication Number
WO 2010/146397 A2

PCT

(51) International Patent Classification:
E04B 1/80 (2006.01)

(21) International Application Number:
PCT/GB2010/051007

(22) International Filing Date:
17 June 2010 (17.06.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0910460.5 17 June 2009 (17.06.2009) GB

(71) Applicant (for all designated States except US): **HUNT TECHNOLOGY LIMITED** [GB/GB]; Batchworth Lock House, 99 Church Street, Rickmansworth, Hertfordshire WD3 1JJ (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **PAYNE, John** [GB/GB]; Hunt Technologies, Batchworth Lock House, 99 Church Street, Rickmansworth, Hertfordshire WD3 1JJ (GB).

(74) Agents: **KELTIE, David** et al.; Keltie, Fleet Place House, 2 Fleet Place, London EC4M 7ET (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: STRUCTURAL ELEMENTS FOR BUILDINGS

(57) Abstract: A panel for use as a wall panel (30) in the construction of a building, the panel being generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges and incorporating flexible across-stud thermal insulation (32) which is generally of rectangular shape, which has dimensions, between its oppositely facing edges that correspond substantially to those of the panel, and which has flexible extensions (33, 35) projecting outwardly beyond edges of the panel (30), whereby when a building is erected from a plurality of such panels (30) the flexible extensions (33, 35) are adapted to overlap and seal gaps at panel junctions to guard against the passage of air and water vapour from the inside to the outside of the building.



WO 2010/146397 A2

Structural Elements for Buildings

The invention relates to structural elements for buildings and more particularly but not exclusively to insulated structural panels or modules, such as wall panels or
5 modules, which are used in constructing the buildings.

A common method of constructing buildings or elements of buildings is to create a supporting frame of steel or timber. A wall may be built from wooden studs or steel beams and a floor from wooden joists. Alternatively, the structural integrity
10 of a wall may be provided by solid masonry, stone or timber wall, with a framework of timber studs fitted inside.

Concerns about the impact of carbon dioxide emissions on climate change have led to pressure on designers and constructors of buildings to reduce the level of
15 carbon dioxide emitted from a building. This is addressed both by improving the efficiency of heating systems therein, and also by reducing heat losses from the building.

Heat is lost from the building in two ways – through the fabric of the building via
20 conduction, convection and radiation, and also by loss of warm air which is replaced by cold air. Both of these need to be addressed to produce an energy efficient building.

To reduce the amount of heat lost through the fabric of the building, the space
25 between the supporting members of the building frame is commonly used for insulation. Conventional insulation materials such as rigid polyurethane boards (PUR) and glass or mineral wool are widely used in this way. However, neither of these methods of insulation can effectively prevent leakage of warm air from the building to the outside, which is replaced with colder air that requires energy to
30 heat.

Rigid PUR boards need to be accurately measured, marked out and cut to fit each individual space between the wall studs. Since wall stud spaces are not

even, it is impossible in practice to obtain a close fit of the PUR board between the studs, even for a skilled worker. Thicker PUR boards are even more difficult to cut and fit accurately. Gaps between the edges of the boards and the studs allow air to leak from the inside to the outside of the building. Over time, the wall studs age and distort, making the gaps larger and increasing air leakage.

Glass wool is an air-open material, allowing passage of warm air through the wool from the inside to the outside of the building. Glass wool is not able to prevent air leakage. Increasing the thickness of the glass wool does not provide an answer since convection cells can form in layers of glass wool greater than 25 mm in depth, whereby an air current circulates warm air from the inside to the outside of the building and cold air in the opposite direction. Increasing the density of the glass wool to form a batt or board does not provide a complete solution since air is still able to circulate through the body of the glass wool. In use and over time, loose materials such as glass wool can slump down inside the wall cavity, leaving a gap at the top with little or no insulation material.

In addition, both PUR and glass wool are time-consuming and unpleasant materials to use. Sawing of PUR boards generates large quantities of PUR dust and “crumbs”, which cause a very messy environment. The crumbs stick by electrostatic attraction to clothing and hair, making protective clothing desirable. Glass wool requires personal protective equipment such as a face mask to prevent inhalation of small glass particles and gloves to prevent a rash on areas of skin that come into contact with glass wool.

Multi-foil insulation materials provide a barrier to air leakage and air permeation and provide extremely effective insulation performance by generating air spaces with low emissivity surfaces. However, in order to generate these spaces, the multi-foil insulation must be battened to the studs. This is a time consuming process, and in addition compresses the multi-foil insulation leading to a loss of performance at the battened areas and the introduction of cold bridges into the wall.

Another method of constructing buildings or elements of buildings is to use panels or modules which are generally of rectangular shape. Panels are discrete
5 elements of the building and may be a wall panel, a floor panel (cassette) or a roof panel. Typically, there are open timber frame wall panels and closed timber frame wall panels, both of which are fabricated in a factory, and then transported to the site where they are erected.

- 10 A typical open timber frame wall panel incorporates a breathable membrane, plywood or OSB sheathing and timber studs, possibly with insulation between studs.

The open timber frame wall panel is erected on site and then further insulation
15 may be added, for example plasterboard, which is fitted across the inner surface of the panel, and an outer cladding such as brick or timber boarding which is attached to the outer surface of the panel.

On the other hand, a typical closed timber frame wall panel incorporates a
20 breathable membrane, plywood or OSB sheathing, timber studs, with insulation between studs, further insulation across the front of the studs, timber battens to create a services void and plasterboard. On site, the closed timber frame panels will be fitted together to form the building.

- 25 The individual open and closed timber frame panels can be factory-fabricated to high standards of thermal performance, air and water vapour tightness.

Modules may consist of one or more entire rooms and are also fabricated in a factory, transported to site and fitted together like building blocks.

30

However, when wall panels or modules are fitted together on site, it is very difficult to eliminate small gaps between the edges of adjoining panels or modules, for example at the junction of the wall panels or modules with the

ground floor or intermediate floors, junctions between adjacent wall panels or modules, or junctions of the wall panels or modules and roof panels. Small gaps between panels or modules allow air movement that reduces the thermal performance of the building, and water vapour movement that can lead to
5 problems of condensation or high humidity. Also, air and water vapour can pass through the insulation itself which further reduces the thermal performance of the building.

Moreover, during the lifetime of a building, the timber from which the wall studs
10 are made can shrink or warp, again opening up gaps in the wall through which air and water vapour can pass.

US 2,913,104 discloses an insulating mineral wool blanket construction unit having an encasing sheet of duplex asphalt-laminated paper or an aluminium foil
15 laminated to its outer face which is extended at opposite sides to form flexible flaps which are coated with a pressure-sensitive adhesive and applied to the studs to provide a complete vapour seal or barrier to the transmission of water vapour from one side of the construction to the other.

GB 2 449 985 discloses a flexible insulation structure having an insulating body and two flexible flaps extending from opposite sides of the insulating body for positioning and securing the insulating structure to adjacent supporting members such as rafters, wall studs or floor joists. The flaps wrap over edges of the supporting member and the insulating body is capable of being fitted in the space
25 between the supporting members with sufficient drape to compensate for variations in the width of the space between the supporting members so that the air space adjacent the insulation structure is substantially preserved.

JP 11 287003 relates to the sealing of small gaps left when fitting rigid boards of insulation between timber studs. Small flexible pieces which are separate from
30 the rigid boards are squeezed between the timber studs and the rigid board, and open out like little springs to seal the gap.

JP 11 280170 relates to the prevention of air leakage between rigid insulation and a structural timber that is addressed, and is by means of a separate piece of flexible polymer that is squeezed between the rigid board and the timber insulation.

- 5 JP 11 166272 relates to the prevention of air leakage between rigid insulation boards and a structural timber by sticking separate small fins into the edge of the rigid board that are sealed against the timber.

US 2,913,104, GB 2449 985, JP 11 287003, JP 11 280170 and JP 11 166272 all suffer from the above mentioned disadvantages of the timber wall studs with
10 which the insulation cooperates shrinking or warping over time and opening up gaps in the wall through which air and water vapour can pass.

DE 3347339 relates to sealing the gaps between rigid insulation boards by means of a separate T-shaped structural bar fitted between the sides of adjoining insulation panels with the bar of the T filled into a corresponding
15 recess in one surface of each of the adjoining panels and the leg of the T protruding beyond the opposite surface of the adjoining panels and to which a sealing cover strip is fixed to protruding leg.

The sealing and joining method disclosed in DE 3347339 is of complex and expensive construction and requires the fitting of separate members to each
20 other that and to the adjacent boards to seal the gaps between adjacent boards and join them together. Moreover, this sealing method does not have the potential to seal other than between adjacent boards.

US 6 293 069 discloses rigid insulation boards that have separate pressure-sensitive adhesive sealing strips which are adhered along the side edges of the
25 board *in situ* to overlap the next board and seal the gaps between the adjacent boards.

So the rigid boards of US 6 293 069 have to be placed in position and then the pressure sensitive sealing strips applied to adjacent boards which is time

consuming, fiddly and does not have the potential to seal gaps other than between adjacent boards.

WO 94/19559 discloses rigid insulation boards which are complete roof or wall sections having rigid upper and lower edge flanges on opposite sides which are
5 a continuation of the rigid top and bottom corrugated sheets of sheet metal and overlap with, and are screwed to, the adjoining corrugated sheets to connect the corrugated boards together to form a wall or a roof by also connecting edge flanges to timber roof ridge beams.

The board joining method of WO 94/19559 does not seal the gaps between
10 adjacent panels and timber roof beams against the passage of air and water vapour and does not have the potential to seal these gaps or any other gaps.

Hereinafter, for convenience, such panels and modules will be generically referred to as "panels".

15 Accordingly, the main object of the present invention is to provide a panel, such as a wall panel for use in the construction of a building that overcomes, or at least substantially overcomes, the problem of reduced thermal performance caused by the passage of air and water vapour from the inside to the outside of a building when a plurality of such panels are fitted together in the construction of the
20 building.

From one aspect, the present invention consists in a panel for use as a wall panel in the construction of a building, the panel being generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges
25 and incorporating flexible across-stud thermal insulation which is generally of rectangular shape, which has dimensions, between its oppositely facing edges that correspond substantially to those of the panel, and which has flexible extensions projecting outwardly beyond edges of the panel, whereby when a building is erected from a plurality of such panels the flexible extensions can
30 overlap and seal gaps at panel junctions to guard against the passage of air and water vapour from the inside to the outside of the building.

From another aspect, the invention resides in a panel for use as a wall panel in the construction of a building, the panel being generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges and incorporating flexible across-stud thermal insulation which is generally of rectangular shape, which has an inner central core of insulating material enclosed by two flexible, at least substantially air and water vapour impermeable flexible outer layers, the inner central core with its enclosing outer layers having dimensions, between the oppositely facing edges, which correspond substantially to those of the panel, and the outer layers being extended beyond selected ones of the oppositely facing side edges of the panel to form flexible extensions extending entirely along the selected ones of the oppositely facing edges of the panel, whereby when a building is erected from a plurality of such panels, the flexible extensions are adapted to overlap and seal gaps at panel junctions to guard against the passage of air and water vapour from the inside to the outside of the building.

Therefore, the across-stud insulation is effectively a large flexible sheet-like element that is of similar size to that of the panel and has flexible flange-like extensions that can wrap around panel junctions to seal any the gaps. The panel junctions can be between adjacent wall panels, or wall and intermediate floor/ceiling/roof panels, or wall and ground floor panels.

Not only can the sealing presence of the flexible extensions guard against the passage of air and water vapour through any gaps at the junctions between adjacent panels such as wall panels, and/or ground floor panels and/or intermediate floor/ceiling/roof panels, but also, the flexible air and water vapour permeable outer layers of the central inner core guard against the passage of air and water vapour through the across-stud thermal insulation itself.

By incorporating the thermal insulation into the panel itself as across-stud insulation with the flexible extensions projecting beyond edges of the panel enabling overlapping and sealing at panel junctions when a wall is erected from such panels, the thermal performance of the building is thereby increased.

5

Thus, by virtue of the rectangular across-stud flexible thermal insulation incorporated into the panel with its outwardly projecting flexible extensions, the panel has the potential to overlap and seal gaps at panel junctions, either top and bottom, or sides, or all of top and bottom and sides.

10

From yet another aspect, the invention resides in a method of making a panel for use as a wall panel in the construction of a building, the panel being generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges, said method including incorporating flexible across-stud thermal insulation which is generally of rectangular shape, which has dimensions, between its oppositely facing edges that correspond substantially to those of the panel, and which has flexible extensions projecting outwardly beyond edges of the panel, battening the thermal insulation in position so that the flexible extensions project outwardly beyond edges of the panels to overlap and seal gaps at panel junctions when a building is erected from a plurality of such panels.

20

From a further aspect, the invention resides in a method of insulating a building when a plurality of panels of generally rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges are erected adjacent one another in the construction of the building, said method being characterised by incorporating in the panels flexible across-stud thermal insulation which is generally of rectangular shape, which has dimensions, between its oppositely facing edges, that correspond substantially to those of the panels, and which has flexible extensions, battening the thermal insulation in position, so that, the flexible extensions project outwardly beyond edges of the panels, and overlapping gaps at panel junctions with the flexible extensions to seal the gaps and guard against the passage of air and water vapour from the inside to the outside of the building.

25

30

The invention also comprehends a building including any of the panels defined hereinabove and/or insulated according the method.

- 5 The flexible extensions may be simply and easily held in place by any appropriate means such as stapling, nailing, single or double sided tape, battening, or by adhesive.

10 The sealing effect may be maximised by providing for the flexible extensions to project outwardly beyond all the edges of the panels, i.e. top and bottom (substantially horizontal) edges and side (substantially vertical) edges and extend along the edges for substantially their entire length or height, as the case may be.

15 The top and bottom edge extensions can be used to seal any gaps left at the junction between floor and ceiling panels or the top and bottom edge extensions may also be used to seal the top and bottom edges of the panels where the insulation of the insulating body may be open and which would normally allow the passage of air and water vapour into the insulating body.

20 In order to guard against the passage of air and/or water vapour from one panel into an adjoining panel, the flexible extensions may wrap around the top and bottom and side edges of the wall panel, and sealing off the interior and thereby making the panel into a self-contained sealed unit.

25 And gaps at the panel junctions between the panel and an adjacent panel, such as wall panel-wall panel, wall panel-ground floor panel or wall panel-intermediate floor/ceiling/roof panel junctions, may be overlapped and sealed by the flexible extensions to guard against air and water vapour leakages through the gaps between adjoining (adjacent) panels.

30

Ideally, each flexible extension includes two flexible elements of which one flexible element seals any gap at the junctions between adjacent panels to guard against the passage of air and/or water vapour therethrough and the other of the

two flexible elements wraps around the top and bottom and side edges of the panel and sealing off the interior thereby to make the panel into a self-contained sealed unit.

- 5 The thermal insulation may be of any suitable kind consistent with achieving good thermal performance but the Applicant has found that thermal insulation having a central insulating core of flexible insulating material, for example of alternating inner layers of nonwoven wadding and reflective layers, is advantageous because the flexible extensions can be made easily and simply to project
10 outwardly of such a flexible insulating material. This is particularly the case when the central insulating core is provided with larger flexible air/water vapour permeable outer layers covering oppositely facing surfaces of the flexible insulating material and joined together outside the line of the central core to form a seam, leaving the flexible extensions projecting outwardly of the central
15 insulating core and of edges of the panel. As explained in the previous paragraph, the flexible extensions may incorporate one or two flexible elements. The joining operation may be carried out by stitching, that would be sealed by adhesive tape or alternatively by thermal bonding such as heat or ultrasonic welding which produces sealed seams.

20

- From a still further aspect, the invention resides in flexible across-stud thermal insulation for incorporation in a building panel which is generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges, said flexible across-stud thermal insulation being generally of rectangular
25 shape, and having an inner central core of insulating material enclosed by two flexible, at least substantially air and water vapour impermeable flexible outer layers joined together outside the line of the central core to form a seam, the inner central core with its enclosing outer layers having dimensions, between its oppositely facing edges, which correspond substantially to those of the building
30 panel, with the outer layers projecting outwardly of the central insulating core beyond the seam to form flexible extensions which, when the across-stud thermal insulation, is incorporated in the panel and when a building is erected from a plurality of such panels, extend beyond, and entirely along, the selected ones of

the oppositely facing edges of the panel, to overlap and seal panel junctions and guard against the passage of air and/or water vapour from the inside to the outside of the building.

- 5 The flexibility of the across-stud thermal insulation enables it to be wound into a roll as it comes off the manufacturing line, for ease of transport and ultimate incorporation into the building panel.

Such across-stud thermal insulation has the potential to overlap and seal gaps at
10 panel junctions.

One only of the flexible outer layers may extend outwardly of the seam and constitutes each said flexible extension. Alternatively, the two flexible outer layers may extend outwardly of the seam and form two flexible elements which
15 constitute each said flexible extension.

In a preferred embodiment, the insulating material of the central core incorporates alternating inner layers of nonwoven wadding and reflective films.

- 20 In order that the invention may be more readily understood, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a perspective view from one side of a typical, conventional, closed timber frame wall panel;

25

Figure 2 is a perspective view from one side of a corner of a building built from the erection of two of the wall panels shown in Figure 1 and a floor panel (cassette);

- 30 Figure 3 is a perspective view from one side of a closed timber frame wall panel fabricated in accordance with one embodiment of the invention;

Figure 4 is perspective view from one side of a corner of a building built from the erection of two of the wall panels shown in Figure 3 and a floor panel (cassette);

Figure 5 is a diagrammatic sectional view of one embodiment of thermal
5 insulation forming part of the wall panel of Figures 3 and 4;

Figure 6 is a diagrammatic sectional view of an alternative embodiment of thermal insulation forming part of the wall panel of Figures 3 and 4; and

10 Figure 7 is a perspective view from one side of the wall panel Figures 4 and 5 including the alternative embodiment of thermal insulation shown in Figure 6.

In the drawings, the same reference characters are used to designate the same or similar parts.

15

The closed timber frame wall panel shown in Figure 1 is generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges and is indicated by the reference 10. The wall panel 10 is fabricated in a factory and incorporates an outer sheathing board 11 which is fixed to
20 substantially vertical studs 12 between which is insulation 13, such as fibreglass. Insulation 14 extends across the studs 12 and is held in position by substantially vertical battens 15 to which are fixed an inner sheet of plasterboard 16, with the presence of the battens 15 resulting in the formation of a service cavity 17 between the across-stud insulation 14 and the plasterboard 16. A disadvantage
25 of this known panel 10 is that the between-stud insulation 13 is exposed so that air leakage can occur.

In Figure 2, the corner 18 of the building is formed by the erection of two of the closed timber frame wall panels 10 on a floor panel 19, the wall panels 10 being
30 overlapped at 19a. The erection of wall panels 10 on the floor panel 19 results in there being three junctions, namely, wall panel to wall panel (wall to wall) 20, wall panel to floor panel (wall to ground floor) 21, and wall panel to intermediate floor/ceiling/roof panel (wall to intermediate floor/ceiling/roof) 22. As will be

appreciated from Figure 2, the panels 10 and 19 butt against one another at the junctions 20, 21 and 22 leaving gaps at the junctions between the panels which permit the passage of air and water vapour therethrough and thereby reduce the thermal performance of the building.

5

Referring to Figures 3 and 4, a closed timber frame wall panel fabricated in accordance with the invention is also generally of rectangular shape and is generally indicated by reference 30 with oppositely facing top and bottom edges and oppositely facing side edges. The across-stud insulation of wall panel 30 includes thermal insulation 32 disposed within the panel and incorporating flexible extensions such as 33 projecting outwardly of edges of the panel 30 and adapted at least substantially to seal the walls erected from a plurality of such panels 32 against the passage of air and water vapour through the wall from the inside to the outside the building. Between the oppositely facing top and bottom and oppositely facing side edges, the wall panel 10 and 30 are of the same standard dimensions which are common in the building industry nowadays. It is self evident from Figures 3 and 4 that the across-stud thermal insulation has dimensions between its oppositely facing edges (i.e. not including the flexible extensions 33) that substantially correspond to those of the panel 30. For example the dimensions of such panels can be 2.4m x 2.4m or 2.7m x 2.7mm.

As will be more readily appreciated from Figure 4, there are four such flexible extensions, namely side extensions 33, which project beyond the oppositely facing side edges 34 of the panel 30 for the entire height of the wall panel 30 and top and bottom extensions 35 which project beyond the oppositely facing top and bottom edges 36 for the entire length of the panel. The flexible extensions 33 and 35 overlap (wrap around) and seal the gaps at the panel junctions 20, 21 and 22 that would normally permit the passage of air and water vapour as with the panels 10, since the extensions 33 and 35 are adapted to guard against the passage of such air and water vapour through the walls created by the wall panels 30 at the junctions between the panels 32.

As can be seen in Figure 3, the top and bottom edge extensions 35 seal the between-stud insulation 12 which is also present in the panel 30 to guard against air and/or water vapour leakage through the between-stud insulation 12.

- 5 The across-stud thermal insulation 32 of the wall panel 30 has a central (inner) insulating core 38 which is enclosed by two flexible outer layers 44 and 45 forming the respective flexible extensions 33 and 35 and which extends across the studs 12 (not visible in Figures 3 and 4) between the battens 15 and the between-studs insulation 13 (also not visible in Figures 3 and 4). Thus, from the
- 10 central core 38, the extensions 33 and 35 project outwardly beyond the oppositely facing side and top and bottom edges 34 and 36 respectively of the panel 30. The panel 30 is completed by fixing with the inner sheet of plasterboard 16 to the battens 15, leaving the service gap 17.
- 15 As will be more readily appreciated from Figure 5, the central core 38 of flexible insulating material is a multi-foil insulation incorporating alternating inner layers of nonwoven wadding 40 and reflective layers 42, such as metallised films, nonwovens etc., and is the same width as that of the panel 30. For example, for a wall panel of height 2.4m, the central insulating core 38 would have a width of
- 20 2.4m. So the across-studs insulation has dimensions between its oppositely facing edges that correspond substantially with those of the panel 30 (as well as of panel 10). However, the two flexible outer layers 44 and 45 which cover the oppositely facing surfaces of the flexible insulating material 40, and which are at least substantially air impermeable and are joined together outside the line of the
- 25 central insulating core 38 to form respective seams 46, extend beyond the seams 46 and oppositely facing panel edges. The joining operation may be carried out by stitching, which would be sealed by adhesive tape, or alternatively by thermal bonding such as heat or ultrasonic welding which produces sealed seams.
- 30 This leaves the flexible extensions 33 and 35 which are at least substantially air and water vapour permeable projecting outwardly of the central insulating core 38 and of the edges 34 and 36 respectively of the wall panel 30. For example, if the core is 2.4m wide and the outer layers are 3m wide, then each flexible extension

33 and 35 will be 300mm in width. The flexible multi-foil insulating material is designed such that the central insulating core 38 is the same dimensions as the whole height of the wall or width of the floor panel to be insulated.

- 5 In the embodiment of thermal insulation 32 illustrated in Figure 5, each flexible extension 33, 35 is formed by one of the two outer layers 44 and 45. On the other hand, in the alternative embodiment of thermal insulation 32 of Figure 6, each flexible extension 33, 35 is formed by the two outer layers 44 and 45 resulting in each flexible extension being constituted by two flexible elements 48 forming
- 10 double flexible extensions each of which has a sealing function as will be appreciated from Figure 7 to which reference will now be made.

Figure 7 shows one of the two flexible elements 48 (identified as 48a) sealing the top of a wall panel 30 and the other of the flexible elements 48 (identified as 48b)

15 being adapted to seal an adjacent panel 30 (not shown).

The single flexible extensions 33, 35 and double flexible extensions 33, 35, 48 may project beyond oppositely facing side edges, or oppositely facing top and bottom edges in which cases the seam 46 would run along two opposite sides

20 respectively of the central insulating core 32 or both oppositely facing side and top and bottom edges of the panel 30 in which case the seam 46 would run along all sides of the central insulating core 32.

And both the single flexible extensions 33, 35 and double flexible extensions 33, 35, 48 may be simply and easily held in place by stapling, nailing, single or

25 double sided tape, battening, or by adhesive.

The flexible extensions 33 and 35 projecting outwardly from the respective edges 34 and 36 of the wall panel 30, can be used to:-

30

- i) wrap around the top and bottom edges of the panel 30 in the case of extensions 35, sealing off the interior and making the panel 30 into a self-contained sealed unit, thereby guarding against the passage of air and/or water

vapour from one panel 30 into the adjoining panel 30, as will be appreciated from Figure 3; or

- ii) seal the junction between the wall panel 30 and the adjacent panel 30, for example wall panel 30 to wall panel 30, and wall panel 30 to the adjacent floor panel 19 thereby guarding against air and/or water vapour leakage through gaps between adjoining (adjacent) panels 30, as will be appreciated from Figure 4.

The double flexible extensions 33,35,38 projecting outwardly from the respective edges 34 and 36 of the wall panel 30 can be used for both i) and ii).

10

Various modifications may be made without departing from the scope of the invention as defined in the appended claims. For example, although the invention has been described with reference to a wall panel 30, the panel 30 with its flexible extension forming part of the panel could be adapted for use as a floor panel, a ceiling panel or a roof panel. Whilst the flexible extensions 33 and 35 are an integral part of the thermal insulation and project from the central insulating core 38 and that is the preferred construction for reasons of simplicity of fabrication, and effectiveness of insulation and cost, it is conceivable that the panel 30 could be modified made in such a way that the flexible extensions extend from another part of the panel 30.

15

20

Claims

1. A panel for use as a wall panel in the construction of a building, the panel
5 being generally of rectangular shape with oppositely facing top and bottom edges
and oppositely facing side edges and incorporating flexible across-stud thermal
insulation which is generally of rectangular shape, which has dimensions,
between its oppositely facing edges that correspond substantially to those of the
panel, and which has flexible extensions projecting outwardly beyond edges of
10 the panel, whereby when a building is erected from a plurality of such panels the
flexible extensions are adapted to overlap and seal gaps at panel junctions to
guard against the passage of air and water vapour from the inside to the outside
of the building.
- 15 2. A panel for use as a wall panel in the construction of a building, the panel
being generally of rectangular shape with oppositely facing top and bottom edges
and oppositely facing side edges and incorporating flexible across-stud thermal
insulation which is generally of rectangular shape, which has an inner central
core of insulating material enclosed by two flexible, at least substantially air and
20 water vapour impermeable flexible outer layers, the inner central core with its
enclosing outer layers having dimensions, between the oppositely facing edges,
which correspond substantially to those of the panel, and the outer layers being
extended beyond selected ones of the oppositely facing side edges of the panel
to form flexible extensions extending entirely along the selected ones of the
25 oppositely facing edges of the panel, whereby when a building is erected from a
plurality of such panels, the flexible extensions are adapted to overlap and seal
gaps at panel junctions to guard against the passage of air and water vapour
from the inside to the outside of the building.
- 30 3. A panel as claimed in claim 1 or claim 2, wherein the flexible extensions of the
flexible across-stud thermal insulation extend beyond the oppositely facing side

edges of the panel to overlap and seal gaps at the panel junctions between adjacent panels.

4. A panel as claimed in claim 1 or claim 2, wherein the flexible extensions of the flexible across-stud thermal insulation extend beyond the oppositely facing top and bottom edges of the panel to seal gaps at the panel junctions between the top edges of the panels and an intermediate floor, ceiling or roof panel and between the bottom edges and a ground floor panel.
5. A panel as claimed in claim 1 or claim 2, wherein the flexible extensions of the flexible across-stud thermal insulation extend beyond the oppositely facing side edges of the panel to seal gaps at the panel junctions between adjacent panels and extend beyond the oppositely facing top and bottom edges of the panel to seal gaps at the panel junctions between the top edges of the panels and an intermediate floor, ceiling or roof panel and between the bottom edges and a ground floor panel.
6. A panel as claimed in any of claims 1 to 5, wherein selected ones of the flexible extensions of the flexible across-stud thermal insulation are adapted to wrap around the top and bottom edges of the panel, thereby sealing off the panel interior and making the panel into a self-contained sealed unit.
7. A panel as claimed in any of claims 1 to 6, wherein each flexible extension of the flexible across-stud thermal insulation includes two flexible elements of which one flexible element seals gaps at panel junctions to guard against the passage of air and water vapour therethrough and the other of the two flexible elements wraps around the top and bottom and side edges of the panel to sealing off the panel interior, thereby to make the panel into a self-contained sealed unit.
8. A panel as claimed in claim 2, or any claim dependent thereon, wherein the flexible outer layers forming the flexible extensions of the flexible across-stud thermal insulation are joined together outside the line of the central core to form a

seam, leaving the flexible extensions projecting outwardly beyond the central insulating core and edges of the panel.

9. A panel as claimed in claim 1, or any claim dependent thereon, wherein the flexible across-stud thermal insulation has an inner central insulating core of flexible insulating material and is enclosed by at least substantially air and water vapour impermeable flexible outer layers joined together outside the line of the central core to form a seam, leaving the flexible extensions projecting outwardly of the central insulating core and of edges of the wall panel.

10

10. A panel as claimed in claim 8 or claim 9, wherein for each flexible extension of the flexible across-stud thermal insulation, one only of the flexible outer layers extends outwardly of the seam and constitutes each said flexible extension.

11. A panel as claimed in claim 8 or claim 9, wherein the two flexible outer layers extend outwardly of the seam and form two flexible elements which constitute each said flexible extension of the flexible across-stud thermal insulation, thereby sealing off the panel interior and making the panel into a self-contained sealed unit.

20

12. A panel as claimed in claim 8 or claim 9, wherein the two flexible outer layers extend outwardly of the seam and form two flexible elements which overlap and seal a panel junction and open edge respectively of the panel, thereby sealing off the panel interior and making the panel into a self-contained sealed unit.

25

13. A panel as claimed in claim 2 or any claim dependent thereon or claim 9, wherein the flexible insulating material of the central core incorporates alternating inner layers of nonwoven wadding and reflective films.

14. A panel as claimed in any of claims 1 to 13, and having outer sheathing fixed to studs with insulation therebetween, and wherein the across-stud thermal insulation is fixed to the studs by battens to which is fixed an inner sheet creating a service cavity between the inner sheet and the across-stud thermal insulation.

15. Use of a panel as claimed in any of claims 1 to 14, in the construction of a building.

5 16. Flexible across-stud thermal insulation for incorporation in a building panel as claimed in any of claims 2 to 14, which building panel is generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges, said flexible across-stud thermal insulation being generally of rectangular shape, and having an inner central core of insulating material enclosed by two
10 flexible, at least substantially air and water vapour impermeable flexible outer layers joined together outside the line of the central core to form a seam, the inner central core with its enclosing outer layers having dimensions, between its oppositely facing edges, which correspond substantially to those of the building panel, with the outer layers projecting outwardly of the central insulating core
15 beyond the seam to form flexible extensions which, when the across-stud thermal insulation is incorporated in the panel and when a building is erected from a plurality of such panels, extend beyond, and entirely along, the selected ones of the oppositely facing edges of the panel, to overlap and seal panel junctions and guard against the passage of air and water vapour from the inside to the outside
20 of the building.

17. Flexible across-stud thermal insulation as claimed in claim 16, wherein for each flexible extension, one only of the flexible outer layers extends outwardly of the seam and constitutes each said flexible extension.
25

18. Flexible across-stud thermal insulation as claimed in claim 16, wherein the two flexible outer layers extend outwardly of the seam and form two flexible elements which constitute each said flexible extension.

30 19. Flexible across-stud thermal insulation as claimed in any of claims 16 to 18, wherein the insulating material of the central core incorporates alternating inner layers of nonwoven wadding and reflective films.

20. A method of fabricating a panel for use as a wall panel in the construction of a building, the panel being generally of rectangular shape with oppositely facing top and bottom edges and oppositely facing side edges, said method including incorporating flexible across-stud thermal insulation which is generally of
5 rectangular shape, which has dimensions, between its oppositely facing edges, that correspond substantially to those of the panel, and which has flexible extensions projecting outwardly beyond edges of the panel, battening the thermal insulation in position so that the flexible extensions project outwardly beyond
10 edges of the panels to overlap and seal gaps at panel junctions when a building is erected from a plurality of such panels.

21. A building including a plurality of panels as claimed in any of claims 1 to 14.

Figure 1

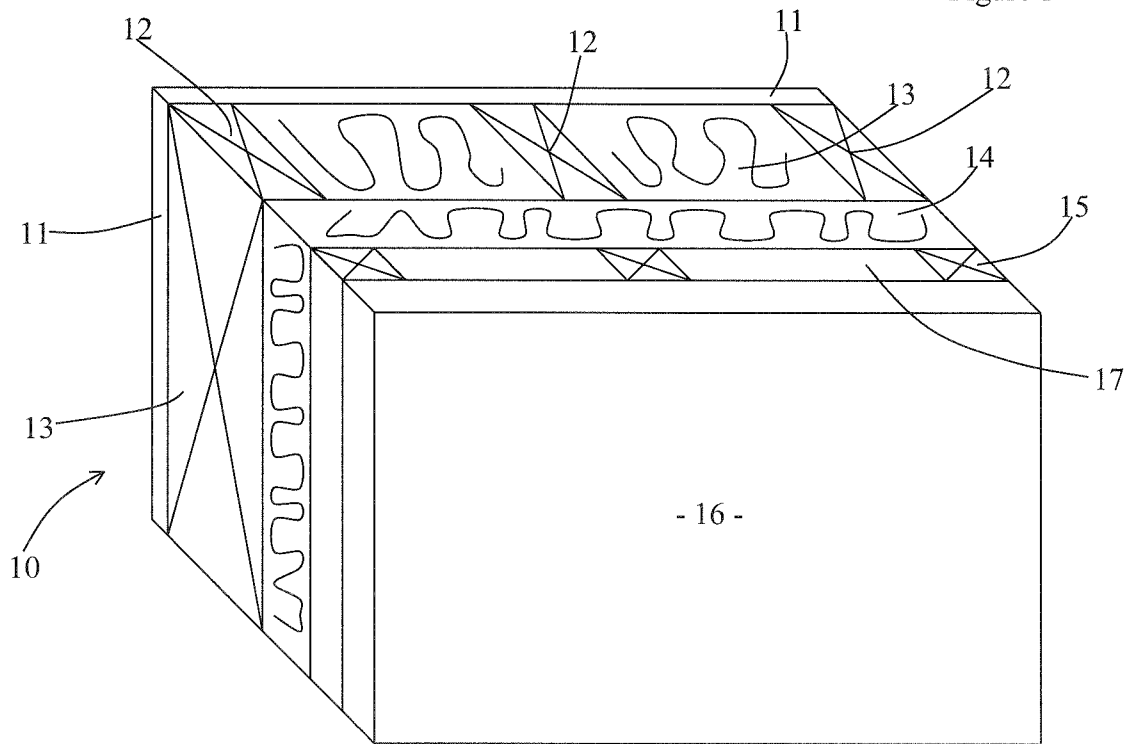


Figure 2

