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(54) Panels

(57) A panel comprises a pair of facing sheets and a core which comprises an open cell honeycomb structure filled with foam and having walls which extend between the facing sheets and the foam filling. The walls of the honeycomb structure bridge the space defined between the two facing sheets.

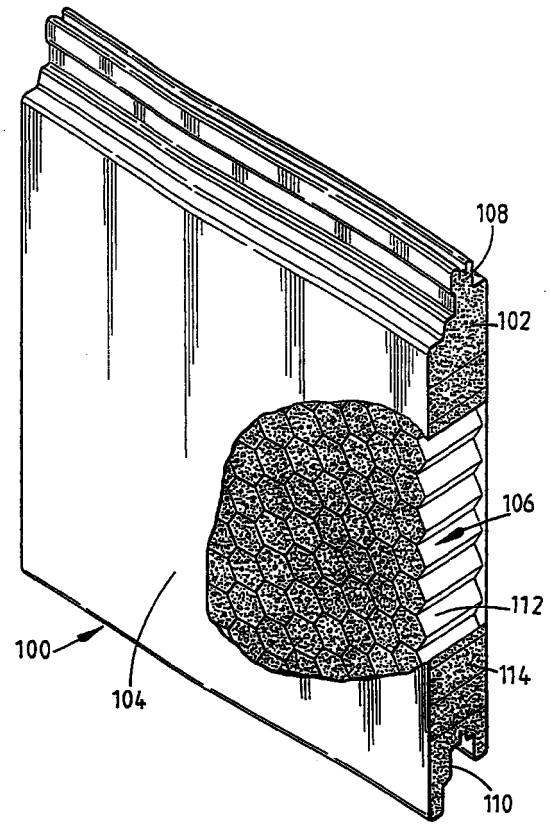

FIGURE 1

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Description

[0001] This invention concerns panels, especially building panels for use in constructing walls and roofs.

[0002] Building panels are known which comprise metal facing sheets and a core of polyurethane foam. Whilst having good insulation properties, these panels do have some disadvantages. One disadvantage is that they have a limit on their load bearing capacity even when made relatively thick because polyurethane foam is not particularly strong. Another disadvantage arises simply from the use of polyurethane foam which gives off toxic fumes in fire situations. Increasingly, therefore, there is a movement away from using such wall panels.

[0003] A known building panel is disclosed in US-A-2744042. The disclosed panel is a laminate in which a foamed resin is disposed within the interstices of a honeycomb structure in order to secure minimum density and still return relatively good strength, and impact resistance.

[0004] An object of this invention is to provide panels which do not suffer from, or at least alleviate, the disadvantages referred to above.

[0005] According to this invention there is provided a panel comprising a pair of facing sheets between which is sandwiched a core which comprises an open cell honeycomb structure filled with foam and having walls extending between the facing sheets, the panel being characterised in that the walls of the honeycomb structure bridge the space defined between the two facing sheets.

[0006] The facing sheets may be of metal, especially of steel, more especially of galvanised steel. Preferably outer faces of the or each facing sheet is covered or coated with a corrosion protection layer.

[0007] The facing sheets may alternatively be made of non-metallic materials and as such are preferably rigid boards. Examples of suitable rigid boards for use in the invention include particle boards, cement particle boards, glass fibre reinforced cement boards, cellulose reinforced gypsum boards, crushed slate boards and resin boards. Wooden facing sheets or composite wooden facing sheets may also be used in forming panels of the invention, including, for example, plywood and chipboard. Preferably facing sheets used in the invention are able to offer some fire resistance due to their composition, the addition of fire resistant materials or coating thereof with fire resistant materials.

[0008] The open cell structure forming part of the core of a panel according to the invention is preferably a honeycomb structure, wherein lengths of material are bonded together at intervals or are formed into a lattice by being interwoven. There are two principle ways of producing a honeycomb structure suitable as a core. The first way is the expansion process, in which sheets of material, having adhesive applied in strips, are cut and stacked on top of each other and then the adhesive is cured, usually under pressure and at elevated temperature. Slices are then cut to the required thickness and expanded to give the honeycomb structures. The other way of making honeycomb structures is to corrugate sheets of material, apply adhesive to nodes and stack the sheets in an oven to cure.

[0009] The material used to form the open cell structure may be metallic or non-metallic. Aluminium is a preferred metal for forming the open cell structure. Suitable non-metallic materials for forming the open cell structure include paper and cardboard impregnated with a stiffening material, such as a resin, especially a phenolic resin, thermoplastic polyurethane sheets, fibreglass, carbon fibre in a resin, such as phenolic, epoxide or polyamide resin, and polypropylene or polyester sheets.

[0010] The honeycomb structure may be of a conventional hexagonal cell type or may be reinforced by flat-sheets between each node to form trapezoidal cells.

[0011] The foam filling for the core of panels of the invention is preferably a synthetic foam, suitable examples of which include polyurethane, polyisocyanate and phenolic foams.

[0012] Opposed panel ends may be shaped or provided with complementary formations for engagement with ends of adjacent panels, such as in tongue and groove fashion or by provision of overlapping rebates.

[0013] In another aspect, the invention provides a method of making a panel comprising a pair of facing sheets between which is sandwiched a core which comprises an open cell structure having walls extending between the facing sheets and a foam filling, the method comprising the steps of laying out one profiled facing sheet with the open cell structure thereon, pouring the foam filling in uncured or partially uncured state into the open cell structure to fill the longitudinal channels, laying the other facing sheet on top of the open cell structure and curing the foam filling to form a cohesive structure.

[0014] Advantage of panels according to the invention may also include improved strength against impact damage as well as dimensional stability.

[0015] Panels of the invention are suitable as building panels and as such may be used, for example, as wall panels, roof panels, floor panels (decking) and for making doors, especially fire doors or roller shutter doors.

[0016] This invention will now be further described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 shows a first panel according to the invention; and

Figure 2 shows a second panel according to the invention.

[0017] A wall panel 100 comprises inner and outer substantially flat facing sheets 102 and 104 respectively and a core 106. Ends of the facing sheets are bent and

shaped to form opposite ends of the panel tongue and groove jointing profiles 108 and 110 respectively for joining panels end to end. The core 106 comprises a honeycomb structure 112 of aluminium or phenolic resin impregnated paper and a polyurethane or polyisocyanate foam filling 114.

[0018] The panel illustrated in Figure 1 may be made in the following way. One facing sheet is load down and the honeycomb structure load thereon. Uncured or partially cured polyurethane or polyisocyanate foam in flowable form is poured onto the honeycomb structure, the underlying facing sheet acting as a tray. The other facing sheet is laid on top and the foam cured. As the foam cures it bonds to the two facing sheets.

[0019] Figure 2 of the accompanying drawings illustrates an embodiment of the invention not based on use of metal facing sheets. A panel 200 comprises inner and outer flat facing sheets 202 and 204 of cement particle board and a core 206. Alternative materials for the facing sheets include particle boards, glass reinforced cement boards, cellulose reinforced gypsum boards, crushed slate boards and resin boards. The core 206 comprises a honeycomb structure 208 of aluminium or phenolic resin impregnated paper and a polyurethane or polyisocyanate foam filling 210.

[0020] The honeycomb structures used in each of the illustrated embodiments may, of course, be substituted by a honeycomb structure made of any other suitable material such as of sheets of polyurethane, fibreglass, carbon fibre, polypropylene or polyester.

[0021] Panels of the invention may have several advantages over prior art panels. The open cell core provides strength enhancing load spanning characteristics of the panels and the overall flatness of the panels can be improved relative to prior art panels. The panels perform better in fire situations in the respects of structural integrity and control of spread of smoke. The open cell core structure can retain smoke and hence delay its escape. Panels having an outer profiled facing sheet also provides a means for venting smoke to the exterior of a building upwards along the profiles.

Claims

1. A panel comprising a pair of facing sheets (102, 104) and a core (106) which comprises an open cell honeycomb structure (112) filled with foam and having walls extending between the facing sheets and the foam filling (114), the panel being characterised in that the walls of the honeycomb structure (112) bridge the space defined between the two facing sheets (102, 104).

2. A panel as claimed in claim 1, wherein the honeycomb structure comprises lengths of material bonded together at intervals.

3. A panel as claimed in claim 1, wherein the honeycomb structure comprises lengths of material interwoven into a lattice.

4. A panel as claimed in any one of claims 1 to 3, wherein the open cell structure is of metal.

5. A panel as claimed in claim 4, wherein the open cell structure is of aluminium.

6. A panel as claimed in any one of claims 1 to 3, wherein the open cell structure is non-metallic.

7. A panel as claimed in claim 6, wherein the open cell structure is of paper or cardboard impregnated with a stiffening material.

8. A panel as claimed in claim 7, wherein the stiffening material is a resin.

9. A panel as claimed in claim 8, wherein the resin is a phenolic resin.

10. A panel as claimed in claim 6, wherein the open cell structure is of a material selected from thermoplastic polyurethane sheets, fibreglass, carbon fibre in a resin, polypropylene sheets and polyester sheets.

11. A panel as claimed in any one of claims 1 to 10, wherein the foam filling is a synthetic foam.

12. A panel as claimed in claim 11, wherein the foam filling is selected from polyurethane, polyisocyanate and phenolic foams.

13. A panel as claimed in any one of claims 1 to 12, wherein the facing sheets are of metal.

14. A panel as claimed in claim 13, wherein the facing sheets are of steel.

15. A panel as claimed in any one of claims 13 and 14, wherein outer faces of one or both of the facing sheets is or are covered with a corrosion protection layer.

16. A panel as claimed in any one of claims 1 to 12, wherein the facing sheets are of non-metallic material.

17. A panel as claimed in claim 16, wherein the facing sheets are of rigid board.

18. A panel as claimed in claim 17, wherein the rigid board is selected from particle boards, cellulose reinforced gypsum boards, crushed slate boards and resin boards.

19. A panel as claimed in claim 16, wherein the facing

sheets are of wood or a wood composite.

20. A panel as claimed in claim 19, wherein the facing sheets are of plywood or clipboard.

21. A panel as claimed in any one of the preceding claims, wherein facing sheets have fire resistant materials added thereto or are coated therewith.

22. A panel as claimed in any one of the preceding claims, wherein opposed panel ends are shaped or provided with complementary formations for engagement with ends of adjacent panels.

23. A panel as claimed in claim 22, wherein said complementary formations comprise a tongue on one end and a corresponding groove on the other end of the panel.

24. A panel as claimed in claim 22, wherein opposite ends of the panel are rebated oppositely whereby a rebate of one panel is over-lappable with a rebate of an adjacent panel.

25. A method of making a panel comprising a pair of facing sheets which comprises an open cell structure having walls extending between the facing sheets and a foam filling, the method being characterised by the steps of laying out one profiled facing sheet with the open cell structure thereon, pouring the foam filling in uncured or partially uncured state into the open cell structure to fill the longitudinal channels, laying the other facing sheet on top of the open cell structure and curing the foam filling to form a cohesive structure.

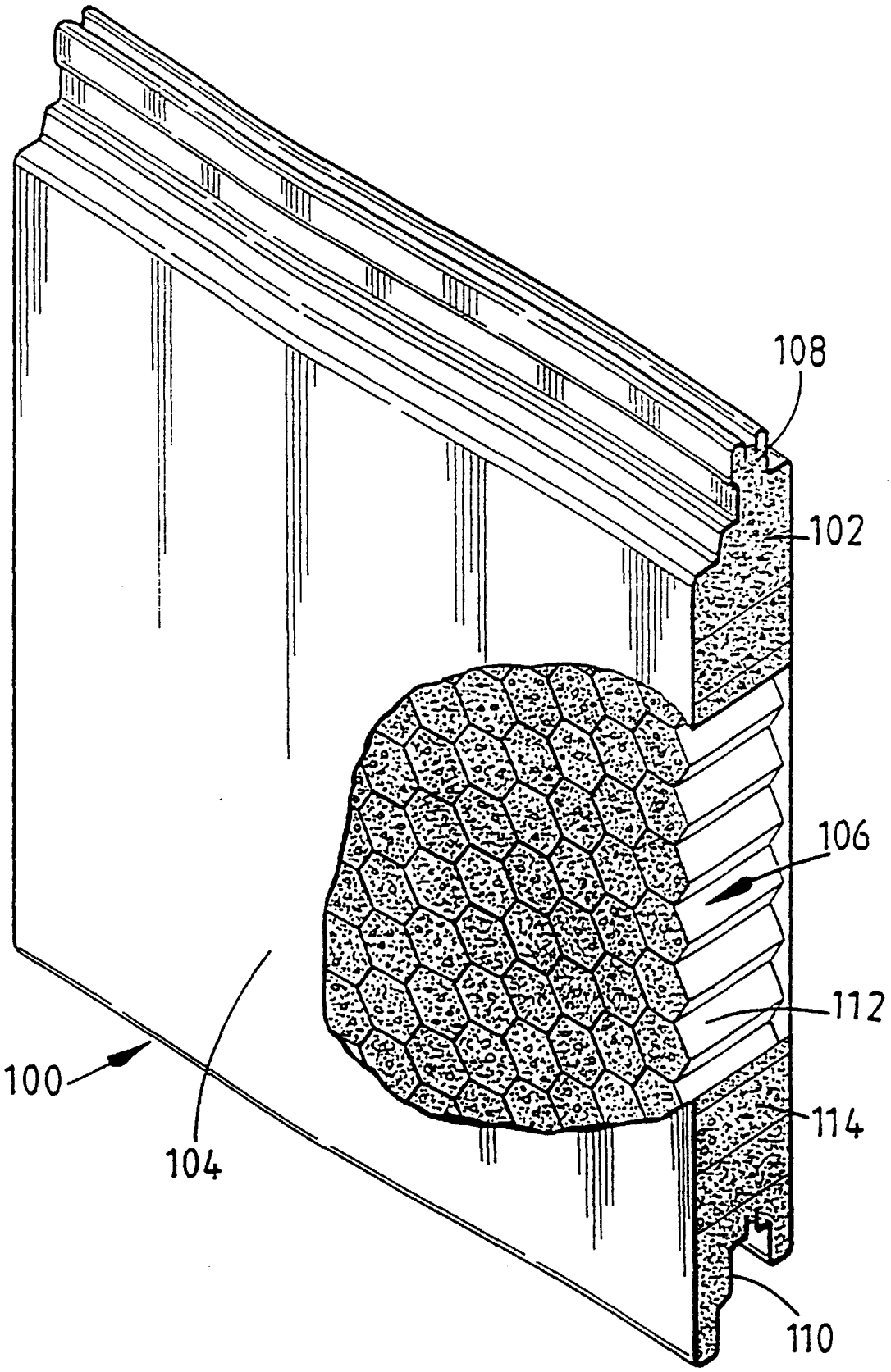

FIGURE 1

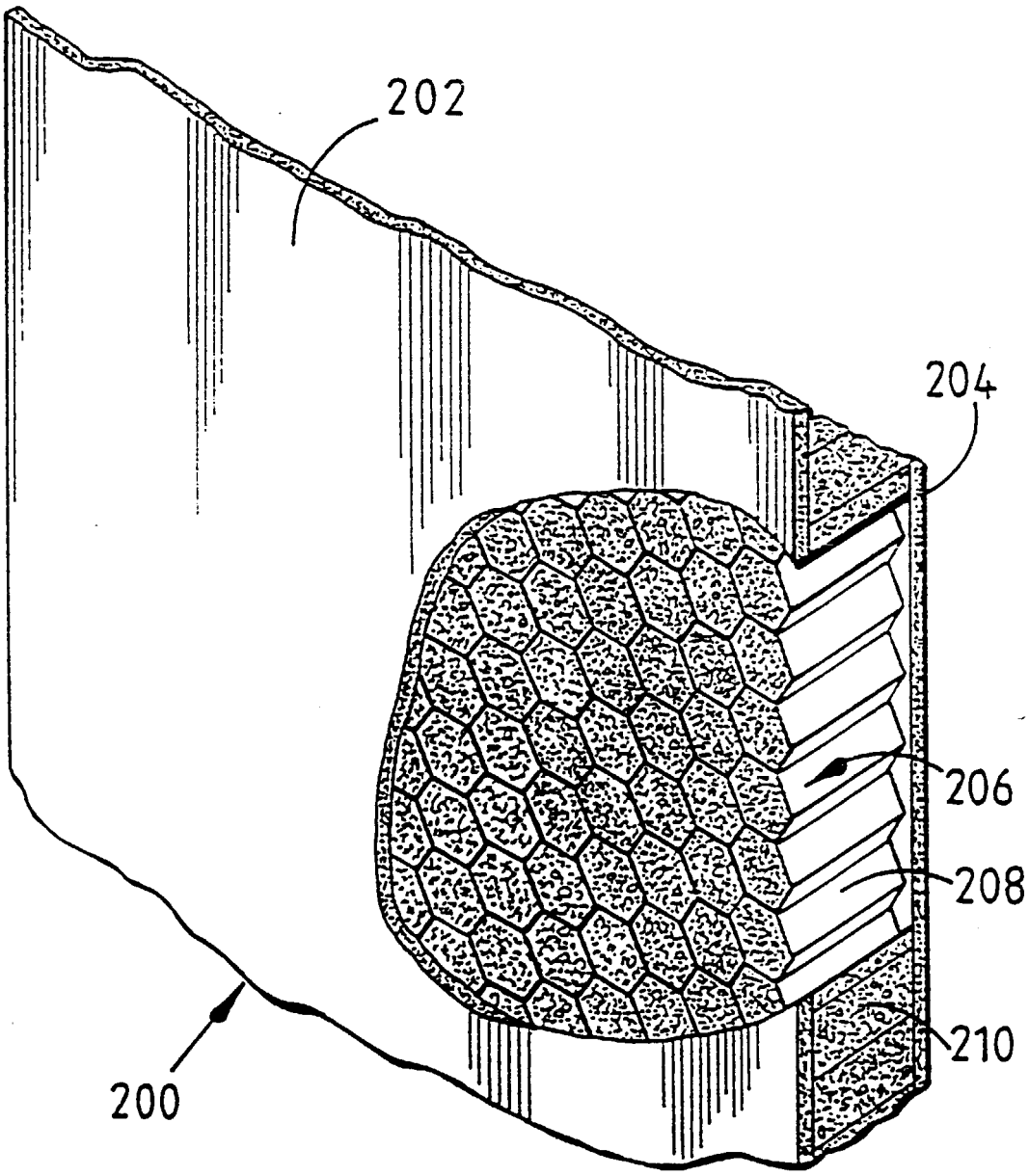

FIGURE 2