

BUILDING PANEL STRUCTURE

Many types of prefabricated panels for buildings have been developed and a particularly advantageous insulating panel is shown in U.S. Patent No. 4,241,555. An improvement in this panel, wherein thin reinforcing strips having a shallow U-shaped configuration are bonded into panel surfaces during molding of the panel, is the subject of our co-pending British Patent Application No. 2135708A.

10 According to the invention of GB-A-2135708 there is provided an insulating rectangular building panel comprising a core of expanded cellular plastics material having parallel front and back surfaces and reinforced with reinforcing strips, at least along the longitudinal and transverse edges of the panel, the reinforcing strips comprising: at least two longitudinal strips of U-shape each of which extends the full length of the panel with its side portions embedded in said core and the web connecting the side portions set within the front surface of the core so that the surface of the web remote from the bulk of the core is flush with the surface of the core; at least two further longitudinal strips of U-shape each of which extends the full length of the panel with its side portions embedded in said core and the web connecting the side portions set within the back surface of the core so that the surface of the web remote from the bulk of the core is flush with the surface of the core, the side portions of the strips on the front surface being offset from the side portions of the strips on the back surface of the core; a front transverse strip adhered to each of the two transverse edges of the front surface of the core, and a back transverse strip adhered to each of the two transverse

edges of the back surface of the core, the front transverse strips being spaced from the back transverse strips and each of the transverse strips on each surface of the panel being adhered to all of the longitudinal strips on the same surface (front or back) of the panel.

The present invention provides improvements in the foregoing type of panel, wherein surface reinforcing strips provide further capabilities extending the utility of panels formed in accordance herewith.

According to the present invention, the core of said panel has at least one indentation running along one of its edges or parallel with one pair of its edges, with at least one further reinforcing strip at the indentation and lying at least along the edges of the indentation.

The improved building strips of the present invention have reinforcing strips on surfaces thereof defining or outlining indented portions of a panel that may be employed for a variety of purposes including the placement of conduits, piping and the like or the provision of a panel hinge whereby the panel may be bent to lie in a plurality of planes. The reinforcing strips hereof may be embedded in exterior surfaces of a panel during manufacture of the panel and may have the edges thereof inclined at an acute angle to the plane of the strip to provide an additional gripping action particularly for folded or bent panels and for outlining corners of indented panel portions.

The improved panel hereof may be formed to provide one or more hinges therein whereby the panel may be folded or bent about predetermined lines or hinge axes into desired shapes such as one or more right angle corners. To this end, a reinforcing strip

of light metal may be disposed on one side of the panel along a fold line and the other side of the panel is indented in a V-shape to the center of the strip.

Assuming a required ninety degree fold or bend then the
5 angle of the V would be 90° so that the sides of the V would contact in the folded condition of the panel. Other V angles would be made equal to other fold angles.

Provision of depressions for piping, wiring
10 or the like may be accomplished with particularly formed reinforcing strips which outline a depression in an edge or corner of the panel. Thus, for example, a trough-like depression along the center of the top or bottom of a panel is provided with a thin metal liner
15 having side wings or flanges with the liner being inset so as to flush with the panel surface. As another example, a stair step reinforcing strip may be disposed in a depression along a corner edge of a panel to thus define a channel along the edge that may subsequently
20 be covered by a ceiling or floor strip in a finished building structure.

The present invention also provides integral window frames or the like in the improved panel hereof with such frames being incorporated during panel
25 formation. This materially simplifies building construction both as to time and expense.

The present invention is illustrated with respect to particular preferred embodiments thereof in the accompanying drawings wherein:

30 Figure 1 is a transverse sectional view of a building panel in accordance with the present invention;

Figure 2 is a partial top plan view of a corner of a structure formed including the panel of
35 Figure 1;

Figure 3 is a schematic top plan view of a simple three sided structure formed in accordance herewith;

5 Figure 4 is a partial perspective view of another embodiment of the present invention;

Figure 5 is a partial perspective view of yet another embodiment of the present invention;

10 Figure 6 is a partial transverse sectional view of a further embodiment of the present invention;

Figure 7 is a partial elevational view of another embodiment of the present invention; and

Figure 8 is a sectional view taken in the plane 8-8 of Figure 7.

15 The basic building panel of the present invention follows the teachings of U.S. Patent No. 4,241,555 and U.K. Patent Application No. 2135708A. Briefly, the building panel 11, illustrated in Figure 1, includes a core 12 formed of an expanded cellular material such a polystyrene or the like and having
20 outer and inner faces 14 and 16 respectively. The panel 11 is shown to have offset edges for interlocking with adjacent panels and includes reinforcing strips 17 which may be formed of a thin metal with the sides thereof turned at right angles, as illustrated in
25 Figure 1, to form shallow channels. These strips or channels 17 are disposed flush with front and back surfaces of the core 12 having the sides thereof extending into the core for maximum gripping action and improved structural rigidity, all as described in
30 co-pending U.K. Patent Application No. 2135708A. A channel 17 is disposed along each side of the front face 14 of the core and also along the vertical lateral sides of

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the inner face 16 of the core, but one channel as indicated at 18 has a side thereof extending laterally from the core to provide means for attachment of the panel to another like panel. The above-described panel
5 is formed in the manner set forth in my above-noted copending U.K. patent application and includes lateral reinforcing strips 19 extending across front and rear surfaces of the core as described therein.

The present invention provides particular
10 improvements in the insulating building panel briefly described above and referring particularly to Figure 1 it will be seen that the core 12 has a triangular indentation 21 tapering inwardly from the inner face 16 to a line at the outer face 14. The sides 22 and 23 of
15 this indentation 21 are inclined at an angle of 90° to each other in the illustrated embodiment hereof. At the apex of the triangular indentation 21 there is provided a reinforcing fold strip 24 which may, for example, be formed of a thin metal strip such as
20 aluminium or the like and which has inclined edges 26 extending into the core 12. This reinforcing and fold strip 24 extends the length of the panel from top to bottom at the apex of the triangular indentation 21 for purposes further discussed below. There are also
25 provided at the corners of the triangular indentation 21 reinforcing strips 27 and 28 inset in the core 12 at the inner face 16 thereof and along the outer portions of the faces 22 and 23 respectively of the indentation 21.

30 The improved building panel of the present invention as described above and particularly illustrated in Figure 1 of the drawings provides the capability of selectively forming an angular panel so

as to readily produce corners of structures. In this respect reference is made to Figures 2 and 3 of the drawings wherein a panel 11 is shown to be folded along a vertical line at the apex of the triangular depression 21 therein. The reinforcing strip 24 will be seen to act as a hinge about which the vertical portions of the panel on opposite sides of the center of the hinge may be folded. In the illustrated embodiment this folding is completed to place the sides 22 and 23 of the indentation 21 in contact with each other to form a 90° corner or bend in the panel, as shown in Figure 2. It will be appreciated that this is quite advantageous in forming corners of building structures or the like and provides an additional dimension of utility for the building panel of the present invention. It is also noted that an individual panel may have more than one indentation 21 and in Figure 3 there is illustrated a panel having two such indentations with the panel then being folded at each to form a U-shaped structure 31 having two corners 32 and 33. This folded panel then forms a building with three walls and an open front 34 which may be appropriately roofed and employed as a tool shed, for example. It will, of course, be appreciated that the building panels of the present invention are mounted upon a suitable base such as a concrete slab or the like and are attached thereto in any of a variety of manners.

The scope of the present invention extends to an improved building panel wherein the core thereof of expanded cellular material is provided with one or more indentations for particular purposes such as that illustrated and described above. Such indentations may

also serve other purposes and in Figure 4 there is illustrated in part a basic insulated building panel in accordance with the present invention and having an indentation 41 along the top thereof with a U-shaped reinforcing strip 42 inserted in the depression 41 along the top of the panel adjacent the center thereof. This U-shaped reinforcing strip has lateral extensions 43 and 44 along the top thereof which are inset into the surface of the panel at the top, as indicated, and which also may have downturned edges if desired in the manner of other reinforcing strips of the panel. In the illustration of Figure 4 no attempt is made to illustrate all of the reinforcing strips of the panel; however, same are included in a complete panel. The depression 41 along the top of the panel of Figure 4 is provided to carry or contain various conduits that a be included in a complete building structure. Thus, for example, electrical conduit may be located in this depression or piping for water and the like may be disposed therein and it will further be appreciated that this depression may alternatively be disposed at the bottom surface of the panel instead of the top should it be desired to dispose wiring or the like at such location.

As noted above the indentation of the core of the building panel hereof may be formed in a variety of configurations and locations and in Figure 5 there is illustrated yet another embodiment thereof wherein an indentation 51 is provided as a corner cut-out along the top edge of the panel at the inner face 16 thereof. This indentation 51 is shown to be rectangular in cross-section and a stair step reinforcing strip 52 is shown to be inserted therein and having portions 53 and

54 extending to the top and inner face of the panel in flush relationship thereto. The strip 52 extends across the panel to define or outline the depression 51 which may be employed to contain various conduits, wires, or the like that can be incorporated in a complete structure employing the panels of the present invention. It will be appreciated that the inner face of the panel is adapted to be covered with a facing as further discussed below so that the open inner side of the depression 51 will then be covered in the completed structure. Again, in this instance, no attempt is made to illustrate all of the reinforcing strips of a complete panel; however, it is to be understood that both horizontal and vertical reinforcing strips on both inner and outer faces of the panel are to be included to attain the structural strength of the panel discussed above.

In addition to horizontal indentations such as illustrated in Figures 4 and 5, there may be provided vertical indentations for the purpose of carrying wires, conduits and the like and in this respect reference is made to Figure 6. A vertical rectangular indentation 61 is shown in Figure 6 to be lined with a U-shaped reinforcing strip 62 having lateral outward extensions 63 and 64 at the open side thereof disposed flush with the inner face 16 of the panel. These lateral extensions 63 and 64 may have inwardly turned edges, as illustrated, to additionally lock the strip in the core and to provide additional structural strength for column loading of the core. Also in Figure 6 there is shown a conduit 66 disposed in the indentation 61 and carrying insulated electrical wires 67, for example. As noted above, a completed structure

incorporating the panels of the present invention may preferably include a facing upon the inner surface of the panel and in Figure 6 there is illustrated a thin sheet 68 which may be attached to the inner face 16 as
5 by nails 69 driven through the sheet and reinforcing strips of the panel into the core thereof. This facing sheet 68 may be formed of a variety of materials such as very thin wood panelling, as illustrated, which serves not only the purpose of finishing the interior
10 of the structure, but also of enclosing the opening formed by the indentation 61 in the inner face of the panel. It will also be appreciated that the reinforcing strip 62 may take the place of one of the vertical reinforcing strips of the building panel.

15 It is also possible in accordance herewith to mold conduits directly in the core of the panel in any desired direction so that wires or the like may be extended therethrough during fabrication of structures therefrom.

20 Panels according to the present invention may also include an indentation entirely through the panel for defining an opening that may be employed for a variety of purposes such as the insertion of a window and windowframe. Referring to Figures 7 and 8 there
25 will be seen to be shown in part a building panel 11 in accordance with the present invention and including an expanded cellular core 12 having thin reinforcing strips 17 disposed in opposite faces 14 and 16 thereof and including an opening 71 extending therethrough.
30 This opening 71 is illustrated to have a rectangular configuration and to be bounded by a reinforcing strip 72 having a shallow, U-shaped configuration with the sides thereof being disposed in

the core in flush relationship to the faces 14 and 16 thereof. Reinforcing strip 72 about the opening 71 provides a boundary surface for receiving and attachment of a window frame which is dimensioned to fit snugly in the opening against the reinforcing strip thereabout. It will be appreciated that the core 12 of the building panel hereof does not in itself provide substantial structural strength but instead provides the insulating property thereof and a support for the reinforcing strips so that together the core and strips provide the requisite structural strength to receive materials applied to the inner and outer faces of the panel completing a building structure. Materials applied to the faces of the building panel hereof may widely vary and it is common for the exterior to be covered with concrete or with panels and the interior to be covered with plaster or sheet material such as plasterboard or thin plywood. The opening structure illustrated in Figures 7 and 8 and briefly described above, provides the requisite physical strength for supporting a windowframe in a building panel in accordance with the present invention and materially simplifies the fabrication of a building from the panels hereof. It is also noted that the panels of this invention are formed in a mold, as described in my above-noted co-pending patent and patent application and the opening 71 provided hereby may be quite readily formed by placing the unitary reinforcing strip 72 in appropriate position in the mold and blowing the plastic material into the volume thereabout in the mold whereat same is expanded as by steam to complete the core about the opening. In this respect reference is made to U.S. Patent Specification No. 4,284,447.

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The reinforcing strips or channels 17 are similarly disposed in the mold prior to expansion of the cellular material therein and a suitable adhesive system is also employed to bond all reinforcing strips
5 to the core. It will, furthermore, be appreciated that the exterior surfaces of the reinforcing strips are flush with the exterior surfaces of the core in accordance with the method of manufacturing noted above.



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CLAIMS

1. An insulating rectangular building panel comprising a core of expanded cellular plastics material having parallel front and back surfaces and reinforced with reinforcing strips, at least along the longitudinal and transverse edges of the panel, the reinforcing strips comprising: at least two longitudinal strips of U-shape each of which extends the full length of the panel with its side portions embedded in said core and the web connecting the side portions set within the front surface of the core so that the surface of the web remote from the bulk of the core is flush with the surface of the core; at least two further longitudinal strips of U-shape each of which extends the full length of the panel with its side portions embedded in said core and the web connecting the side portions set within the back surface of the core so that the surface of the web remote from the bulk of the core is flush with the surface of the core, the side portions of the strips on the front surface being offset from the side portions of the strips on the back surface of the core; a front transverse strip adhered to each of the two transverse edges of the front surface of the core, and a back transverse strip adhered to each of the two transverse edges of the back surface of the core, the front transverse strips being spaced from the back transverse strips and each of the transverse strips on each surface of the panel being adhered to all of the longitudinal strips on the same surface (front or back) of the panel, and said core having at least one indentation running along one of its edges or parallel

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with one pair of its edges, with at least one further reinforcing strip at the indentation and lying at least along the edges of the indentation.

- 5 2. A panel as claimed in claim 1 wherein the indentation has sides inclined with respect to each other and intersecting in an apex line which lies substantially within the plane of the front or back surface of said panel and said further reinforcing strip includes one at the bottom of said indentation, which includes said apex line and is formed of a bendable material whereby said panel may be folded along said apex line.
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- 15 3. A panel as claimed in claim 2 wherein the longitudinal edges of said further reinforcing strip are inclined inwardly relative to the core of said panel.
- 20 4. A panel as claimed in claim 2 or 3 including an additional reinforcing strip disposed along each of the two intersections of a side of said indentation and the surface of said panel opposite to the surface which includes said apex line.
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5. A panel as claimed in claim 2,3 or 4 in which the sides of said indentation lie at 90° to each other and at equal angles to the surfaces of said panel whereby folding of said panel to contact the sides of said indentation forms a panel with a 90° corner.
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6. A panel as claimed in any one of the preceding claims wherein said indentation comprises at least one core depression having a generally rectangular cross-section and extending into said core a distance substantially less than the thickness of said core, said further reinforcing strip covering substantially all surfaces of said depression with edges extending flush with the panel surface into which said extension extends.
7. A panel as claimed in claim 6 wherein said depression extends into a transverse edge of said panel along the middle thereof between the edges of the surfaces of the said panel to define a trough for disposition of conduits therein.
8. A panel as claimed in claim 6 wherein said depression extends along a transverse edge of one of the surfaces of the panel, to define a space for placement of conduits or the like to run across the width of the panel.
9. A panel as claimed in claim 8 and including a rigid cover sheet attached to a surface of said panel to overlie said depression.
10. A panel as claimed in any one of claims 6 to 9 wherein the at least one core depression comprises a depression which extends across one surface of said panel parallel with one of its pairs of parallel edges, the panel including a cover sheet attached to said surface for covering said depression and any conduits or the like disposed therein.



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11. A panel as claimed in any one of the preceding claims and including an opening between said front and back surfaces for receiving a window frame or the like, the panel edges at the periphery of the opening being indented and reinforced with said reinforcing strips.

12. A building panel substantially as hereinbefore described, and as shown in Figures 1 to 3, Figures 4,5,6 or 7 and 8 of the accompanying drawings.
