FORM 1

REGULATION 9

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A PATENT

We, RADVA PLASTICS CORPORATION

of 604 Seventeenth Street, RADFORD, VIRGINIA 24141

U.S.A.

hereby apply for the grant of a Patent for an invention

entitled:

INSULATING PANEL AND BUILDING STRUCTURE

which is described in the accompanying Complete Specification

Our address for service is:

SHELSTON WATERS

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SYDNEY NSW 2000

Dated this 29th day of June, 1984

RADVA PLASTICS CORPORATION

by Robert J. Shelton

Fellow Institute of Patent Attorneys of Australia

SHELSTON WATERS

To: The Commissioner of Patents

WODEN ACT 2666

FILE: 10 DI

FEE: $88.00

BACKGROUND OF INVENTION

Many types of prefabricated panels have been developed
FORM 7—REGULATION 12 (1)
COMMONWEALTH OF AUSTRALIA
PATENTS ACT, 1952-1973
DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT.

In support of the Application made by

RADIA PLASTICS CORPORATION

(hereinafter referred to as "Applicant") for a patent for an invention entitled:

"INSULATING PANEL AND BUILDING STRUCTURE"

1. LUTHER I. DICKENS, President
   604 Seventeenth Street
   Radford, VA 24141, U.S.A.

do solemnly and sincerely declare as follows:

1. I am authorised by Applicant to make this declaration on its behalf.

2. LUTHER I. DICKENS
   310 3rd Street
   Radford, VA 24141, U.S.A.
   is/are the actual inventor(s) of the invention and the facts upon which Applicant is entitled to make the Application are as follows:
   Applicant is the Assignee of the said Inventor(s).

Declared at                    Radford, Virginia, U.S.A.
this  Third  day of    July    1984

To THE COMMISSIONER OF PATENTS.

SHELSTON WATERS
PATENT ATTORNEYS
55 CLARENCE STREET, SYDNEY
AUSTRALIA

SUMMARY OF INVENTION

The insulating building panel of the present invention is formed as a four sided sheet that may be planar or curved in
An insulating building panel comprising:

- a core of expanded cellular plastic having parallel front and back surfaces,
- a first plurality of thin reinforcing strips having a U-shape with short side portions, embedded longitudinally in said core in offset relation in said front and back surfaces with a web and side portions extending into said core; and
- a second plurality of thin reinforcing strips adhered to said core in spaced relation laterally across the front and back surfaces of said core over said first plurality of strips.

The building structure formed with panels of the present invention is adapted to be coated or covered on both sides, and the exterior of the building may, for example, be coated with concrete. In order to provide a means for the
The building panel of the present invention may be employed in a variety of different ways for varying applications. Thus, for example, the panel hereof may be prefinished for use in permanent, panelized constructed housing or for relocatable...
Many types of prefabricated panels have been developed for a wide variety of building applications and one particularly advantageous development in the field is described in U. S. Patent Application Serial No. 659,758 entitled "Composite Panel Structure and Method of Manufacture" and U.S. Patent Application Serial No. 40,192 describing a method of manufacturing a composite building panel. A system of constructing buildings with the foregoing panels is described in U. S. Patent No. 4,094,110. Reference is made to the foregoing patent and patent applications for relevant prior art in this field.

The present invention comprises an improvement in the inventions of the above-noted patent and patent applications and as such provides further significant advancements in the field of insulating building panels and methods of manufacture thereof.
SUMMARY OF INVENTION

The insulating building panel of the present invention is formed as a four sided sheet that may be planar or curved in one or two directions. The panel is formed of expanded plastic so as to have a cellular structure and thin reinforcing strips of particular configuration are formed of metal or plastic and bonded to the opposite faces of the expanded plastic at least along the edges thereof. For ease of description the expanded plastic portion of the panel is herein termed a "core" although in fact, such portion forms the major element of the panel and need not be encased in a cover or shell.

The expanded plastic panel core has offset or stepped edges with two adjacent edges being complimentary to the other two edges of the four sided panel. The core is formed in a mold wherein beads of material such as polystyrene are heated, as by steam, to expand and join together into a cellular structure having closed cells. Reinforcing strips of thin metal, for example, are formed as shallow channels, i.e., with turned edges, and are bonded to opposite faces of the core during core formation. The strips are disposed longitudinally of the core with the turned edges of the strips facing inwardly of the mold so that they are embedded in the core. The strips are offset on opposite faces of the panel and the depth of the strip edges is only a small fraction of the core thickness so that no high conductivity heat path exists through the panel. The reinforcing strips have a substantial rigidity against bending because of the shallow channel configuration thereof and thus are readily handled and positioned for bonding with the cellular core.

The claims defining the invention are:...
There are additionally provided thin reinforcing strips having an L-shaped configuration, i.e., a shallow channel with one side removed. These strips are bonded to panel edges and may have a width equal to the width of a channel strip plus a channel depth. One flat reinforcing strip per panel is also employed and by a particular arrangement of strips on the front and back surfaces of the panel with strips overhanging two adjacent panel edges, a lightweight structural insulating panel is formed which is adapted for connection as by sheet metal screws to contiguous abutting panels to form a building structure.

The exterior of the structure formed of the panels hereof is adapted to be coated with concrete or the like to provide the requisite final structural strength and rigidity and rebar may be incorporated in this portion of the structure if additional strength is required. The back or inner face of the walls or the like formed of the insulating building panels hereof may be finished in a variety of ways. Thus, for example, the inner surface may be plastered and/or various types of sheet-like material such as wood or composite veneer or the like bonded thereto.

4. The panel of Claim 1 further defined by at least two opposite edges thereof being complementarily offset wherein one of said edges has an extending ridge along the length
The present invention is illustrated with respect to a preferred embodiment thereof in the accompanying drawings, wherein:

Figure 1 is a front elevational view of a panel in accordance with the present invention;

Figure 2 is a side elevational view of the panel of Figure 1;

Figure 3 is a rear elevational view of the panel of Figure 1;

Figure 4 is an enlarged broken transverse sectional view taken in the plane 4-4 of Figure 1;

Figures 5, 6 and 7 are partial sectional views taken in the planes 5-5, 6-6 and 7-7 of Figure 1, respectively;

Figure 8 is a broken transverse sectional view taken in the plane 8-8 of Figure 1;

Figure 9 is a partial transverse central sectional view of the panel of Figure 1 attached to like laterally contiguous abutting panels;
Figure 10 is a partial central vertical sectional view of the panel of Figure 1 attached to like contiguous abutting panels above and below same; and

Figure 11 is a partial sectional view showing the mounting of wire mesh on panels hereof for application of concrete or the like.
through 7 comprises a reinforced insulating panel 11 having a "core" 12 of cellular expanded plastic having reinforcing strips 13 in a particular arrangement, as described below. The shape of the core determines the shape of the panel and, while variations therein are possible, the illustrated core has parallel planar front and rear surfaces 14 and 16, respectively, with parallel side edges 17 and 18 and parallel top and bottom edges 21 and 22. The core 12 and thus the panel 11 is herein illustrated and described with respect to a flat or planar configuration; however, it is noted that the panel may be curved either longitudinally, laterally, or both. Similarly, the dimensions of the core and thus the panel may be varied according to the application; however, panels of substantial size are contemplated by the present invention. Thus, for example, a building panel may have a length of about 9 feet and a width of about 3 feet or so, with a thickness of 3 to 4 inches.

The core 12 of the present invention is formed of a lightweight expanded plastic to have good insulating properties and at least limited structural rigidity so that the core is in fact substantially rigid. The core may be formed of a variety of materials such as expanded polystyrene, polyethylene or polyurethane having an appropriate density to provide good thermal insulation and structural strength. As an example, the core may be formed of expanded polystyrene having a density of the order of 1 lb. per cubic foot to 6 lbs. per cubic foot, and advantageous tested prototypes have been formed with a density of 2 lbs. per cubic foot. Preferably the expanded plastic is formed as a closed cell structure to maximize the thermal insulating properties thereof.
Considering further the physical configuration of the core 12 of the panel 11, same is formed with offset or stepped side edges 17 and 18, as illustrated in Figure 4. More particularly, the side edge 17 is formed with a longitudinally extending lateral rib or projection 26 which, in the illustrated embodiment, has a rectangular cross-section to form a square shoulder with the remaining surface of the side edge 17. This projection or rib 26 is disposed on the side edge 17 adjacent the front face 14 of the core. The other side edge 18 of the core has a longitudinally extending lateral indentation 27 with the same dimensions as the projection 26 and also disposed adjacent the front face 14 of the core. It will thus be seen that the projecting rib 26 is adapted to fit into and mate with an indentation such as the indentation 27 on an identical panel abutting the panel illustrated in Figure 4. This is further described and discussed below.

The top and bottom edges 21 and 22 of the core are formed similar to the side edges in that an upward projection 28 extends across the front of the top edge 21, and a mating indentation 29 extends across the front of the bottom edge 22. It will be seen that the top and bottom edges of the core have vertical shoulders adapted to but together on contiguous like panels.
The panel of the present invention includes, in addition to the core described above, a plurality of reinforcing strips 13 which are particularly located and configured to complete the panel as a structural element having very good heat insulating properties. These reinforcing strips may be formed of various materials such as a light gauge steel (as low as 29 gauge). Referring first to Figure 4 of the drawings, there will be seen to be provided at least first and second light reinforcing strips 31 and 32, with each being formed as a shallow channel of thin metal, plastic or the like. The strip 31, for example, is formed with a thin, central elongated web 33 with the lateral edges 34 turned or bent at 90° to the web 33 to form the shallow channel configuration, again as illustrated in Figure 4. The channel 31 is disposed at the corner of the back surface 16 and side edge 17 with the web lying in the plane of the back surface 16, one side 34 embedded in the panel at surface 16, and the other strip side 34 lying in the inset plane of the side edge 17, as illustrated. The strip 31 is inset into the core 12, as shown, and this may be accomplished as described below, but preferably including an adhesive bonding to the core. The reinforcing strip 32 is disposed in like manner at the opposite corner of the back surface 16 with a side edge 18. An additional like channel 36 is shown to be disposed in inset relation to the back surface 16 of the core and extending longitudinally thereof along the center of the core.
A further reinforcing strip which may be identical to the strip 31 is disposed along the corner of the front surface 14 and side edge 18 of the core in inset relation thereto in the same manner as the strip 32 is disposed on the rear surface. An additional like channel shaped reinforcing strip 42 is disposed longitudinally of the front surface 14 of the core in extension longitudinally thereof at the center of this front surface. This central longitudinal strip 42 is also inset in the front surface of the core with the sides thereof extending perpendicularly into the core itself. At the corner of the front surface 14 and edge 17 of the core there is provided another reinforcing strip 43 which is inset in the front surface 14, but which has only one edge 44 turned at 90° to extend into the core and which is located to provide the other side of the strip an extension laterally outward beyond the rib 26 of the side edge 17. The width of the strip 43 may be equal to the width of the strip 42 plus one side thereof so that the strip 43 may be formed from the same stock as the other strips. The distance that the strip 43 extends from the lateral edges 17 of the front face 14 may be equal to the depth of the rib or projection 26 from the remainder of the side edge 17, for example, and in one structure of the present invention these dimensions may be one inch. All of the vertical reinforcing strips described above are inset in the core with the back or the webs or the like thereof aligned with the core surfaces and the turned edges directed inwardly of the core, as shown in Figure 4. The turned edges of the reinforcing strips have a depth substantially less than the thickness of the core so that under no circumstances can the reinforcing strip on one side of the core touch or engage the reinforcing strip on the other side and it will be noted that the strips on the front and back surfaces are offset so that the strip edges are not aligned.
The foregoing is particularly important in the attainment of the high insulating properties of the present invention for any metal path through the core would provide a heat path therethrough to materially decrease the heat insulating properties of the panel. It is also noted that all of the vertical reinforcing strips are coextensive with the length of the core surface upon which they are disposed.

The present invention also provides lateral reinforcing strips, at least along the top 21 and bottom 22 of the panel. These strips are illustrated in Figures 5 and 6 and it will be seen therefrom that two different strip configurations are employed. A first flat planar strip 51 extends across the top of the surface 14 in extension above the rib or projection 28 along the top edge 21 of the panel. This strip 51 overlies the embedded vertical strips 41, 42 and 43 and engages the front surface 14 of the core therebetween. The strip 51 is adhered to the core and ends of the strips 41, 42 and 43 by a suitable bonding agent. At the top of the back surface 16 there is provided a reinforcing strip 52 which may be identical to the vertical strip 43 described above, except as to the length thereof. This strip 52 is disposed against the rear surface 16 at the top thereof with the turned edge of the strip abutting the top edge 21 of the core and this strip is adhered to the core and the ends of the vertical reinforcing strips 31, 32 and 36, which it overlies, by a suitable bonding agent.
The attainment of the patent there-
forging properties
vertical
the core
lateral reinforcing strip 2 of the panel.
5 and it will be
3 across the top
projection 28
strip 51 overlies the
ages the front
strip 51 is adhered
3 by a suitable
16 there is
identical to the
side the length
rear surface 16
strip abutting
adhered to the
strips 31, 32 and
ent.

The panel of the present invention, as described
above and illustrated in Figures 1 through 8 is adapted to be
joined together with like panels to form a building structure.
Thus, for example, panels may be joined together to form a wall
of a building or a roof of a building. There is illustrated in
Figure 9 a panel 11, shown in lateral cross-section, and abut-
ting and joined to like panels 11a and 11b, also shown in cross-
section. It will be seen that the side edge projection or rib
26 of panel 11 fits into the mating side edge indentation 27a
of panel 11a with the reinforcing strip 43 of panel 11 overlying
the reinforcing strips 41a of panel 11a. Similarly, the side
edge projection or rib 26b of panel 11b fits into the side edge
races 27 of panel 11 with the reinforcing strip 43b of panel .
11b overlying the reinforcing strip 41 of panel 11. The panels
are joined together by sheet metal screws 61 driven through
the overlying reinforcing strips 43-41a and 43b-41, as
illustrated. It will be seen that a plurality of panels joined
together, as shown, will in fact form a structural wall and
such wall is adapted to be further operated upon, as described
below.

Similar connections of panels may also be made in the
vertical direction, as illustrated in Figure 10 wherein a
panel 11 is shown to be abutted at the top by a panel 11c and
at the bottom by a panel 11b. It will be seen that the top
dge projection 28 of panel 11 fits into the bottom edge
indentation 29c of panel 11c, with the upper cross reinforcing
strip 51 of panel 11 overlying the bottom cross reinforcing
strip 53c of panel 11c. Sheet metal screws 61 are extended
through these overlapping reinforcing strips and into the core
to lock the panels together. A similar arrangement is provided
at the bottom of panel 11 and top of panel 11b, as illustrated.
The channel shaped reinforcing strips of the present invention are particularly advantageous, not only in the resultant structure of the panel hereof, but also in the manufacture thereof. It will be appreciated that the turned edge or edges of a reinforcing strip provide the strip with the capability of resisting bending. This then materially improves the longitudinal compression strength of the strip and also facilitates handling of same during manufacture of the panel.

The panel of the present invention is formed in a mold wherein the reinforcing strips are first positioned and then the mold is closed and filled with polystyrofoam pellets, for example. The addition of heat, as by directing steam into the mold, causes the pellets to expand and bond together into a closed cellular structure. Preferably an adhesive is applied to the inner surfaces of the reinforcing strips when they are inserted in the mold and the application of heat to expand the plastic core will cause this adhesive to become operable so that the strips are not only embedded in the core, but are also adhered thereto. The strips are thus permanently bonded to the core and the turned edges of the channel reinforcing strips extend into the core itself to improve the bonding and also to materially strengthen the resultant panel.
The building structure formed with panels of the present invention is adapted to be coated or covered on both sides, and the exterior of the building may, for example, be coated with concrete. In order to provide a means for the concrete to be retained against the front face of a panel, for example, there may be provided a wire mesh 71, as illustrated in Figure 11, which is mounted in spaced relation to the front face 14 of the panel by spacer blocks 72. A sheet metal screw 73 with a washer 74 under the head thereof extends through the spacer block 72 and is threaded through a panel reinforcing strip 42, for example, with the wire mesh being held under the washer 74. The wire mesh 71 extends over or across a plurality of panels 11 and mesh edges may be woven together to provide a continuous mesh covering that becomes embedded in a concrete shell forming the exterior of the building structure. The building structure is adapted to receive a coating of concrete which may, for example, be applied through a nozzle or by hand and which encompasses the wire mesh as a continuous shell. The inner surface or rear surface of the panel 11 is adapted to be covered, possibly by plaster, or as illustrated in Figure 11, by a thin wood or composite veneer 76 which may be adhered to the panel by suitable adhesive or bonding agent. The resultant building structure has extremely good heat insulating properties as well as being structurally sound and relatively easily and quickly erected and completed. Wiring and piping may be placed in the walls formed by panels of the present invention; however, it is noted that no metal connections extend through the wall to provide paths for heat transfer.
housing. Thin set brick, stucco, or wood panelling can be applied to the exterior side and the interior surface may be covered with plaster, dry wall, or panelling. Such panels are commonly used on monolithic poured concrete slabs on block foundations. The panels are positioned and connected by the application of self-tapping sheet metal screws and the joints are then covered by feature strips. It will be appreciated that relocatable housing or the like formed in the manner identified above is very lightweight, aside from the foundation or concrete slab, so that an entire unit can be airlifted, if necessary.

The present invention has been described above with respect to particular preferred embodiments thereof; however, it will be apparent to those skilled in the art that numerous modifications and variations are possible within the scope of the present invention and thus it is not intended to limit the invention to the precise terms of description or details of illustration.
Claim 1: Relocatable building panels are provided for use in building applications. Substantial savings in both labor and time can be achieved by the use of such panels which are delivered on blocks, with joints cut and prepped by the builder. The joints are then filled in the manner of panels on site. Such panels are ideal for gable-end additions to existing buildings; however, it is appreciated that numerous claims are made in the scope of this patent application to limit the details of...
The claims defining the invention are:

1. An insulating building panel comprising
   a core of expanded cellular plastic having parallel
   front and back surfaces,
   a first plurality of thin reinforcing strips having
   a U-shape with short side portions, embedded longitudinally in
   said core in offset relation in said front and back surfaces
   with a web and side portions extending into said core; and
   a second plurality of thin reinforcing strips
   adhered to said core in spaced relation laterally across the
   front and back surfaces of said core over said first plurality
   of strips.

2. The panel of Claim 1 further defined by
   said core having four edges,
   said first plurality of strips including one
   strip having a longitudinal side portion extending outwardly in
   alignment with the web from a first edge of said core, and
   said second plurality of strips having one strip
   extending from a second edge of said core along the length of
   the strip.

3. The panel of Claim 2 further defined by the strips
   of said first and second pluralities of strips extending from
   adjacent edges of said core.
4. The panel of Claim 1 further defined by at least two opposite edges thereof being complementarily offset wherein one of said edges has an extending ridge along the length thereof at one of said surfaces and the opposite edge has a like extending ridge along the length thereof at the other of said surfaces for mating of two or more of said panels along said opposite edges with reinforcing strips of contiguous panels overlapping for joinder.

5. The panel of Claim 4 further defined by two more opposite edges of said panel being formed in like manner to those of Claim 4 for overlapping of reinforcing strips in orthogonal relation to said two opposite edges.

6. The panel of Claim 1 further defined by a first surface of said panel being adapted to mount a wire mesh extending over a plurality of like panels by standoff blocks and sheet metal screws extending through the wire mesh and block and reinforcing strips for supporting a coating such as concrete.

7. The panel of Claim 1 further defined by one surface of said panel having adhered thereto a protective and decorative covering such as a layer of wood.

8. A combination of panels of Claim 1 wherein reinforcing strips of two adjacent edges of each panel extend outwardly along the edge length to overlie reinforcing strips of contiguous panels and sheet metal screws extend through overlying reinforcing strips to join said combination together.

Dated this the 29th day of June, 1984

RADVA-PLASTICS CORPORATION

Attorney: ROBERT G. SHELSTON

Fellow Institute of Patent Attorneys of Australia
DRAWINGS
formed as a closed cell structure to maximize the thermal insulating properties thereof.