April 4, 1967 J. R. WILLIAMS 3,312,033

HOLLOW PANEL

Filed May 25, 1964 3 Sheets-Sheet 1

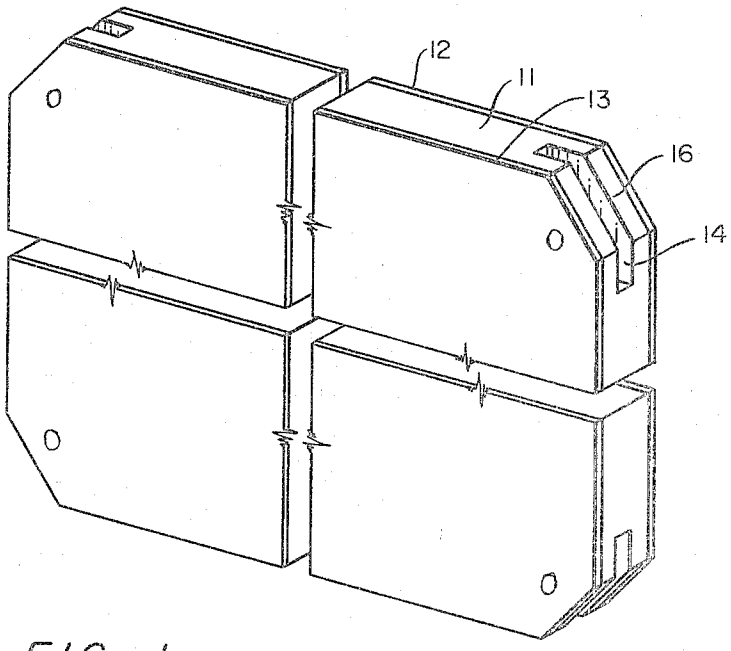


FIG. 1

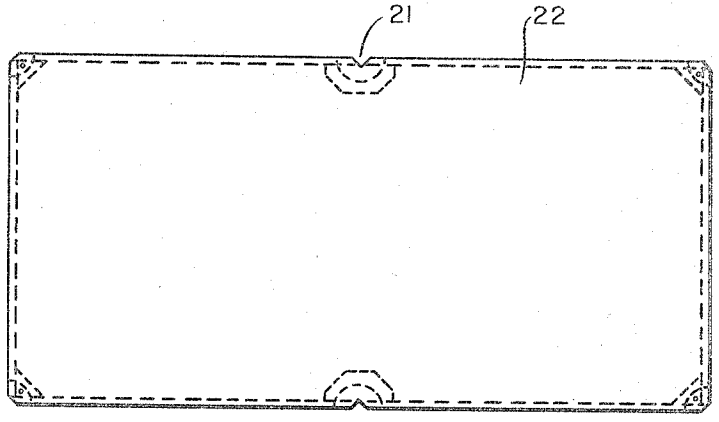


FIG. 2

INVENTOR.
JOHN R. WILLIAMS
BY
Fleit and Swain
ATTORNEYS

April 4, 1967 J. R. WILLIAMS 3,312,033

HOLLOW PANEL

Filed May 25, 1964 3 Sheets-Sheet 2

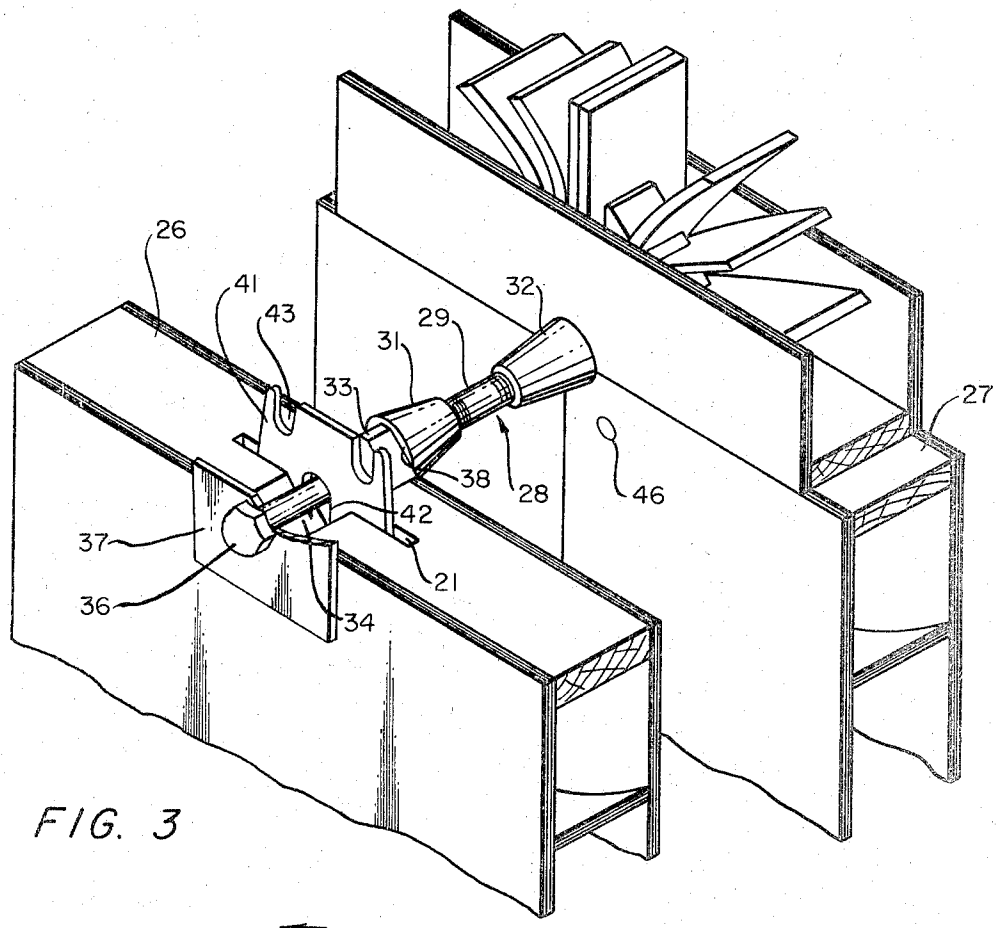


FIG. 3

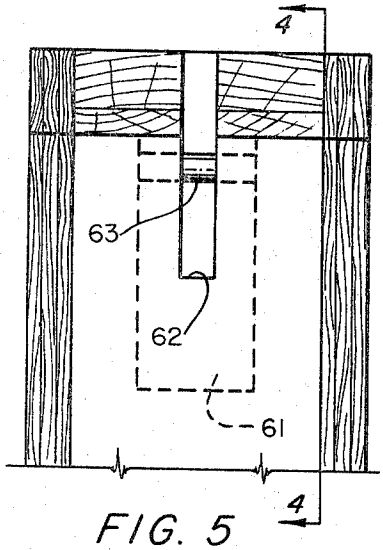


FIG. 5

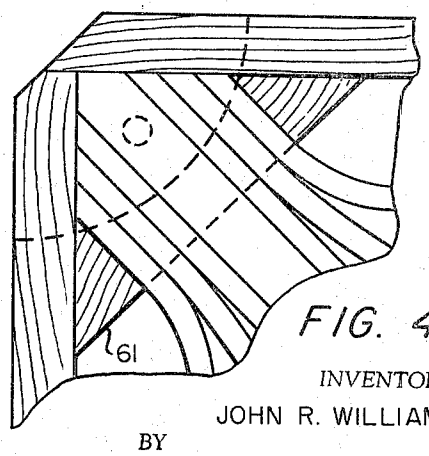


FIG. 4

INVENTOR.
JOHN R. WILLIAMS
BY
Fleht and Swain
ATTORNEYS

April 4, 1967 J. R. WILLIAMS 3,312,033

HOLLOW PANEL

Filed May 25, 1964 3 Sheets-Sheet 3

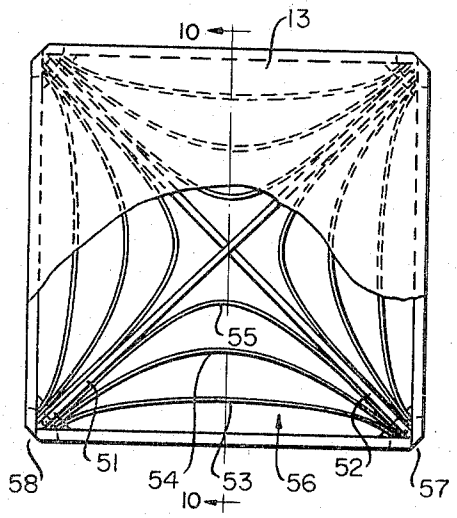


FIG. 6

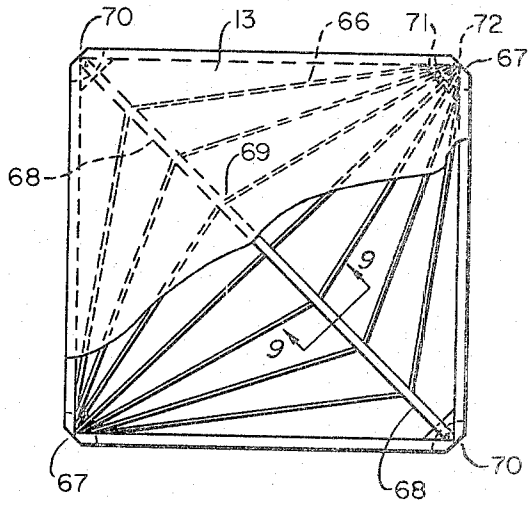


FIG. 7

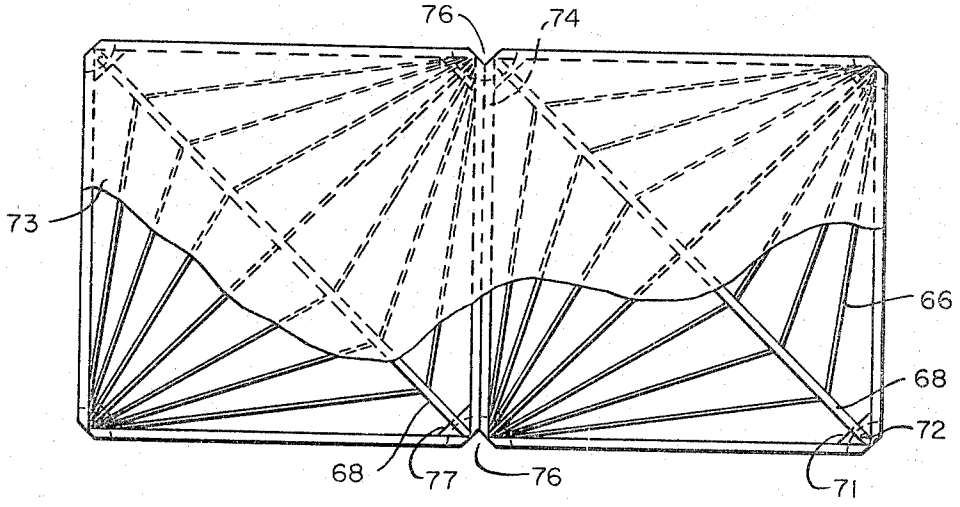


FIG. 8

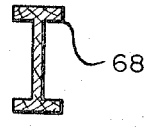


FIG. 9

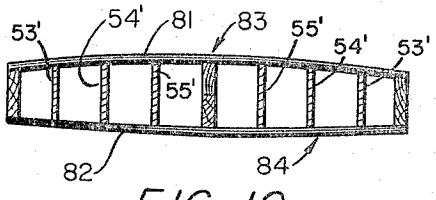


FIG. 10

INVENTOR.
JOHN R. WILLIAMS
BY
Fleht and Swain
ATTORNEYS

United States Patent Office 3,312,033 Patented Apr. 4, 1967

3,312,033

HOLLOW PANEL

John R. Williams, Hayward, Calif., assignor to Utah Construction & Mining Co., San Francisco, Calif., a corporation of Delaware

Filed May 25, 1964, Ser. No. 369,888
11 Claims. (Cl. 52—615)

This invention relates generally to hollow panels and more particularly to hollow panels suitable for use as floor and wall members in modular, prefabricated or other types of buildings, for concrete forms, and for other applications in which lightweight, inexpensive panel units are required. The invention relates more particularly to high strength panels which are adapted to be supported at spaced points such as at the corners.

Hollow panels including a rectangular frame provided with spaced front and back walls or faces, often referred to as skins, and a core are known and are in general use. The cores have been of honeycomb construction, foam plastic or braced construction.

The forces applied to the faces of this type of panel are, in general, distributed equally along the edges or frame of the panel. The panels are generally supported along their entire edges whereby the distributed forces are accommodated.

In my copending application Ser., No. 315,172, filed Oct. 10, 1963, now Patent Number 3,168,772, there is described a concrete form system employing panels secured to one another in edgewise abutting relationship and including tie assemblies which extend through the spaced walls to engage vertical studs placed outside of the walls.

It is an object of the present invention to provide a panel in which the forces applied to the face of the panel are concentrated at predetermined points on the panel, for example, at the corners of a square panel and the corners and intermediate points along the long edge of a rectangular panel. This makes it possible to support the panel solely at these support points. For example, in concrete forming systems, the vertical studs may be eliminated by the use of such panels.

It is a general object of the present invention to provide an improved panel structure.

It is another object of the present invention to provide a panel in which the forces applied to the faces are concentrated at support points.

It is another object of the present invention to provide an inexpensive and simple panel.

It is still a further object of the present invention to provide a panel which is strong and light.

These and other objects of the invention will become more clearly apparent from the following description taken in conjunction with the accompanying drawing.

Referring to the drawing:

FIGURE 1 is a perspective view of a panel adapted for concrete construction with portions broken away to more clearly show the corners;

FIGURE 2 is a front elevational view of a rectangular panel for concrete construction;

FIGURE 3 shows schematically how the panels of the invention are employed in a concrete forming system;

FIGURE 4 is an enlarged view of a corner of a panel taken along the line 4—4 of FIGURE 5;

FIGURE 5 is an enlarged edge views of a corner of the panel;

FIGURE 6 shows the internal construction of a typical panel;

FIGURE 7 shows another internal construction for a panel;

FIGURE 8 shows an elongated rectangular panel including a slot at the center of the long edges;

FIGURE 9 is a sectional view taken along the line 9—9 of FIGURE 7;

FIGURE 10 is an elevational view taken on section lines 10—10 of FIGURE 6 with modified ribs and showing a panel having cambered faces.

Referring to FIGURE 1, the panel is illustrated as being broken away at the center portions whereby the corners thereof are shown in better detail. The panel includes a generally rectangular frame 11 provided with spaced walls or skins 12 and 13 secured thereto as, for example, by gluing, to define the hollow panel. Each of the corners of the panel includes slots 14, to be presently described in detail. The corners of the panels are bevelled 16 to define with adjacent panels a recess or for the reception of support means, for example, a tie rod assembly, when panels of this type are used in concrete forming construction. It is to be understood that when the panels are used in conventional construction wherein there is no requirement for the support means to extend through the panels, the corners may be square whereby there is no recess defined when adjoining panels are abutted to one another.

In FIGURE 2, a panel similar to that of FIGURE 1 is shown. However, the panel is seen to be rectangular with a locking slot 21 formed along the broad sides of the panel 22.

FIGURE 3 illustrates the use of panels of this type in a concrete form system. The form system illustrated includes spaced walls 26 and 27 between which the concrete is poured. The walls are formed by panels which are maintained in spaced relationship with respect to one another by a tie rod assembly designated generally by the reference numeral 28. The assembly includes a tie 29 which threadably receives at opposite ends cones 31 and 32. The ends of the cones are provided with square shanks 33 which are accommodated within the recess formed between adjacent and cooperating panels, for example, the recess 34. The large end of the cones each threadably receives an extension bolt 36 which extends through a plate 37. When the enlarged round end of the cone is larger than the square shank, tightening of the bolt serves to clamp the panel against the large end of the adjacent cone. Referring to the figure, tightening of the bolt 36 brings the face of the panel 26 against the large end 38 of the cone 31.

Disposed in the slots formed by the cooperating slots 14 of the abutting panels forming the lower portion of the wall 26 of the intermediate slot 21, there is a locking element 41. The locking element includes an elongated slot 42 which passes over the bolt 36 and four slots 43 which engage pins 46 which are disposed in the panel and extend across the slots whereby the locking element 41 serves to lock the adjacent panels to one another so that panels abutting in edgewise relationship cannot separate. The locking element further serves to lock the panels so that they cannot move laterally with respect to one another, that is, the panels are maintained substantially in alignment. The foregoing type of concrete form assembly is described in my copending application referred to above and will not be described further in this application.

It is observed that the walls are supported primarily at the corners of the panels and at the center of the long edges of a rectangular panel. The pressure of the concrete outwardly against the walls is over the total face of the wall. In accordance with the present invention, means are provided to substantially transfer the entire force to the support points at the corner of the panels and intermediate the same whereby to minimize bulging of the panel and permit the sole support to be arranged at said support points.

As previously described, and more particularly described in my copending application, the panels used in the prior art for concrete forming, for building construction and the like have, in general, included a core arrangement, such as cellular bracing, or an expanded plastic filler. In accordance with the present invention, the core is formed of a plurality of spaced non-intersecting ribs which serve to transfer forces to the corners or support points of the panel.

Referring more particularly to FIGURE 6 wherein like reference numerals are applied to parts like FIGURE 1, the skin 13 is partly broken away to show the interior construction of the panel. The panel includes pair of crossed struts 51 and 52, each of which extends between opposite corners of the panel. In each of the sectors defined between these struts, there are placed plurality of spaced bowed ribs. The ends of the ribs are tangent to the struts 51 and 52 at the corners. Thus, the plurality of bows 53, 54 and 55 are placed in the sector 56. Generally, the bows may be spaced equally. Any force applied in the sector 56 will then be primarily transferred along these ribs to the two adjacent corners 57 and 58. Similarly, forces exerted on any other sector of the panel will be transferred to the adjacent corners.

The construction might, for example, comprise struts 51 and 52 made of ¾ inch plywood material, while the bows or ribs 53, 54 and 55 may be made of ¼ inch plywood material.

If it is desired to provide air communication between the various sectors, each of the bows may be drilled out. A further advantage of drilling out an dremoving material from the bows is to provide a much lighter panel while retaining the structural strength of the edgewise arrangement of the ribs within the panel structure.

FIGURE 4 is an enlarged view of a corner showing the various ribs coming to the corner and then extending tangentially away from the corner.

The slots at the edges of the panel are formed by first cutting out a relatively large slot in the bows and struts and subsequently inserting a solid block of material 61 which is then cut out to provide a smaller slot 62 for the reception of the locking element 41 previously described. Referring to FIGURE 5, the smaller slot 62 is shown formed in the block material 61. A pin 63 is shown extending through the slot to engage with the slots 43 formed in a locking element 41 of the type previously described.

Referring to FIGURE 7, there is shown another panel including non-intersecting spaced ribs. The ribs extend between a corner and a diagonal strut which transfers the forces to the corners with which it is associated.

In the embodiment of FIGURE 7, each of the ribs 66 has one end secured to a corner such as 67, and the other end secured at 69 to a strut 68 which may be in the form of an I-beam such as shown in FIGURE 9. The strut has substantial stiffness in comparison to the ribs 66.

Forces applied to any given sector are then transferred along the ribs to the corner 67 and at the other end of the ribs to the strut 68, and thence to the adjacent corner 70. Thus, pressure in any one of the sectors again will be transferred to adjacent corners—to one corner directly along the ribs, to the other corner from the ribs, to the strut and thence to the corner.

As before, a solid slotted insert 71 is provided to accommodate pins 72 for locking adjacent panels to one another through a locking element, such as 41.

A rectangular panel such as that shown in FIGURE 2 may be made by joining together two core assemblies of the type shown in FIGURES 6 or 7, such as illustrated in FIGURE 8, and then applying outer skins 73. A rectangular frame extends along all of the other outer edges. A transverse element 74 is formed by the corresponding frame members. As before, the panel illustrated includes

non-intersecting ribs 66 each having one end affixed to a strut 68 and the other end to a corner as previously described. Forces in any sector will be transferred to the opposite edges at the intermediate points 76 or to the corners.

At the intermediate points, a solid slotted block 77 is provided to receive a locking element in the manner previously described. The outer corners are formed in the manner described with respect to FIGURES 6 and 7 and will not be described in further detail.

When panels of the type illustrated are used with relatively heavy loads, they may tend to bulge. In order to maintain a planar face on the side on which the forces are being applied, it may be desirable to compensate for the bulging by forming cambered faces. Referring more particularly to FIGURE 10, there is shown a sectional view of a panel such as the panel shown in FIGURE 6. It is seen that the ribs 53′, 54′, and 55′ are formed with a greater width at the center. The width at the center of adjacent ribs is progressively greater toward the center of the panel. In the panel illustrated, the width on the upper part 81 of the rib 54 increase more than the width on the lower part 82. The other ribs are formed in a similar manner whereby the upper surface 83 of the panel will have a substantially greater camber than the lower surface 84 of the panel. As a result, the upper face will serve to accommodate much greater forces than the lower face.

In other respects, the panel is similar to those described including side frames and corner locks of the type previously described.

Similarly, the panel having the internal construction shown in FIGURE 7 may be formed wherein again each of the ribs is formed with a greater width at the center of the panel than at the edges of the same.

Thus, there has been provided a panel which is light in construction and formed and adapted to transfer forces from any portion of the panel to adjacent corners which are then used to form the sole support for the panel.

I claim:

1. A panel comprising a rectangular frame, spaced skins secured to opposite sides of said frame to define a hollow panel, a plurality of non-intersecting ribs extending adjacent one another and having their edges secured to said skins, said ribs having at least one end meeting at a corner of said panel to transfer forces applied to the skins along the ribs to the corner, said ribs spreading away from one another away from the corner, and means at the other end of said ribs for transferring along the ribs forces applied to said skins to an adjacent support point.

2. A panel as in claim 1 in which said last named means comprises a strut having one end extending to the support point, the other end of said ribs being secured to the strut.

3. A panel as in claim 1 wherein said last named means comprises the ends of said ribs meeting at the adjacent support point.

4. A panel as in claim 1 wherein the ends of said ribs include projecting finger portions defining a slot, and a support block disposed in said slot.

5. A panel as in claim 4 in which the corners of said panel are bevelled.

6. A panel comprising a rectangular frame, spaced skins secured to the opposite sides of said frame to define a hollow panel, a pair of crossed struts extending between opposite corners of said frame and defining a plurality of sectors within said frame, a plurality of spaced non-intersecting bowed ribs extending between adjacent corners in each of said sectors, the ends of ribs of adjacent sectors being secured to one another and to the corner of said frame whereby forces applied to the skin of said panel are transferred along the ribs and struts to adjacent corners.

7. A panel comprising a rectangular frame, spaced skins secured to the opposite sides of said frame to define

a hollow panel, a diagonal strut extending between a pair of opposite corners of said frame, a plurality of spaced non-intersecting ribs having one end joined to one another at another of said corners and the other end secured to said strut whereby forces applied to the faces of the panel are transferred to the corner along the ribs and along the ribs and strut to an adjacent corner.

8. A panel comprising a rectangular frame, spaced skins secured to opposite sides of said frame to define a hollow panel, a plurality of non-intersecting ribs extending adjacent one another and having their edges secured to said skins, said ribs having at least one end meeting at a corner of said panel to transfer forces applied to the skins along the ribs to the corner, said ribs spreading away from one another away from the corner each of said ribs having a width which is greater toward the center of the panel than at the edge whereby said skins are cambered, and means for transferring along the ribs forces applied to said skins to adjacent support point.

9. A panel comprising a plurality of reinforcing ribs, a rectangular frame secured to the ends of said ribs, said

ribs having a width substantially equal to the width of said frame where the frame is secured thereto and increasing in width toward the center of the ribs and the center of the panel in both directions, and a skin applied to at least one edge of said ribs and said frame, said skin being convex due to the increase in width of said ribs.

10. A panel as in claim 9 wherein a skin is applied to each side of said ribs and frame to form a closed panel.

11. A panel as in claim 10 where the width on one side of the center line through the ribs increases more on one side than the other whereby to provide a greater camber on one face of said panel than on the other.

References Cited by the Examiner

UNITED STATES PATENTS

2,109,009 2/1938 Hadley ---------- 52—381

HARRISON R. MOSELEY, *Primary Examiner.*

P. M. CAUN, *Assistant Examiner.*