United States Patent [19]

Olson et al.

[11] **3,874,141**

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[54] **BUILDING PANELS**

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[21] Appl. No.: **368,289**

[52] **U.S. Cl.** **52/630,** 52/81, 52/86

[51] **Int. Cl.** **E04b 1/32**

[58] **Field of Search** 52/81, 86, 63, 630, 584

[56] **References Cited**

UNITED STATES PATENTS

1,681,819	8/1928	Small	52/86
3,111,788	11/1963	Ouellet	52/86
3,144,103	8/1964	Krueger	52/86
3,203,144	8/1965	Fuller	52/81
3,439,459	4/1969	Silberkuhl	52/584
3,557,501	1/1969	Kolozsvary	52/584

FOREIGN PATENTS OR APPLICATIONS

564,940	2/1958	Belgium	135/1 R
1,315,078	2/1962	France	52/86

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[57] **ABSTRACT**

A symmetrical quadrilateral plate, generally diamond shaped, folded along two lines symmetrically spaced on each side of its major axis to form a flat central valley and two similar triangular portions. Extensions portions are provided at the ends of the major axis and define extensions of the valley, the end portions being bent upwardly or downwardly from the plane of the valley.

11 Claims, 8 Drawing Figures

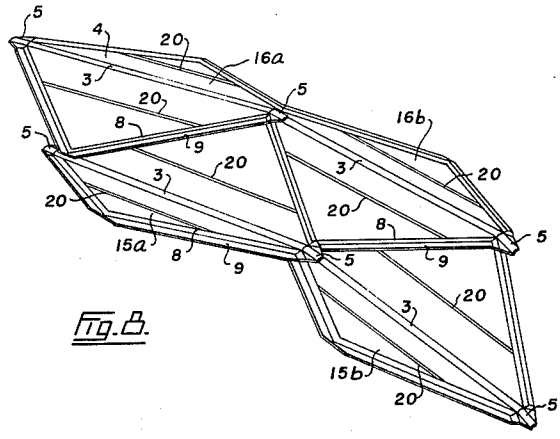


Fig. 8.

Fig. 1.

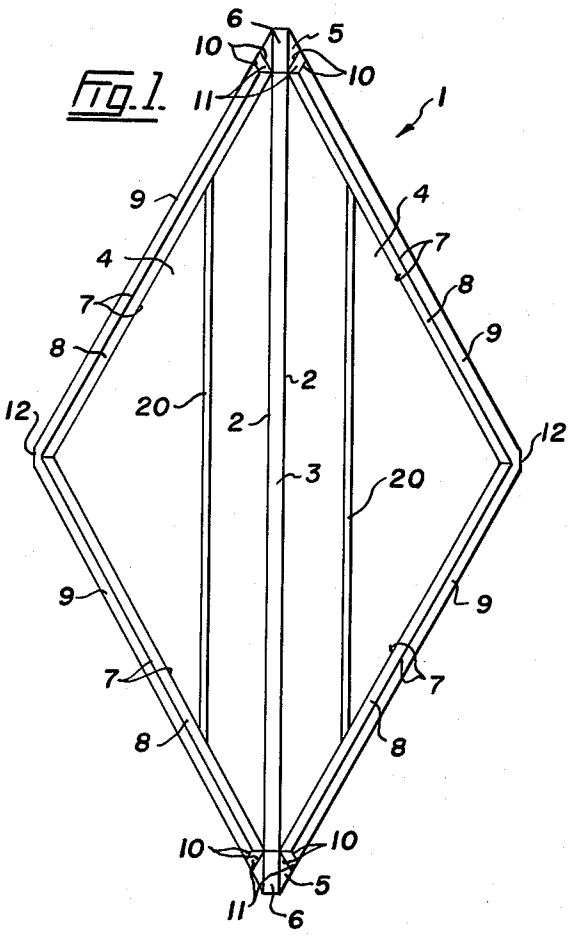


Fig. 2.

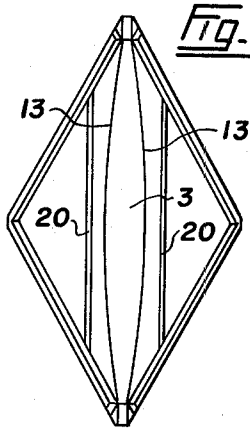
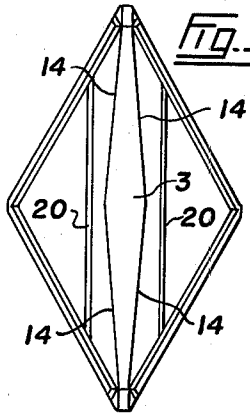


Fig. 3.



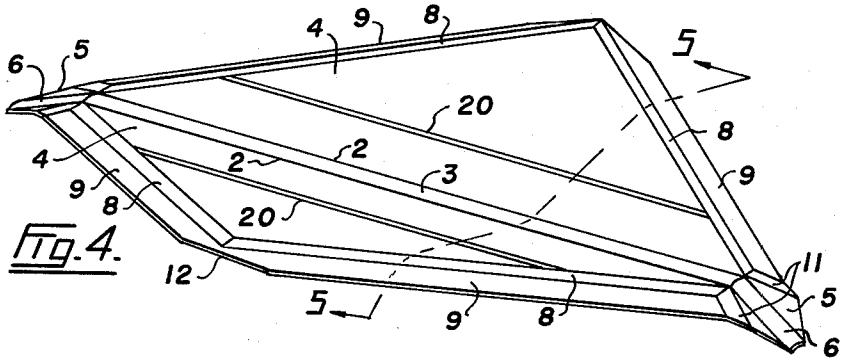


Fig. 4.

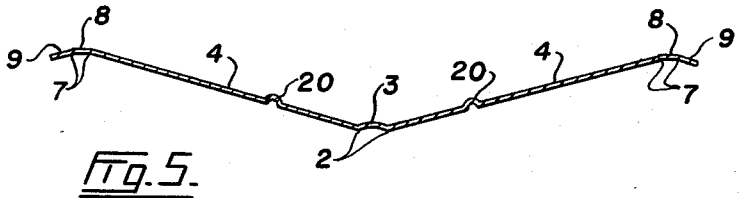


Fig. 5.

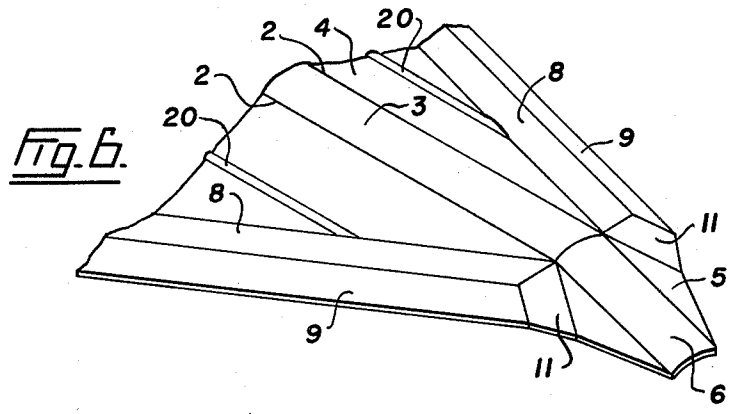


Fig. 6.

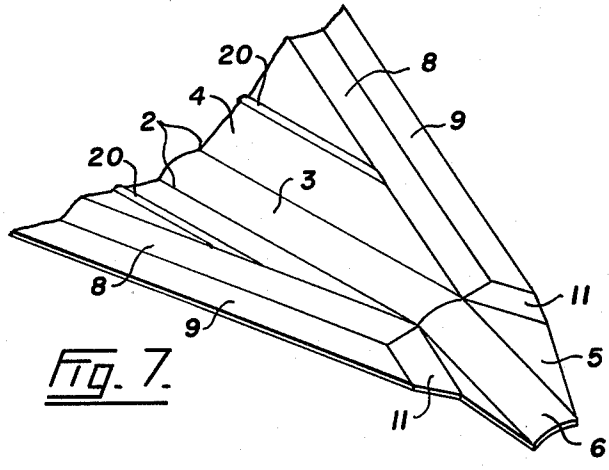


Fig. 7.

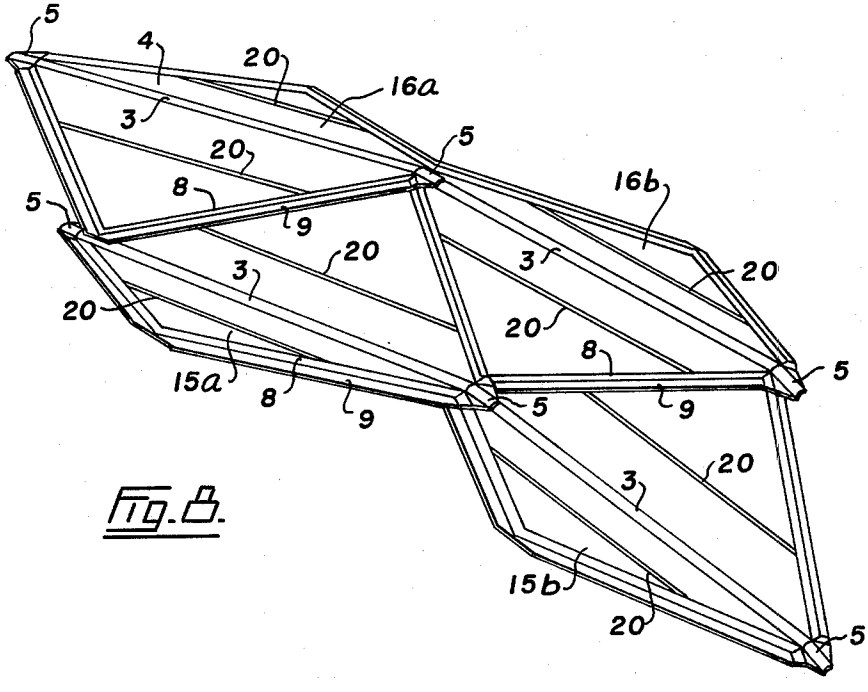


Fig. 8.

BUILDING PANELS

The invention relates to modular building panels for use in building construction, and particularly to folded plates for use in buildings which derive their strength from the three-dimensional configuration of the plates.

In a preferred embodiment, the invention provides a symmetrical quadrilateral modular plate for cooperative use with similar plates in building construction, said plate being folded along two lines symmetrically spaced on each side of a diagonal of symmetry to form a flat central valley, and two similar, at least substantially triangular portions lying in intersecting planes disposed at equal angles to the plane of symmetry of the plate, said plate having extension portions at the ends of the diagonal of symmetry defining extensions of said valley, with said extension portions being bent, whereby the valley extensions define acute angles on the same side of the plate with the central valley.

Preferably, adjacent each edge of the plate, folds are formed along two parallel lines to define a ridge plane and a peripheral flange for overlapping engagement with adjacent plates in a building construction.

The invention will now be further described by way of example with reference to the accompanying drawings in which

FIG. **1** is a plan view of a modular plate according to the invention,

FIGS. **2** and **3** are plan views similar to FIG. **1** of alternative configurations of the plate,

FIG. **4** is a perspective view from above the plate of FIG. **1**,

FIG. **5** is a sectional elevation on the line **5—5** of FIG. **4**,

FIG. **6** shows an end detail of a further configuration of plate,

FIG. **7** shows an end detail of the plate of FIGS. **1** and **4** and,

FIG. **8** is a perspective view of part of a building construction incorporating four plates according to the invention.

Referring first to FIGS. **1, 4** and **5**, the plate **1** shown is generally diamond shaped and is bent along two parallel lines **2**, equally spaced from the major diagonal of the plate to form a central valley **3** having a reverse curve (as best seen in FIG. **5**) and similar triangular portions **4** lying in intersecting planes disposed at equal angles to the plane of symmetry of the plate. In addition, two ribs **20** are preferably formed in the plate in parallel relation to the lines **2**. Instead of the ribs **20** however, the plate may be slightly bent along the same lines in the opposite direction to the bends at the lines **2**. Either arrangement enhances the stiffening of the plate.

At each end of the plate, generally planar extension portions **5** are provided each defining an extension **6** of the central valley **3**. The extension portions **5** are bent downwardly so that the valley extensions **6** define substantially the same acute angles relative to the diagonal of symmetry and on the same side of the plate with the valley **3**, as best seen in FIG. **4**. Adjacent to each edge, the plate **1** is bent along a pair of lines **7** to form a ridge plane **8** and a peripheral flange **9**.

The extension portions **5** are also folded along two parallel lines **10** to form extension ridge planes **11** convergent with the main ridge planes **8** at the same angle to the major diagonal.

The flanges **9** are cut away parallel to the major diagonal to permit abutment with a similar cut away portion of an adjacent plate.

FIGS. **2** and **3** show plate configurations similar to that of FIGS. **1, 4** and **5** but in which the plate is bent along the lines diverging from the ends of the plate so that the flat central valley **3** is of greater width in the centre of the plate than at the ends. In FIG. **2**, the fold lines **13** are curved whereas in FIG. **3** the lines **14** are straight so as to define angles at the center position.

Turning now to FIGS. **6** and **7**, these show details of the end portions of two different plates. In FIG. **6**, the extension portions **5** are bent in the same direction as the triangular portions **4**. In FIG. **7**, the extension portions **5** are bent in the opposite direction to the triangular portions **4**, this arrangement being that shown in the plate of FIG. **4**. The extension portions **5** at the ends of each plate may be bent so that the valley extensions **6** lie at the same or different angles to the central valley **3**, depending upon the shape of the building into which the plates are to be incorporated.

The plates may be made of plastics material or metal sheet aluminum or steel. When the plates are formed from aluminum sheet, the fold lines **2** are preferably spaced apart by between about **30** and **60** times the thickness of the sheeting. Where steel sheeting is used, the spacing of the fold lines **2—2** is preferably between **30** and **80** times the thickness of the sheeting. It has been found that the formation of the double fold lines **2—2** substantially increases the capacity of a building assembled from such plates to resist dead weight loading. For example where a symmetrical load is applied to a building of generally cylindrical configuration constructed from such plates, the yield limit has been found to occur at a load level about **80%** greater than the case of buildings formed with plates having only a single fold line along the major diagonal.

FIG. **8** shows part of a building structure assembled from four plates according to the invention, two plates **15*a***, **15*b*** being of the form shown in FIG. **4** with extension portions **5** bent in the opposite direction to the triangular portions **4**, and the other two plates **16*a***, **16*b*** having extension portions bent in the same direction as the triangular portions **4** in the manner shown in FIG. **6**. It will be seen that the uppermost plate **16*a*** has its ridge plane **8** and peripheral flange **9** overlapping the corresponding plane **8** and flange of the plate **15*a***. At the same time, the extension portion **5** overlaps the extension portion **5** of the plate **16*b***. The plate **15*a*** overlaps the plates **16*b*** and **15*b*** in a similar manner so that the structure is resistant to the ingress of rain.

We claim:

1. A building panel comprising symmetrical quadrilateral modular plate for cooperative use with similar plates in building construction, said plate being folded along two lines symmetrically spaced one on each side of a diagonal line of symmetry to form a central valley between said lines and two similar at least substantially triangular portions lying in intersecting planes disposed at equal angles to a plane of symmetry of the plate, and said plate having extension portions at the ends of said diagonal of symmetry, and extension portions being generally planar and including therein a continuous extension of said two lines, thus defining extensions of said central valley and the plane of each said generally planar extension portion being bent to define an acute angle with the diagonal line of symmetry, whereby said

extension portions are shaped to lap with an extension portion of an adjoining plate on the building construction.

2. A building panel as claimed in claim **1,** wherein said central valley is transversely curved so as to be convex in the direction in which said triangular portions are bent, and said extensions being similarly curved.

3. A building panel as claimed in claim **1,** wherein said extension portions are bent so as to define the same acute angle with said diagonal of symmetry.

4. A building panel as claimed in claim **1,** wherein said extension portions are bent from said diagonal of symmetry in the same direction as said triangular portions.

5. A building panel as claimed in claim **1,** wherein said extension portions are bent from said diagonal of symmetry in the opposite direction to said triangular portions.

6. A building panel as claimed in claim **1,** wherein the sides of said triangular portions defining the sides of said plate are each folded adjacent the edges thereof to form a peripheral flange.

7. A building panel as claimed in claim **6,** wherein each side of said plate is folded adjacent the edge thereof along two parallel lines to define a ridge plane.

8. A building panel as claimed in claim **7,** wherein said extension portions are folded along two parallel lines on each side of said diagonal of symmetry to form extension ridge planes convergent with said main ridge planes at the same angle to the diagonal of symmetry.

9. A building panel comprising symmetrical quadrilateral modular plate for cooperative use with similar plates in building construction, said plate being folded along two lines symmetrically spaced one on each side of a diagonal line of symmetry to form a central valley between said lines and two similar at least substantially triangular portions lying in intersecting planes disposed at equal angles to a plane of symmetry of the plate, said plate having extension portions at the ends of said diagonal of symmetry, said portions defining extensions of said central valley and being bent to define acute angles relative to the diagonal line of symmetry and being shaped to lap with an extension portion of an adjoining plate on the building construction, said central valley being transversely curved so as to be convex in the direction in which the triangular portions are bent, and said extensions being similarly curved.

10. A building panel comprising symmetrical quadrilateral modular plate for cooperative use with similar plates in building construction, said plate being folded along two lines symmetrically spaced one on each side of a diagonal line of symmetry to form a central valley between said lines and two similar at least substantially triangular portions lying in intersecting planes disposed at equal angles to a plane of symmetry of the plate, said plate having extension portions at the ends of said diagonal line of symmetry, said extension portions defining extensions of said central valley and being bent to define acute angles relative to the diagonal line of symmetry and being shaped to lap with an extension portion of an adjoining plate on the building construction, the sides of said triangular portions defining the sides of said plate being folded along two parallel lines to define a ridge plane and including a peripheral flange adjacent each said ridge plane on the exterior thereof to define the outer edge of said plate.

11. A building panel as claimed in claim **10,** wherein said extension portions are folded along two parallel lines on each side of said diagonal of symmetry to form extension ridge planes convergent with said main ridge planes at the same angle to the diagonal line of symmetry.

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