United States Patent [19]

Olsen

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[54] **DECORATIVE OPENWORK PANEL STRUCTURE**

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[52] **U.S. Cl.** **52/663,** 52/311, 52/507, 52/588

[51] **Int. Cl.**.....**E04c 2/42,** E04f 19/06

[58] **Field of Search**.....52/663, 665, 669, 52/478, 507, 520, 581, 588, 311

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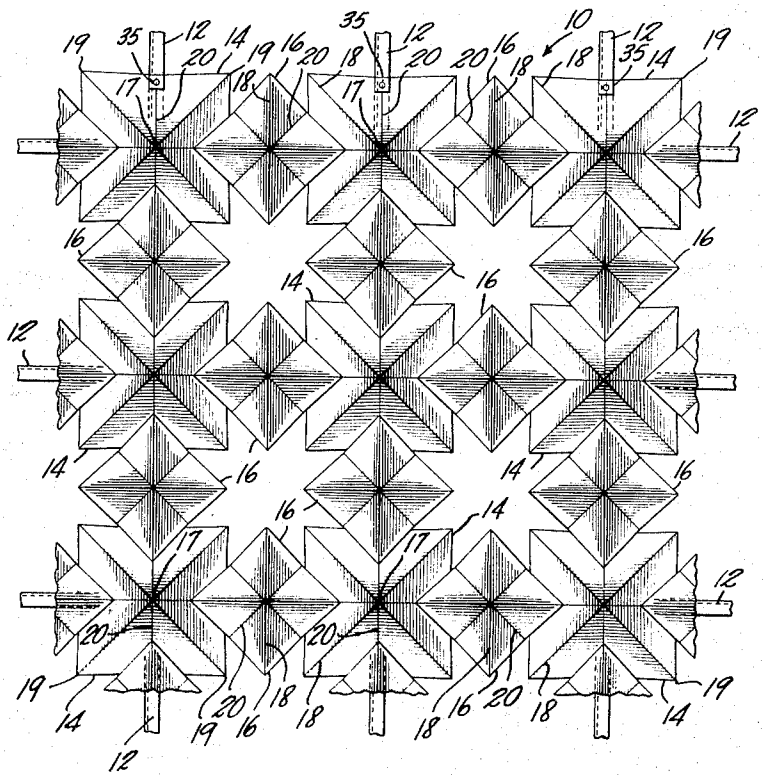
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Assistant Examiner—James L. Ridgill, Jr.
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[57] **ABSTRACT**

A panel structure has a framework of criss-crossing support members, a primary panel fastened to the framework at each intersection of the support members and a secondary panel fastened to each pair of adjacent primary panels. Portions of each secondary panel overlap a portion of the pair of adjacent primary panels to which the secondary panel is fastened, so that the fasteners which are used to secure the primary panels to the support members are concealed by the secondary panels.

8 Claims, 7 Drawing Figures



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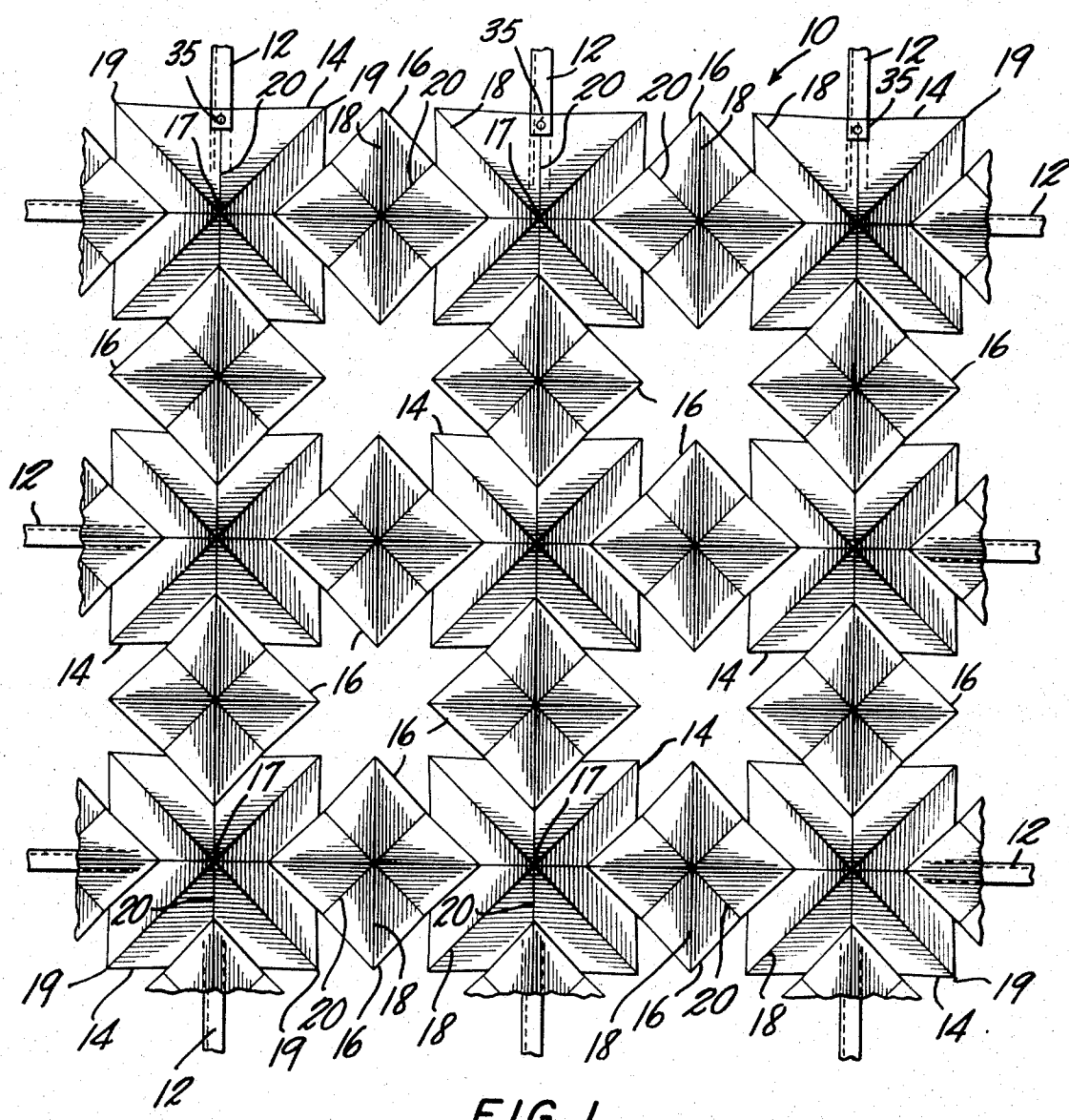


FIG. 1

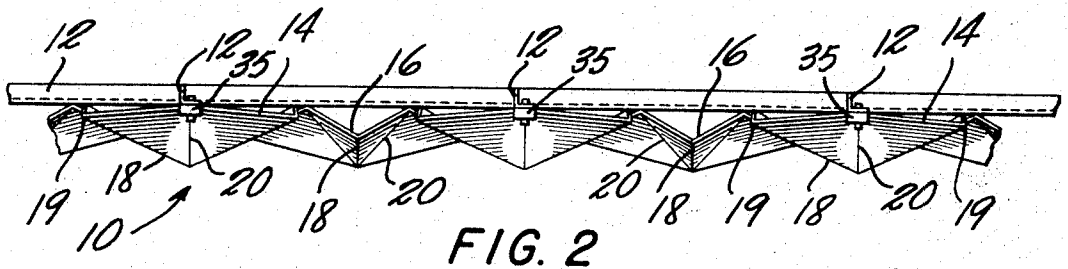


FIG. 2

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2 Sheets-Sheet 2

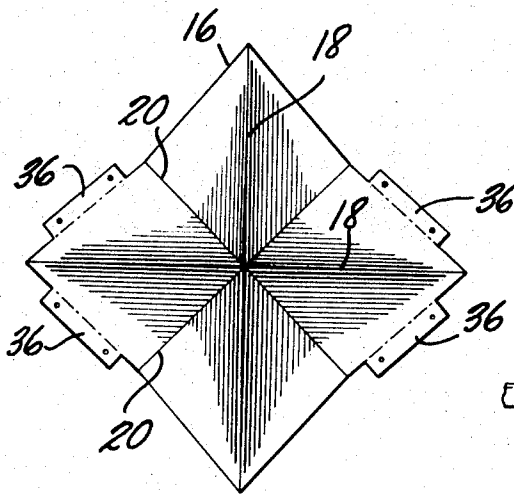


FIG. 3

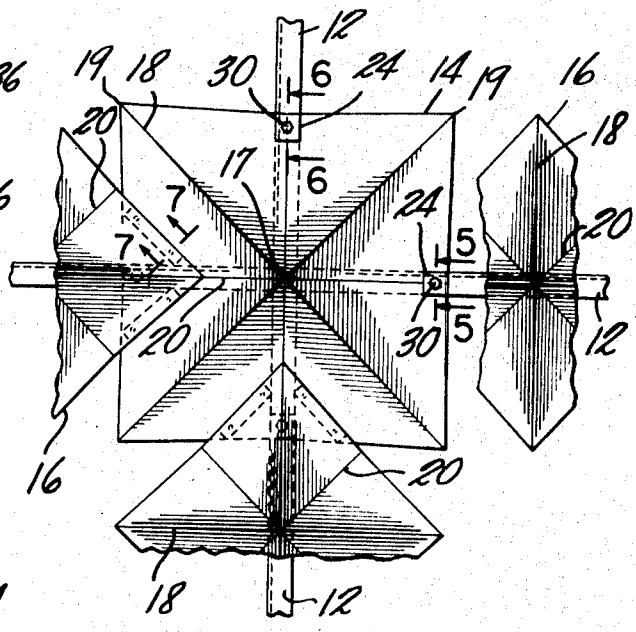


FIG. 4

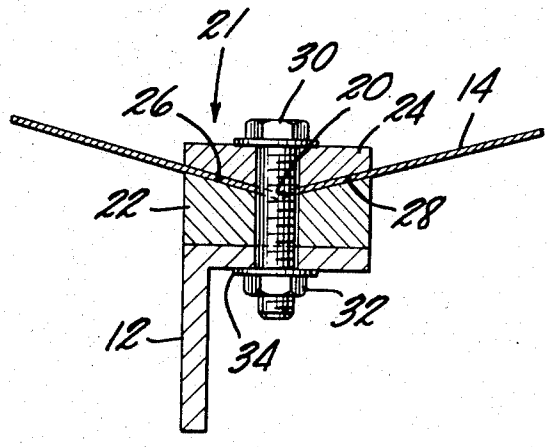


FIG. 5

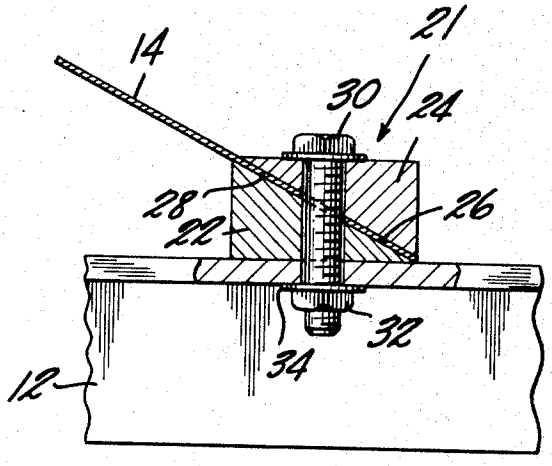


FIG. 6

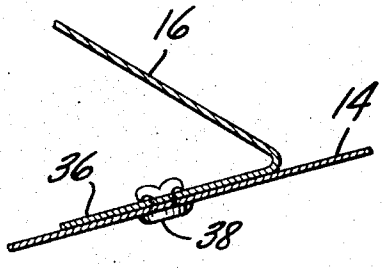


FIG. 7

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DECORATIVE OPENWORK PANEL STRUCTURE

BACKGROUND OF THE INVENTION

This invention relates to panel structures and, more particularly, to panel structures of the type used for building refacings, visual screening for equipment, partitioning and the like.

There is a wide range of uses for panel structures for both indoors and out. For example, these structures can be used for building refacing, for equipment enclosures, partitions and numerous other decorative and functional purposes. Ideally, these structures should be sturdy and durable, light in weight, inexpensive to produce and install, and attractive. For outdoor purposes, such panel structures must be able to withstand wide variations in weather conditions and high winds.

Panel structures of a wide variety of shapes and designs have been developed for these purposes, but many of these structures have features that are in some respects undesirable. Some structures are heavy or have a large number of component parts, which adds to production and installation costs. Others that are relatively light in weight have been developed, but they have been found to be less durable and unable to stand up under diverse weather conditions. Moreover, many known panel structures are unattractive due to the exposure to the viewer of the supporting frameworks or fasteners which are used to secure the component parts of the structure to the framework.

SUMMARY OF THE INVENTION

There is provided, in accordance with the invention, a novel and improved panel structure of the type referred to above that overcomes many of the disadvantages of previously known panel structures, that offers numerous advantages in its own right and that is aesthetically pleasing to the viewer because the structural elements and fasteners are concealed by a unique arrangement of unusually shaped panels that make up the face of the panel structure.

More particularly, the panel structure has a supporting structural framework that is formed of two groups of support members, each group being composed of two or more spaced-apart and preferably parallel members, and the members of each group crossing those of the other group, preferably at right angles to each other. A primary facing panel is at each intersection of two support members and fastened to those members by bolts or other suitable fasteners located near the margin of the panel, and a secondary panel is fastened to each pair of adjacent primary panels. Portions of each secondary panel overlap portions of the adjacent primary panels to which the secondary panel is fastened, so that the fasteners that hold the primary panels to the support members are concealed from view.

In one embodiment of the invention, each of the panels is formed of a sheet of lightweight, durable material, such as aluminum or plastic and is substantially square in shape. The secondary panels have the same shape as the primary panels and are, preferably, smaller in size. The square metal sheet is stamped or otherwise formed into a three-dimensional, generally pyramidal geometric shape in which the center of the square is the apex of the pyramid and the diagonals extend from the corners of the apex at a suitable angle

relative to the plane formed by the corners. The major axes of the square extend from midway along each side to the apex at an angle relative to the above-identified plane, that is greater than the angle of the diagonals, thereby resulting in the diagonals being raised relative to the major axes so that an attractive star-like appearance is presented when the panel is viewed from the front and so that attachment of the secondary panels is facilitated.

The primary panels are preferably oriented on the frame with the apex of each panel centered on an intersection of the support members and the major axes centered along the support members. The secondary panels are preferably smaller in size than the primary panels and of basically the same shape and are oriented on the frame 45° out of phase relative to the primary panels; i.e., the diagonals are centered along the support members.

The primary and secondary panels are positioned on the frame so that a diagonal of each secondary panel coincides with the coinciding major axis of each pair of adjacent primary panels, and portions of the secondary panel near each corner along that diagonal overlap a portion of each of the adjacent primary panels midway along one side.

In this way, the edges of the secondary panel near those corners engage the faces of the overlapped primary panel that are on either side of the lowered major axis in a close-fitting relationship. Because of the unusual pyramidal-type shape of the panels, they are preferably formed with a height so that the angles of their diagonals and major axes, relative to the plane formed by the corners, are such that this close fit is possible. Therefore, the secondary panels should be "flatter," i.e., the height of the pyramid be less than that of the primary panels. However, as long as the primary and secondary panels have corresponding dimensions so that they fit together as described above, panels of different heights may be used.

In order to fasten the primary panels securely to the frame without bending them, it is preferable to use pairs of clamps that have faces angled to coincide with the angled parts of the faces of the panels which they engage. A lower clamp having an upper face formed to match the lower face of the panel is positioned on the support member and a primary panel is placed over it. An upper clamp having a lower surface that matches the panel faces which it engages is then placed over the panel, and a bolt is passed through the two clamps, the panel and the support member, thereby to secure the panel to the support member. Each of the fasteners that secure the primary panels to the framework is preferably positioned near the margin of the primary panel so that it can easily be concealed by the overlapping portion of the secondary panel.

Each secondary panel is provided with tabs that are integral with the panel and extend outwardly along each of the edges that engage the primary panel. These tabs are bent inwardly and under the secondary panel at an angle coinciding with the angle of the overlapped faces of the primary panel and are attached to the primary panel by rivets or similar fasteners that are passed through the tab and the coinciding overlapped portion of the primary panel.

Thus, there is provided, in accordance with the invention, a panel structure that has the advantages of being strong and durable, as well as light in weight, inexpensive to produce and attractive. The panels are positioned on the frame in such a way that the supporting framework and the fasteners used to secure the primary panels to the frame are concealed when the structure is viewed from the front. Moreover, the panels can be shaped and interfitted so that the fasteners are also concealed when the structure is viewed from the side, all of which can be done without weakening the structure or increasing its production costs.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, reference may be had to the following description of an exemplary embodiment, taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a front pictorial view of a portion of the overall panel structure, showing the preferred arrangement, orientation and shape of the primary and secondary panels, with the concealed support members being shown extending from the edges;

FIG. **2** is a top pictorial view of the portion of the panel structure shown in FIG. **1**;

FIG. **3** is a front pictorial view of one of the secondary panels, showing in particular the tabs projecting outwardly from edges of the panel that engage a portion of a primary panel;

FIG. **4** is a front elevational view of one of the primary panels showing its relationship with regard to intersecting support members and overlapping secondary panels;

FIG. **5** is a sectional view taken along line **5—5** as shown in FIG. **4**, showing primarily the clamp and bolt that are used to fasten the primary panels to the support members;

FIG. **6** is a sectional view taken along line **6—6** as shown in FIG. **4**, showing the clamp and bolt similar to the ones in FIG. **5**, but from another angle; and

FIG. **7** is a sectional view taken along line **7—7** as shown in FIG. **4**, showing primarily the connection between the tabs of the secondary panels and the overlapped portion of the primary panels.

DESCRIPTION OF AN EXEMPLARY EMBODIMENT

Referring now to FIGS. **1** and **2**, the panel structure is shown in its assembled state and is designated generally by reference numeral **10**. The main structural framework of the panel structure **10** is formed of two groups of support members **12**, with the support members **12** in each group crossing those in the other group, preferably at right angles to each other. The crisscrossing support members **12** may, for example, be lengths of aluminum or steel of L-shape cross-section and are secured to each other at their intersections by spot welding, bolts or the like. As shown in FIGS. **1** and **2**, the support members **12** that comprise each group are parallel to each other, but other arrangements of crisscrossing support members may also be used in conjunction with facing panels of appropriate geometry.

A primary panel **14** is centered at each intersection between two of the support members **12** and secured to them. The other basic components of the panel structure **10** are the secondary panels **16**, and one is secured to each pair of adjacent primary panels **14**, a portion of the secondary panels **16** overlapping a portion of each adjacent primary panel **14** to conceal the support members **12** and fasteners that are used to secure the primary panels **14** to the frame, which will be discussed in detail below.

As shown in FIGS. **1** and **2**, the primary and secondary panels, **14** and **16**, are preferably formed of square sheets of a lightweight metal such as aluminum, or other durable rigid material. The secondary panels **16** are formed in the same shape as the primary panels **14**, but the secondary panels **16** are preferably smaller in size. To form the panels **14** and **16**, the square metal sheet is stamped or otherwise formed into a three-dimensional, generally pyramidal geometric shape. The center **17** of each square is the apex of the pyramid and the diagonals **18** extend from the corners **19** to the apex **17** at a suitable angle relative to the plane formed by the corners **19**. The major axes **20** of each square extend from midway along each side to the apex **17** at an angle relative to the plane formed by the corners **19** that is greater than the angle of diagonals, thereby resulting in the diagonals **18** being raised relative to the major axes **20** so that an attractive star-like appearance is presented when the panel is viewed from the front, as shown in FIG. **1**.

The primary panels **14** are secured to the support members **12** by suitable fasteners that are located near the margins of the panels **14** so that the fasteners can be concealed by the overlapping portions of the secondary panels **16** as shown in FIGS. **1** and **4**, which will be described in greater detail below. The fasteners that are preferable for use with the panels **14**, of the shape described and shown in conjunction with this embodiment of the invention, are those shown in FIGS. **5** and **6** and are generally designated by reference numeral **21**.

Each fastener **21** includes a pair of blocks **22** and **24** with coinciding faces **26** and **28**, respectively, that are disposed at angles that coincide with the angles at which the faces of the panels **14** are disposed. The lowermost block **22** is positioned on the support member **12** and the panel **14** is placed on the block **22**. The uppermost block **24** is then placed over the panel **14** and the bolt **30** is passed through the corresponding opening in the blocks **22** and **24**, the panel **14** and the support member **12**, and a nut **32** is screwed onto the bolt **30** so that the panel **14** is secured to the support member **12**. A washer **34** can be interposed between the nut **23** and the support member **12**.

As shown in FIGS. **5** and **6**, the faces **26** and **28** of the blocks **22** and **24**, respectively, coincide with the faces of the panels **14** so that they engage each other in a snug, tight-fitting relationship. In this way, the panels **14** are not bent out of shape and they are securely attached to the support members **12**.

As mentioned above, the fasteners **21** are positioned near the margins of the panels **14** so that they can easily be concealed from both the front and side by the overlapping portions of the secondary panels **16**. Moreover, the fasteners **21** secure the panels **14** to the support members **12** effectively enough so that along the outer edges of the panel structure **10**, where an overlapping secondary panel is not provided, for example, as shown along the top of the portion of the panel structure in

FIG. 1, a fastener 21 is not needed. However, for securing the primary panels 14 to the support members 12 along those outer edges, the panels 14 can be sandwiched between a single block 35 and the support member 12, as shown best in FIG. 2. Other suitable fasteners may also be used.

The primary panels 14 and the secondary panels 16 are formed so that their diagonals 18 and major axes 20 are disposed at suitable angles to the plane formed by the corners 19 to allow the edges along the overlapping portion of each secondary panel 16 to engage the overlapped faces of the primary panels 14. This feature enables the panels 14 and 16 to be joined together to form a strongly constructed, composite panel structure that has no fasteners or support members exposed to detract from its attractiveness.

In order to fasten the secondary panels 16 to the primary panels 14, the secondary panels 16 are preferably formed with tabs 36 (see FIG. 3) extending from the portions of the edges that engage the angled faces of the primary panels 14, the tabs 36 being bent back or doubled under the secondary panels 16 at an angle coinciding with the angle at which the face of the overlapped primary panel 14 is disposed, as shown in FIG. 7. Rivets 38 are passed through corresponding holes in the tabs 36 and the primary panel 14. Because the faces of the panels 14 and 16 are disposed at the angle described above, a space is formed between the underside of the overlapping portion of the secondary panels 16 and the primary panels 14, thereby to allow the rivets 38 to be easily installed from the rear of the panel structure 10. By having the rivets 38 installed in this manner, they are concealed from view, as are the fasteners 21.

The primary panels 14 are preferably oriented on the support members 12 such that the apex 17 of each primary panel 14 is centered on an intersection, and the major axes 20 are centered along the support members 12. As mentioned above, the secondary panels 16 are preferably smaller in size than the primary panels 14, but any suitable size relationship between them may be provided. The secondary panels 16 are oriented so that they are 45° out of phase relative to the primary panels 14; i.e., the diagonals 18 of the portions of the secondary panels 16 that overlap the primary panels 14 coincide with the coinciding major axis 20 of the overlapped pair of adjacent primary panels 14. By orienting the primary and secondary panels, 14 and 16, in this manner, as shown in FIG. 1, when the panel structure 10 is viewed from the front the support members 12 as well as the fasteners 21 and rivets 38 are concealed, which, along with the unusual shape of the panels 14 and 16, provides for a panel structure 10 that is unusual and attractive. In addition, as shown in FIG. 2, with the shapes of the panels 14 and 16 and their orientation and overlapping relationship, all of the fasteners are concealed when the structure 10 is viewed from the sides.

Thus, there is provided, in accordance with the invention, a novel and improved panel structure that is strong, light in weight, inexpensive to produce, durable and attractive. The embodiment of the invention described above is intended to be merely exemplary, and those skilled in the art will be able to make numerous variations and modifications to it without departing from the spirit and scope of the invention as defined in the appended claims, and any such variations and modifications are contemplated as being within the scope of the claims.

I claim:

1. A panel structure, comprising a framework having two groups of spaced-apart support members, each group having at least two members therein, with the members in each group crossing those in the other group and connected to them substantially perpendicular thereto to form a grid-like supporting framework, a group of at least four primary panels, a group of at least four secondary panels, said panels in each group being formed of a rigid material and having a quadrangular pyramidal shape, the center of each of the panels being the apex of the pyramid, and the diagonals of each of the panels extending from the corners to the apex at a suitable angle relative to the plane formed by the corners of that panel, the major axes of each panel extending from midway along the edges of the panel to the apex at an angle relative to said plane that is greater than the angle of the diagonals so that the diagonals are raised relative to the major axes, the apex of each of said primary panels being centered on an intersection between two of the support members, the major axes of said primary panels being centered along the support members, a first fastening means located near the margin of each primary panel and along one of the major axes for fastening said primary panel to a support member, each of said means having a lower block and an upper block, with said primary panel being sandwiched between the blocks, said blocks, the primary panel and the support member having a corresponding hole therein for receiving a bolt means to secure said primary panel to the support member, and the faces of said blocks that engage said primary panel being shaped and disposed at an angle relative to said support member to coincide with the shape and angle of the portion of said primary panel said faces engage so that the panel can be secured to the support member without being bent out of shape, a diagonal of each of the secondary panels being centered along a support member between each adjacent pair of primary panels, and portions of said secondary panels near the corners of the diagonal overlapping the portion of each of the adjacent primary panels to which said secondary panel is fastened, said overlapping portion covering the first fastening means, and said overlapping portion having a tab projecting outwardly therefrom, the tab having at least one opening therein corresponding with an opening in the overlapped portion of said primary panel, the tab being bent to a position between said secondary panel and said primary panel so that the secondary panel can be attached to the primary panel, and fastening means passing through the corresponding hole in the tab and the overlapped portion of the primary panel.

2. A panel structure, comprising a framework having two groups of spaced-apart support members, each group having at least two members therein, and the members of each group crossing the members of the other group and connected to them to form a grid-like supporting framework, a group of at least four primary panels, first means located near the margin of each primary panel for fastening said primary panel to the sup-

port members, each primary panel being generally centered on an intersection between two of the support members, a group of at least four secondary panels, and second means for fastening each of said secondary panels to an adjacent pair of primary panels, portions of each secondary panel overlapping the portion of each of the adjacent primary panels to which said secondary panel is fastened where said first means are located, so that said first means are covered by said portions of the secondary panels.

3. A panel structure in accordance with claim 2, wherein said first means includes a lower block and an upper block, with said primary panel being sandwiched between the blocks and the lower block being disposed adjacent a support member, with said blocks, the primary panel and the support member having a corresponding hole therein for receiving a bolt means to secure said primary panel to the support member, and the faces of said blocks that engage said primary panel are shaped and disposed at an angle relative to said support member to coincide with the shape and angle of the portion of said primary panel said faces engage so that the primary panel can be secured to the support member without being bent out of shape.

4. A panel structure in accordance with claim 2, wherein the overlapping portions of said secondary panels each has a tab projecting outwardly therefrom, the tab having an opening therein that corresponds with an opening in the overlapped portion of a primary panel, so that the tab can be bent to a position between the secondary panel and the primary panel for fastening the secondary panel to the primary panel.

5. A panel structure in accordance with claim 2, wherein the panels in each group are formed of a sheet of metal that is substantially square in shape, and the secondary panels are smaller in size than the primary panels.

6. A panel structure in accordance with claim 5, wherein the support members in each group are generally perpendicular to those in the other group, the center of each of said primary panels is centered on an intersection between two of the support members, the major axes of said primary panels are centered along the support members, and each of said secondary panels is skewed relative to said primary panels so that one diagonal is centered along a support member.

7. A panel structure in accordance with claim 2, wherein the primary and secondary panels are formed of a substantially rigid material and have a generally quadrangular pyramidal shape, the center of the panel being the apex of the pyramid, and the diagonals of the panel extend from the corners to the apex at a suitable angle relative to the plane formed by the corners, the major axes of the panel extending from midway along the edges to the apex at an angle relative to said plane that is greater than the angle of the diagonals so that diagonals are raised relative to the major axes.

8. A panel structure in accordance with claim 7, wherein the support members in each group are generally perpendicular to those in the other group, the apex of each of said primary panels is centered on an intersection between two of the support members, the major axes of said primary panels are centered along the support members, and each of said secondary panels is skewed relative to said primary panels so that one diagonal is centered along a support member.

* * * * *