

[54] SELF-SUPPORTING STRUCTURES  
MADE FROM SHEET MATERIAL

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[22] Filed: Aug. 9, 1971

[21] Appl. No.: 170,248

[52] U.S. Cl. .... 297/440, 126/9 A, 312/259

[51] Int. Cl. .... A47c 7/00, F24c 1/16

[58] Field of Search ..... 397/440, 445;  
108/150; 5/DIG. 1; 312/258-262; 206/44;  
126/9 A; 248/174

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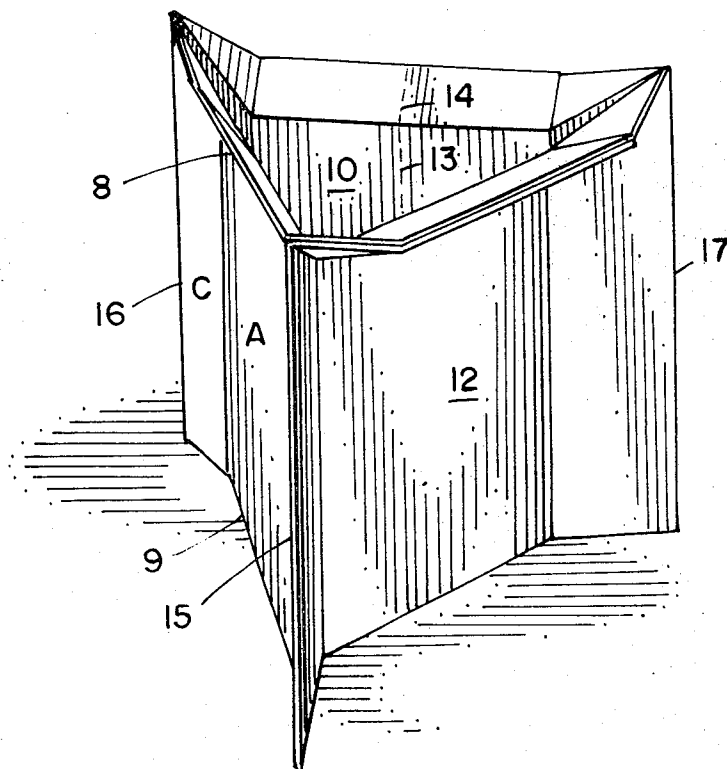
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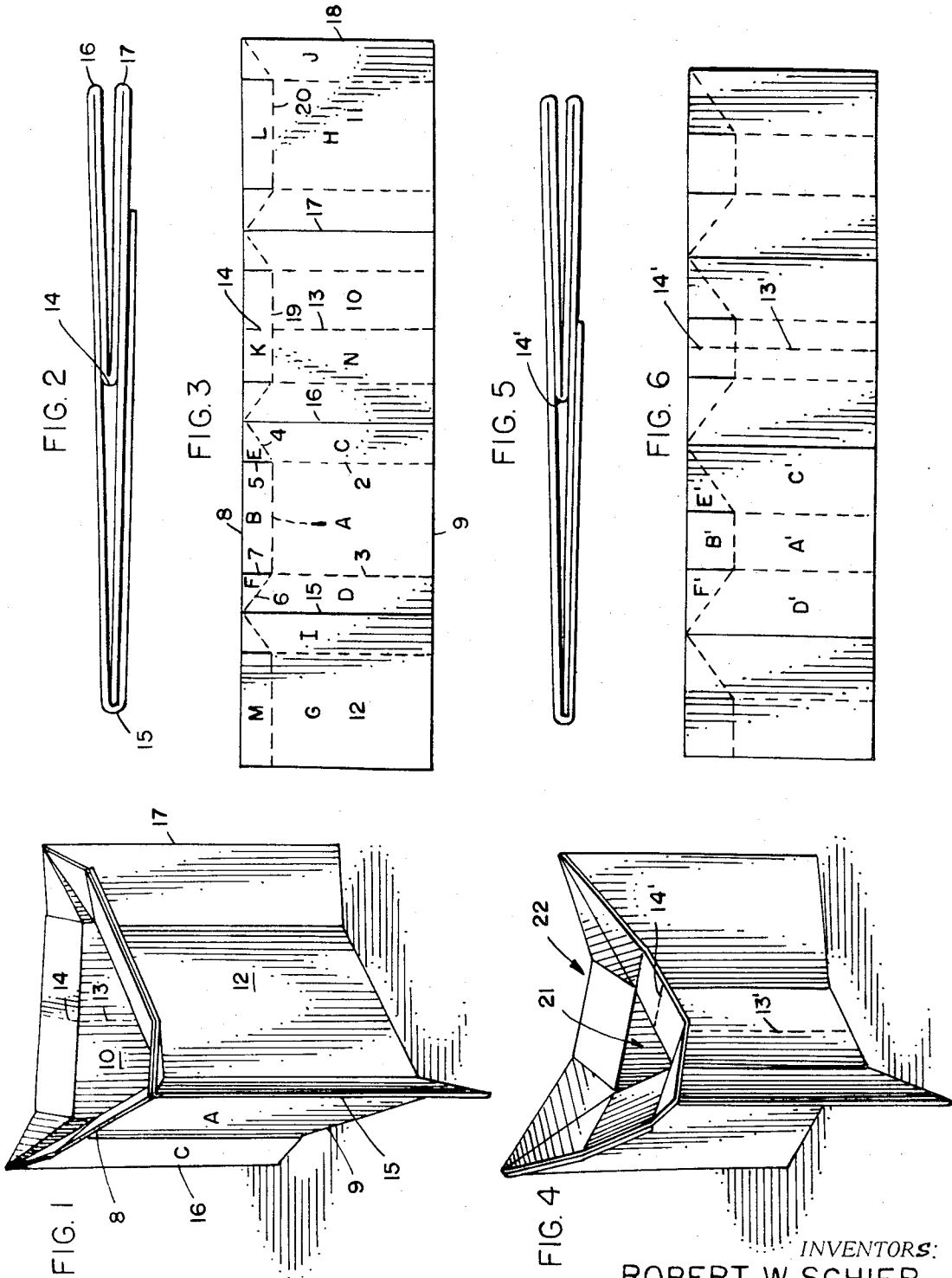
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[57] ABSTRACT

Self-supporting structures made from preformed blanks of sheet material and capable of being folded are provided which are useful for portable seating structures, display bins, containers, holders, barbecue grilles, and many other applications.

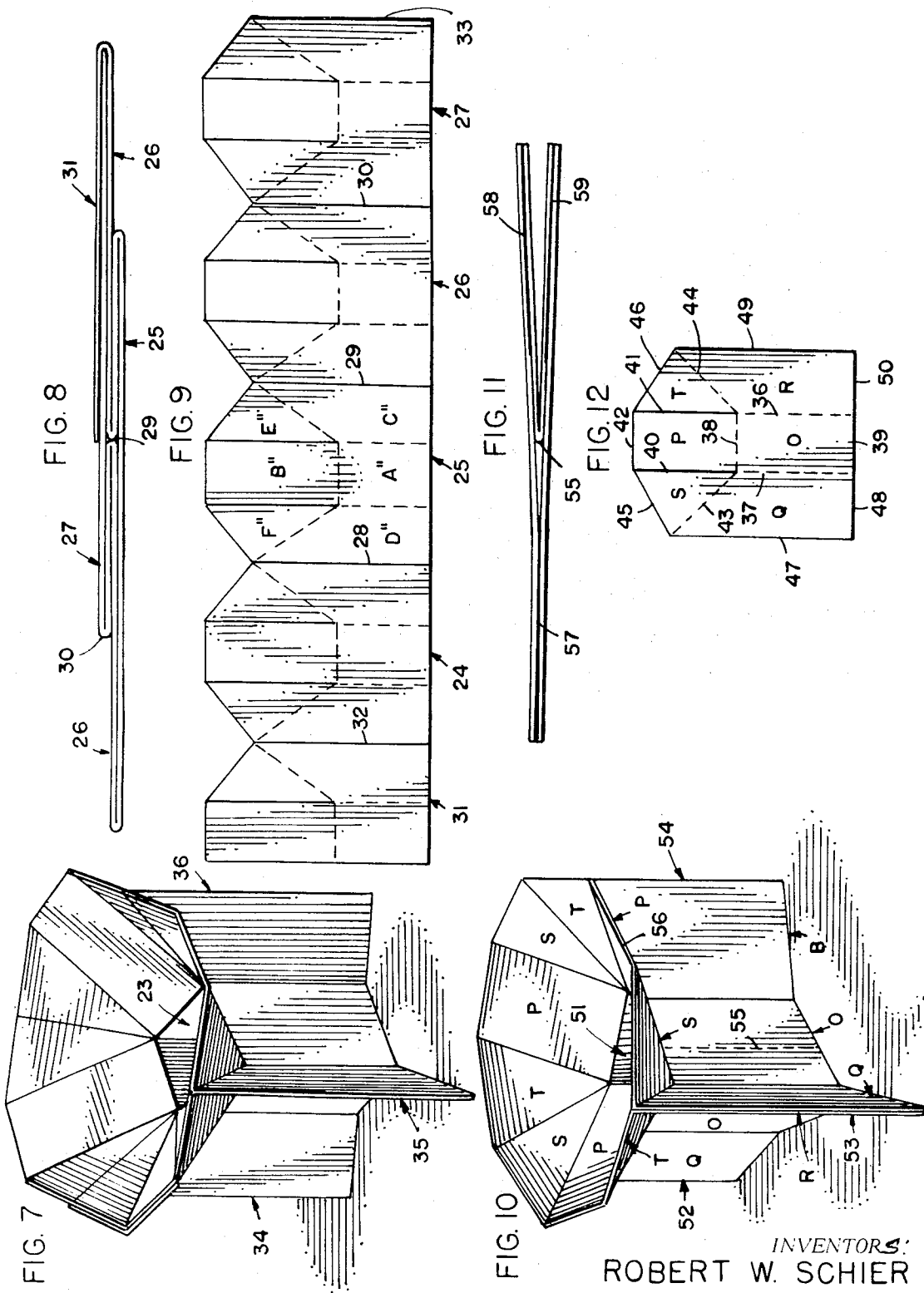
6 Claims, 12 Drawing Figures





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## SELF-SUPPORTING STRUCTURES MADE FROM SHEET MATERIAL

### BACKGROUND

The invention is concerned with the manufacture of self-supporting structures made from preformed blanks of sheet material which structures are useful as seating structures, display bins, holders, containers, barbecue grills, and for many other applications. There is a need for self-supporting portable structures which are useful for portable seating or for portable display bins or for other applications of the type mentioned, and which can be folded into a compact flat package which is also light in weight, is made from inexpensive materials, and is disposable. For example, there is a need for self-supporting foldable seating structures which can be carried as flat units and set up to form a portable seat at golf tournaments and other sporting events where conventional seating is not available.

### OBJECTS

One of the objects of the present invention is to provide new and improved self-supporting structures made from preformed blanks of sheet materials which are capable of being carried as a flat unit and set up to form a portable seating structure.

Another object of the invention is to provide a portable structure of the type described which can be made from cardboard, corrugated paper board, plastic sheet materials, sheet metal, and similar types of readily available sheet materials.

Still a further object of the invention is to provide self-supporting foldable structures which are light in weight, can be used as display bins, holders, containers, or other applications, and are fully portable.

Another object of the invention is to provide self-supporting foldable structures made from preformed blanks of sheet materials which are capable of being carried as a flat unit and set up to form a portable barbecue grill.

Other objects and advantages of the invention will appear from the following description in conjunction with the accompanying drawings.

### THE DRAWINGS

In the drawings, FIG. 1 is perspective view of one embodiment of the invention illustrating the seating structure provided in accordance with the invention;

FIG. 2 shows the seating structure of FIG. 1 folded into a flat package;

FIG. 3 is an elevational view of a blank of sheet material used in constructing the structure shown in FIGS. 1 and 2;

FIG. 4 is a perspective view illustrating a modification of the structure shown in FIG. 1;

FIG. 5 is a plan view of the structure of FIG. 4 after it has been folded into a flat package;

FIG. 6 is an elevational view of a preformed blank of sheet material used to make the structures shown in FIGS. 4 and 5;

FIG. 7 is a perspective view illustrating another embodiment of the invention;

FIG. 8 is a plan view of the structure shown in FIG. 7 after it has been collapsed into a folded shape;

FIG. 9 is an elevational view of the blank of sheet material used to make the structure shown in FIG. 7;

FIG. 10 is a perspective view of another embodiment of the invention;

FIG. 11 is a plan view of the embodiment shown in FIG. 10 after it has been folded to a flat package, and

FIG. 12 is an elevational view of the basic blank of sheet material used to form the structure shown in FIG. 10.

### BRIEF SUMMARY OF THE INVENTION

The invention requires the use of a blank of sheet material which is provided with fold lines and has certain areas fastened together in such a way as to produce a self-supporting structure characterized by a central tubular column of transverse polygonal cross section with supports extending outwardly at the base from the points of intersection of the polygon and with sides of said structure in the upper part thereof extending outwardly between said supports. By forming predetermined fold lines in the blank or blanks from which this structure is made, it can be collapsed to a flat readily portable package.

The blank can be made of any suitable sheet material which is sufficiently rigid so that the structure as a whole will be self-supporting. In general, it is preferable to use corrugated paper board, cardboard, laminated metal foil and corrugated paper board but the invention does not preclude the use of other types of sheet materials having the necessary rigidity including plastic sheet materials, metal sheet materials, laminated and stiffened cloths or combinations of sheet materials. The type of sheet material employed will depend to a considerable extent upon the size and end use of the resultant structure.

### DETAILED DESCRIPTION OF THE INVENTION

For the purpose of the invention the blank of sheet material from which the self-supporting structure is formed should comprise two superposed rectangular panels having as a common boundary between them an inside fold line, a trapezoidal panel on each side of one of said rectangular panels, each of said trapezoidal panels having an inside fold line as a common boundary between one of its parallel sides and one of the opposing sides of said rectangular panel, and a triangular panel on each side of the other of said rectangular panels, each of said triangular panels having an outside fold line as a common boundary with one of the opposing sides of said last mentioned rectangular panel and each of said triangular panels having an inside fold line as a common boundary with one of the non-parallel sides of said trapezoidal panels.

By using at least three such elemental blanks and joining the trapezoidal panels together face to face with the inside fold lines disposed inwardly and the outside fold lines disposed outwardly, a structure is formed having a central tubular column of transverse polygonal cross section with supports extending outwardly at the base from the points of intersection of the sides of the polygon and with sides of said structure in the upper part thereof extending outwardly between said supports.

One way of practicing the invention is to form a blank of sheet material comprising a plurality of blanks of the type described joined together consecutively at their outer sides. If three such blanks are joined together the central tubular column of the resultant

structure will be triangular. If four such blanks are joined together the central tubular column of the resultant structure will be quadrilateral. The blanks can be provided with overlapping areas at the outer edges thereof in order to secure two opposite edges of the blank together. The blanks can also be provided with fold lines in order to make it possible to facilitate folding the resultant structure into a flat package.

In the drawings, the broken lines are used to indicate inside fold lines and the full lines are used to indicate outside fold lines. Dot-dash lines are used to indicate lines that can fold either direction.

In FIG. 3 the elemental blank of sheet material consists of a rectangular panel A, a superposed rectangular panel B, having an inside fold line 1 between panels A and B, trapezoidal panels C and D each having an inside fold line 2 and 3 as a common boundary with panel A and triangular panels E and F on each side of rectangular panel B. Panel E has a common inside fold line 4 with panel C and a common outside fold line 5 with panel B. Similarly panel F has a common inside fold line 6 with panel D and a common outside fold line 7 with panel B. The lines 8 and 9 form the top and bottom of the blank respectively. Two identical areas having fold lines are disposed to the right of the elemental blank as generally indicated at 10 and 11. An area for overlapping is disposed to the left of the elemental blank as indicated at 12. The intermediate area 10 also has a fold line 13 which bisects it and another fold line 14 which is an extension of fold line 13. The fold line 14 is an outside fold line in the final structure of FIG. 1 and an inside fold line in the folded structure of FIG. 2. In order to construct the structure shown in FIG. 1 the trapezoidal areas which adjoin each other are secured together face to face by folding them toward one another around fold lines 15, 16 and 17. They can be held together by adhesive or in any other suitable manner. The area 12 is overlapped with the area 11 and secured thereto so that the panel G overlaps panel H and panel I overlaps panel J. Line 15 then coincides with line 18.

In order to form the structure shown in FIG. 1 the assembled blank is placed in an upright position and the panels B, K and L are turned downwardly and outwardly around the fold lines 1, 19 and 20, respectively. The panel M is outside and coincides with the panel L. To collapse the structure shown in FIG. 1 to produce a flat folded package as shown in FIG. 2, the panels B, K and L-M are pressed upwardly and the panel N is pressed inwardly at fold line 13.

The structure illustrated in FIG. 4 is a modification of the structure illustrated in FIG. 1 and is formed in a similar manner from the blank shown in FIG. 6. The only difference is in the dimensions which result in a structure having a smaller central tubular column 21 and wider outwardly extending sides generally indicated at 22. Comparing FIG. 6 with FIG. 3 it will be seen that the preformed blank of sheet material in FIG. 6 has a narrower panel A', a deeper panel B', wider panels D' and C', and larger triangular panels F' and E'. The fold lines 13' and 14' in FIG. 6 correspond to fold lines 13 and 14 in FIG. 3.

FIG. 7 illustrates a structure in which the central tubular column 23 has a quadrilateral (in this case a square) cross section and is formed from the blank

shown in FIG. 9. The collapsed or folded state of this structure is illustrated by FIG. 8. As shown by FIG. 9 the composite blank from which the structure of FIG. 7 is formed consists of four blanks generally indicated at 24, 25, 26 and 27, consecutively joined together at lines 28, 29 and 30. In addition, there is an overlapping area generally indicated at 31 which is overlapped and secured by means of adhesive or other suitable means to the opposite end of the blank so that line 32 corresponds with line 33.

Each of the areas 24, 25, 26 and 27 consists of two superposed rectangular panels, for example, A'' and B'' in area 25, two trapezoidal panels, for example C'' and D'' in area 25, and two triangular panels, for example, E'' and F'' in area 25. When the opposite ends of the blank are overlapped and secured together and the trapezoidal panels are secured together in a face to face relationship by means of adhesive or other suitable means, and the panels corresponding to B'' are pulled outwardly, a structure is formed as shown in FIG. 7 in which there is a rectangular tubular column 23 and four supports, three of which are generally indicated at 34, 35 and 36. These supports extend outwardly from the corners of the polygonal (in this case the square) central tubular column. This structure can be folded to a flat state which will have the appearance shown in plan view by FIG. 8.

Another variation of the invention is illustrated in FIGS. 10, 11 and 12. In this structure the elemental blank shown in FIG. 12 contains two superposed rectangular panels O and P, two trapezoidal panels Q and R, and two triangular panels S and T. Rectangular panel O has inside fold line 36 as a common boundary with trapezoidal panel R and has inside fold line 37 as a common boundary trapezoidal with panel Q. Panel O has a common boundary with superposed rectangular panel P at inside fold line 38 and a base line boundary 39. Rectangular panel P has a common boundary with triangular panel S at outside fold line 40 and with triangular panel T at outside fold line 41. The top of panel P is at 42. Triangular panel S has a common boundary with the non-parallel side of trapezoidal panel Q at inside fold line 43. Triangular panel T has a common boundary with the non-parallel side of trapezoidal panel R at inside fold line 44. The upper side of panel S is at 45 and the upper side of panel T is at 46. The outside of panel Q is at 47 and the base at 48. The outside of panel R is at 49 and the base at 50.

By using three of the blanks shown in FIG. 12 and securing them together at the trapezoidal panels Q and R face to face by means of adhesive or in any other suitable manner, and pulling outwardly on the panels S, P and T, the structure shown in FIG. 10 is formed. This structure has a central tubular column 51 which is triangular in cross section. The outwardly extending corners 52, 53 and 54 which are formed by joining the trapezoidal panels of the respective blanks together are sufficiently rigid to act as supports for the outwardly extending panels S, P and T of the respective blanks so that the resultant structure is very stable and the basket-like upper part is capable of acting as a receiver or container for various types of articles which can also occupy the space provided by the tubular column 51.

In order to make the structure of FIG. 10 foldable or collapsible one of the sides should contain a fold line

which bisects the panels P and O, vertically. Such a line can be an inside fold line in panel O at 55 as indicated in FIG. 10 and a line which folds inwardly and outwardly in panel P as indicated at 56 in FIG. 10. The folded state of the structure shown in FIG. 10 is illustrated in plan view in FIG. 11 which also shows the various panels united by means of adhesive or in any other suitable manner at 57, 58 and 59.

In a similar manner other self-supporting structures can be prepared in accordance with the invention in various sizes and with blanks of sheet materials of various widths and heights. Thus, the width of each elemental blank may vary from 5 inches or less to up to 5 feet or more. Similarly, the height of each elemental blank may vary from 5 inches or less up to 5 feet or more. The central tubular column, while preferably three-sided or four-sided, can have any number of sides. The upper and lower edges of the blanks of sheet materials can be parallel as shown in FIGS. 3 and 6, or they can have other shapes as shown in FIGS. 9 and 12. For the purpose of providing a seating structure the arrangements shown in FIGS. 1 and 4 are preferred. As an example, an excellent portable foldable seating structure is provided by using a double-faced corrugated board approximately one-eighth inch thick in forming the blank shown in FIG. 6 and by employing a series of three elemental blanks each approximately eighteen to twenty inches wide by 18 to 20 inches high. When collapsed, as shown in FIG. 5, it can be easily carried, shipped, or stored. Structures of this type can also be used as foot stools. They can be converted to tables by placing self-supporting flat panels on the tops thereof.

Structures of the type shown in FIGS. 7 and 10 are especially useful as storage bins or containers for display purposes. For example, they can be used in grocery stores to hold various types of fruits and vegetables. When such structures are placed on a flat supporting surface the items placed therein can be allowed to fill the central tubular column as well as the outwardly extending sides in the upper portions of the structures. These structures, as well as those shown in FIGS. 1 and 4, can be employed as portable barbeque grills by placing a screen over the central opening to support charcoal briquettes or the like, and by placing a grill at a higher level which is so constructed as to be supported by the inner sides of the structure at such level. When this type of structure is used as a portable

barbeque, it is desirable to laminate the inside panels with aluminum or copper foil, or other heat resistant material or else to form the entire blank of sheet material from a substance which will resist heat.

It will be recognized that structures of the type described can have many other uses. For example, in smaller sizes where the height is say 3 to 5 inches, such structures can have an inner liner placed in the upper part thereof so as to serve as a dish for ice cream sundaes. Many other types of applications are made possible by varying the dimensions of the essential panel structures.

The invention is hereby claimed as follows:

1. A self-supporting structure comprising at least three blanks, each blank comprising two superposed rectangular panels having as a common boundary between them an inside fold line, a trapezoidal panel on each side of one of said rectangular panels, each of said trapezoidal panels having an inside fold line as a common boundary between one of its parallel sides and one of the opposing sides of said rectangular panel, and a triangular panel on each side of the other of said rectangular panels, each of said triangular panels having an outside fold line as a common boundary with one of the opposing sides of said last mentioned rectangular panel and each of said triangular panels having an inside fold line as a common boundary with one of the non-parallel sides of said trapezoidal panels, said trapezoidal panels being joined together face to face, the inside fold lines being disposed inwardly and the outside fold lines being disposed outwardly to form a structure having a central tubular column of transverse polygonal cross section with supports extending outwardly at the base from the points of intersection of the sides of the polygon and with sides of said structure in the upper part thereof extending outwardly between said supports.

2. A self-supporting structure as claimed in claim 1 in which said polygon has three sides.

3. A self-supporting structure as claimed in claim 1 in which said polygon has four sides.

4. A self-supporting structure as claimed in claim 1 which is foldable to a flat state.

5. A self-supporting structure as claimed in claim 2 which is foldable to a flat state.

6. A self-supporting structure as claimed in claim 3 which is foldable to a flat state.

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