

Feb. 16, 1971

C. E. GANGEMI

3,562,973

COLLAPSIBLE PREFABRICATED STRUCTURE

Filed Feb. 14, 1969

2 Sheets-Sheet 1

FIG. 1A

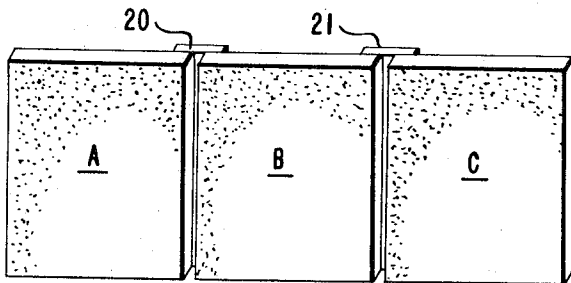


FIG. 1B

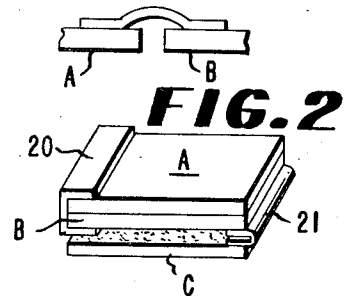


FIG. 3B

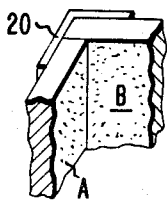


FIG. 3A

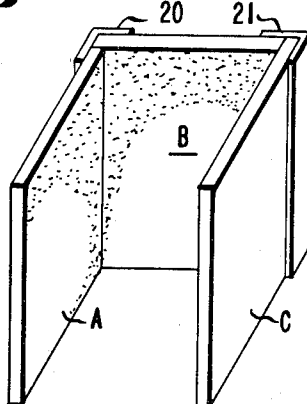


FIG. 3C

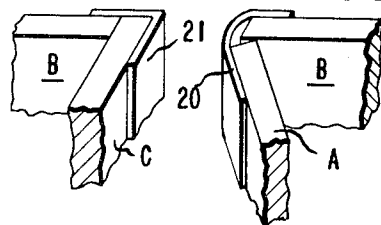


FIG. 3D

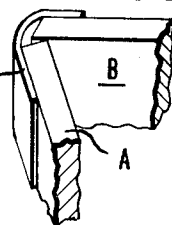


FIG. 3E

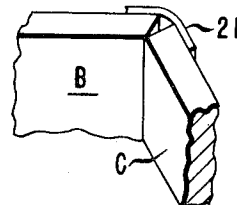


FIG. 4A

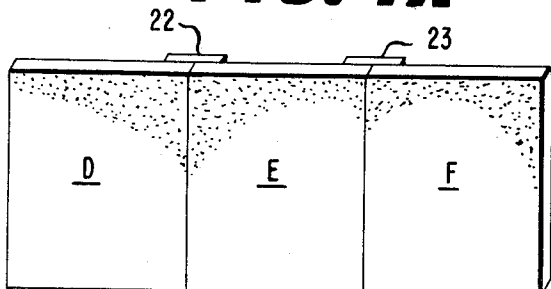


FIG. 4B



FIG. 5

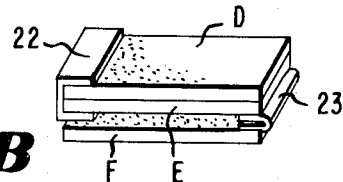


FIG. 6A

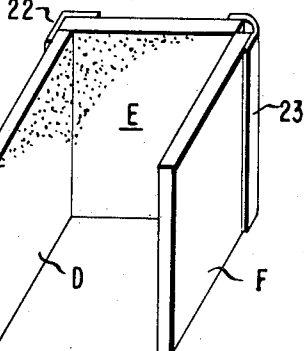
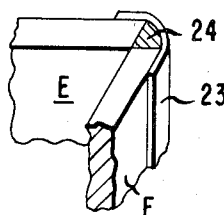


FIG. 6B



INVENTOR
CARL E. GANGEMI

BY *Herbert M. Johnson*
ATTORNEY

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C. E. GANGEMI

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FIG. 7

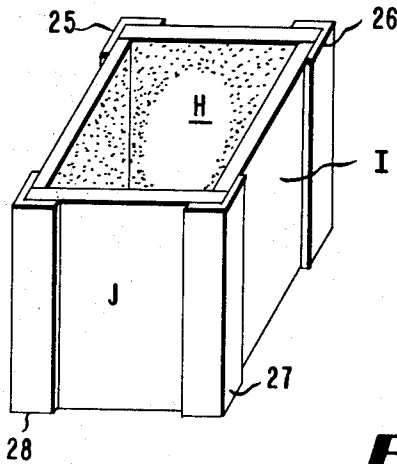


FIG. 8

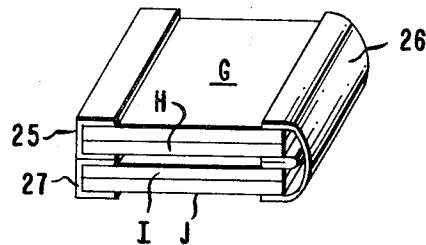


FIG. 9

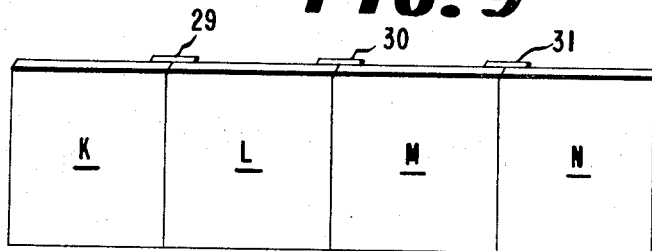


FIG. 10

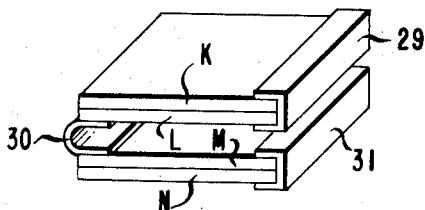


FIG. 11

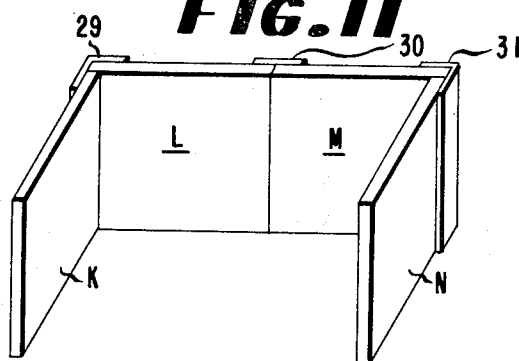


FIG. 12

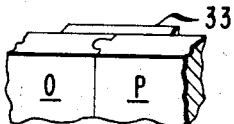


FIG. 13

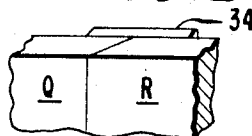


FIG. 14

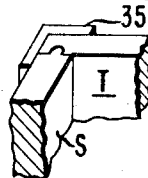
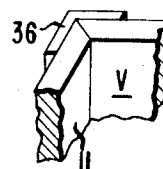


FIG. 15



INVENTOR
CARL E. GANGEMI

BY *Herbert M. [Signature]*
ATTORNEY

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COLLAPSIBLE PREFABRICATED STRUCTURE

Carl E. Gangemi, Wilmington, Del., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed Feb. 14, 1969, Ser. No. 799,417

Int. Cl. E04b 1/344; E04c 2/40

U.S. Cl. 52—71

9 Claims

ABSTRACT OF THE DISCLOSURE

A collapsible structure for use in construction comprising at least two panels and at least one elastomeric strip, bridging the seam between the panels and bonded to the rear of the panels in a manner such that the strips function as elastomeric hinges. These hinges are designed so that they will stretch to allow the panels to be positioned in any angular relation to one another, and contract when the panels are finally positioned, to insure that the front surfaces of the panels are contiguous. When the panels, elastomeric strips and bonds are water resistant, the hinge acts as a seal and the structure is useful as a prefabricated bathtub surround package.

BACKGROUND OF INVENTION

Prefabricated structures are popular construction devices because they are: easy to handle, reduce on-site construction time, and lead to an overall reduction in construction cost. Beside this, they are usually simple to install and can, therefore, be used by unskilled labor. Such prefabricated structures range from prefabricated parts, through simple enclosures, up to and including whole rooms or houses.

Despite the diversity in their appearance, however, prefabricated structures generally have a single feature in common. If a finished product is desired, after the structure has been installed, some sealing between the parts is necessary. This is particularly important in those cases where the structure is intended to be proof against the elements, or where the structure is intended to be used in an area where moisture is present. The sealing of such structures is time consuming, and despite the amount of care taken in forming the seals, they usually deteriorate in the course of time.

The present invention is concerned with a multi-sectional structure in which the seals are preformed, thereby reducing the time required for on-site installation of the structure. It consists of a plurality of panels each connected to another panel by an elastomeric strip which bridges the seam between the panels and functions both as a hinge and a seal. Sufficient stretch is provided in the strips to allow the panels to be folded into a compact shipping package and then unfolded into the form of the desired structure. This is the hinging function. If the materials used are impervious to water, the strips will form a leak-tight seal between the panels, no matter what position the panels are in, so the structures can be used to seal off an area where there is a lot of moisture present. This is the sealing function.

The present invention is also concerned with a prefabricated structure which, when installed, will present a neatly finished surface. This is in part accomplished by bonding the strips to the rear of the panels so that they will be hidden from sight when the structure is installed. In part, however, the hinges themselves contribute to the finished appearance of the installed structure. Providing stretch in the hinges not only allows the panels to be positioned in any angular relation to one another, but, if the hinges are properly designed, the tension in

the strips will pull the panels together until they fit tightly and their front surfaces are contiguous. In those instances where the front surfaces of the panels contain designs with periodic patterns, the patterns can be matched during construction and will stay matched thereafter. Since matching the patterns during installation is time consuming and costly, the present invention is further calculated to reduce on-site installation time and costs.

The present invention is further concerned with a prefabricated structure in which the seals are permanent seals. On-site seals tend to degrade with time, but since the seals in the present invention can be made under factory conditions, they can be expected to be more permanent than on-site seals.

Finally, the present invention is concerned with a prefabricated structure with a degree of variability in its dimensions. In areas, such as the region surrounding the bathtub, there is usually a preformed area into which the prefabricated structure is set. This preformed area is usually inaccurately formed so that some trimming of the panels is necessary during installation. The present invention contemplates adjustable positioning of the panels during installation to compensate for such inaccuracies, while still maintaining the leak-tight seal between the panels.

SUMMARY OF INVENTION

The present invention is a collapsible structure which comprises at least two panels with front and rear surfaces disposed adjacent to one another, and at least one elastomeric strip extending the length of the seam between the panels and disposed on the rear surface of the panels in a manner such as to bridge the seam between adjacent panels. A portion of each strip is bonded to two panels in a manner such as to provide a width of unbonded material covering the seams and extending on either side of the seam to form an elastomeric hinge with sufficient stretch to allow the panels to be folded along the seam between the panels into any desired angular relation with one another. The strip has sufficient tension to insure that when the panels are folded into position for installation, they will be pulled tightly together so that their front surfaces will be contiguous.

The operation and advantages of the present invention can best be understood with reference to the following figures:

FIGS. 1, 2 and 3 illustrate one possible embodiment of the present invention in which the panels are positioned in different angular relation to one another;

FIGS. 4, 5 and 6 illustrate a second possible embodiment of the present invention in which the panels are positioned in different angular relation to one another;

FIGS. 7 and 8 illustrate a third possible embodiment of the present invention in which the panels are positioned in different angular relation to one another;

FIGS. 9, 10 and 11 illustrate a fourth possible embodiment of the present invention in which the panels are positioned in different angular relation to one another; and

FIGS. 12, 13, 14 and 15 illustrate possible variations on the above structures, in which the panels are mated together.

DETAILED DESCRIPTION OF DRAWING

FIGS. 1, 2 and 3 illustrate a single three-sided structure. The difference between the figures being that the panels are oriented in different positions relative to one another. In FIG. 1A the structure is expanded to its full length, and panels A, B and C are aligned in a side by side relationship with the front surfaces of each panel facing forward. Elastomeric strips 20 and 21 are disposed on the rear surface of the panels in a manner such that they

bridge the gap formed between the panels. In this embodiment the panels are not butted against one another, but are separated by a small gap, as shown, for reasons which will appear below. In some instances, however, it may be advantageous to butt the panels together. This also will be discussed below.

In the embodiment shown in FIG. 1, the elastomeric strips extend the entire length of the gap between the panels. This is advantageous when a leakproof seal is desired, but in some instances it may be desirable or necessary to divide the strip into a number of sections; so that instead of one strip extending the length of the panels, there will be several strips in its place.

As can be seen from FIG. 1B, which is an expanded side view of a gap between the panels and the strip bridging this gap, the strip is bonded to the rear surface of the panels in the region furthest from the gap, leaving a considerable portion of the elastomeric strip, covering the gap and extending on both sides of the gap, unbonded. The purpose for this is to provide a sufficient width of unbonded elastomeric material to supply the stretch required to position the panels. The width of unbonded material depends on the thickness of the panels, the size of the gap between the panels and the elasticity of the elastomeric material from which the strips are made. The purpose for using an elastomeric hinge is to allow the panels to be positioned as shown in FIGS. 2 and 3. If there is no gap between the panels the strip will have to be capable of stretching to at least twice the thickness of the panels. If there is a gap, the distance the strip will have to stretch will be reduced by the thickness of the gap. The particular dimensions of the strip, gap, and bonded areas will, therefore, depend on the requirements of the particular structure.

The elastomeric strip can be bonded to the panels in any conventional manner. One simple way is to use a contact adhesive. If such an adhesive is used, a convenient way to insure that there is an unbonded region between the strip and the panels is to cover the edge of the panel, up to a certain width, with masking tape so that when the adhesive is applied to the panel and the strip, the area of panel underneath the masking tape will not be bonded to the strip. The strip will generally be applied under pressure and the adhesive allowed to cure while the strip is in place. After the adhesive has cured, the masking tape can be removed leaving the strip bonded as shown in FIG. 1B.

In FIG. 2, the three panels have been folded together for storage or shipping. Panel A has been folded about the axis formed by the gap between it and panel B to the point where the front surfaces of both panels are in contact. For convenience this positioning can be designated as being the position in which there is zero angle between the two panels. (For comparison the panels in FIG. 1B would then be designated as positioned at 180° relative to one another.) This means that elastomeric strip 20 must be capable of stretching, without rupturing the bond, to at least twice the thickness of the panels. Panel C is then folded until its rear surface is in contact with the rear surface of panel B, or so that it is positioned at 360° relative to panel A. The elastomeric strip 21 is under very little strain because it is folded back on itself. Alternatively, panel C could have been folded over the top of panel A, to a position designated by zero degrees relative to panel B, but if this were done, strip 21 would have to be stretched even further than strip 20. This places an unnecessary strain on the materials and on the bond in view of the fact that the panels can be folded as shown. It is, therefore, not a recommended configuration, but there is no limitation on the construction of the package which would preclude such a configuration. All that is necessary is that the unbonded portion of the strip be wide enough to allow enough stretch to accommodate the position.

FIG. 3A shows the three panels in the positions they

normally assume upon installation. The two side panels have been folded to a position perpendicular to the rear panel. Two different configurations are illustrated for the positioning of the panels. In FIG. 3B the edge of panel A butts against the front surface of panel B. In FIG. 3C the edge of panel B butts against the front surface of panel C. In both cases the front surfaces of the panels are contiguous. The elastomeric strips are adapted so that they will stretch enough to allow the panels to be positioned as shown, but once the panels are in position, the strips contract pulling the panels firmly into contact with one another. The seal is on the rear of the panel, and the front of the structure has a neat finished look.

FIG. 3A shows the side panels oriented perpendicular to the rear panel. It should be obvious that because of the stretch in the hinge it is possible to align the side panels in almost any angular position ranging from zero degrees to 180° relative to the back panel and still have the same type of rear seal with contiguous front surfaces. Certainly, if the panels were moved from their 90° position towards zero degrees relative to the rear panel this would be true, as can be seen from FIG. 3D. If the side panels are arranged at an angle between 90° and 180° relative to the rear panel, it may be necessary to reduce the size of the gap between the panels or to butt the front edges of the panels together as shown in FIG. 3E, but contiguous front surfaces are still possible. If the gap is equal to the thickness of the panels, which is the maximum gap that can be tolerated and still have a tight fitting contact between the panels, then the two front edges will touch when the panel edges and the strip form an equilateral triangle; or where the angle between the panels is 120°. So even without reducing the gap, the front surfaces can be made contiguous between 0° and 120°. In the region between 120° and 180° a reduced gap would be necessary. This will be discussed further in relation to FIG. 6A below. Here it is discussed merely to indicate that the angular relationship between the panels depends on the needs of the construction and can, within limits, be determined at the construction site rather than at the time the panels are produced. It should also be obvious that the structure need not be symmetric. Each side panel can be oriented at a different angle relative to the rear panel, as the situation demands.

The panels can be made from any suitable construction material. Because of the forces exerted on the bonded areas and on the edges of the panels during positioning, a durable material such as plastic is contemplated, but almost any material including plaster board can be used effectively. The fact that there is a durable seal which can be made waterproof, however, makes the structure shown in FIG. 3A particularly suitable for a bathtub surround package. In such use the panels will be constantly subjected to streams of water so that a panel which is impervious to water is preferred. Any plastic material would be suitable. Corian® filled acrylic resin, a simulated marble, is particularly well suited.

The panels may have decorative front surfaces, having random or periodic patterns. In the latter case, the patterns on each panel can be matched with the patterns on the other panels when the structure is assembled. Once the panels are assembled their relation to one another is set and the patterns are permanently matched. Thus, the necessity of matching patterns during installation is avoided.

If the structure is to be used as a bathtub surround the elastomeric strip should also be impervious to water as should the bond between the strip and the panel. Almost any elastomeric sheet material such as Neoprene® is suitable. It is to be noted, however, that if a waterproof seal is required, the elastomeric strip should be a single strip, not sectioned, extending the entire length of the gap between the panels, and that the bond should extend the entire length of the strip. If the seal does not

have to be leakproof, however, sectional strips, spot bondings and water sensitive materials can be used.

As shown in FIGS. 1 through 3 the three panels are separated by a small gap. This is to aid in the formation of the structure by decreasing the amount of stretch needed. The gap is not necessary, however, if sufficient stretch is provided by the elastomeric material itself. FIGS. 4, 5 and 6 illustrate the same type of structure as shown in FIGS. 1 through 3 except that there is no gap. The panels are originally lined up without a gap between them. In FIG. 4A panels, D, E and F are aligned in side by side relation. Elastomeric strips 22 and 23 bridge the seam formed between each panel. As shown in FIG. 4B the bond is made in the same way as in FIG. 1B, leaving enough unbonded material to supply the needed stretch. In this case, however, it may be desirable to apply the strips under tension so that the panels as shown in FIG. 4A are held tightly together.

FIG. 5 illustrates how, as in FIG. 2, the package can be folded. Slightly more stretch must be provided in strip 22 because of the fact that no gap is provided between panels D and E, but other than that, folding the package is the same.

FIG. 6A shows the structure in position for installation. The structure is essentially the same as that shown in FIG. 3A. Here, however, a third alternative positioning of the panels is shown for hinge 23 in FIG. 6B. This configuration is illustrated here, but it is available in the structure discussed above as well. In this configuration, rather than having one edge abutt on one front surface, the two front edges of the panels touch and are held in position by the tension in the strip. The edges can be designed so that this is a stable position, or a plug 24 can be placed between the two panels to maintain their position. By using a plug similar to plug 24, the relative position of the back and side panels can be varied by as much as the width of a panel. The side panel can be moved to overlap the front surface of the back panel, or vice versa, by any amount up to the width of the panels.

Used as a bathtub surround, the three sided structure would be installed in a preformed area. The installation can be made using any suitable means, such as an adhesive. In those situations where the structure is placed in a preformed area, the relative position of the panels can be maintained by the mechanism attaching the structure to the preformed area, and the plug 24 would be unnecessary. The advantage of having the variable positioning of the three panels is that it is possible to vary the length of the back wall by two panel thicknesses and the length of the side walls by one panel thickness. Such preformed areas often have inaccurate measurement, and since it is as advantageous to have a tight fit at the corners, the variation in dimension built into this structure is helpful in offsetting minor variations in the accuracy of the preformed area.

As shown in FIGS. 1 through 6 the structure is a three sided structure. Actually, the structure can be made of as many panels as desired. One simple deviation would be to place a ceiling or a floor on the three sided structure. This would require placing a panel of the desired size above and/or below panel B, adjacent to panel B as are panels A and C. These extra panels can be folded to form a ceiling and floor for the structure of FIG. 3A, but in this instance the ceiling and floor panels would have to be sealed to panels A and C in a conventional manner. It would be possible to provide elastomeric strips presealed to the ceiling and floor which could then be sealed to the side walls at the time of installation. Conventional sealing means would still be needed, but at least a consistent, waterproof seal would be provided throughout.

Another simple deviation from FIG. 3 would be to provide a fourth side as shown in FIGS. 7 and 8. This structure would provide an enclosure into which desired openings could be cut, either at the construction site or before. Folding the package provides a little more dif-

ficulty, especially in the stretch required. The structure could first be folded in half so that the inner surfaces of panels G and H and the inner surfaces of panels I and J are touching. Strips 25 and 27 would be under no more strain than normal. Folding the structure in half again so that the outer surfaces of panels H and I are in contact, for the purpose of forming a more compact shipping package, puts no strain on strip 28, but requires that strip 26 stretch as much as four panel thicknesses. Such a configuration is possible if enough unbonded strip is available to provide the necessary stretch.

In some circumstances the rear panel must be considerably longer than the side panels. It can be made in one piece to the proper shape, but this defeats the advantage of folding the structure into a compact package. An alternative is to divide the rear panel into a number of sections. FIGS. 9 through 11 illustrate a three sided structure in which the rear panel is twice the length of the side panel and is divided into two sections. The structure as illustrated has no gap between the panels. This is merely for illustration and is not meant to limit obvious variations, such as those discussed above.

The four panels K, L, M and N are aligned in side by side relation and the seams between them are bridged by strips 29, 30 and 31 disposed on the rear surfaces of the panels. The structure folds for shipping as illustrated in FIG. 10 in much the same way that the other three sided figures folded, except that there are now two strips, 29 and 31, which must stretch by the thickness of two panels. In position for installation as shown in FIG. 11 the structure resembles the previous three sided structures except that the rear panel is in two sections. The basic criterion for this structure is that panels L and M fit tightly together so that their front surfaces are contiguous. There can be no gap between these two panels, although there is no reason for not providing gaps between panels K and L and panels M and N. It may also be advantageous to apply strip 30 under tension so that the rear panels are held together under some force.

All the panels discussed so far have had flat square edges. This facilitates the compensation for errors in the size of the enclosure into which the structure is to fit. Since the two rear panels must fit snugly together anyway, it is possible to shape the abutting edges of these panels so they fit more snugly. FIG. 12 illustrates one possible shaping, a tongue and groove built into the edges of panels O and P, which are held in place by strip 32. FIG. 13 illustrates beveled edges on both panels Q and R, held together by strip 34. Any such shaping is possible. While more expensive to produce, such shaping decreases the possibility of lateral displacement of the two panels, which is desirable under some circumstances.

If the exact size of the enclosure is known, similar shaping on the edge of the side panel and the front surface of the rear panel, such as that shown in FIGS. 14 and 15 is possible; as is the alternative of shaping the edge of the rear panel and the front surface of the side panel (not shown). In FIG. 14 the shaping is in the form of tongue and groove. In FIG. 15 the shaping is in the form of beveled edges. Any suitable shaping can be used.

It should be obvious that there are countless variations in construction. The above discussion is intended to be illustrative only and is not meant to limit the scope and/or use of the present invention as claimed.

What is claimed is:

1. A collapsible structure for use in construction, which comprises:

(a) at least two synthetic plastic panels with front and rear surfaces, said panels being disposed in such manner that the front surface of each is adjacent to the front surface of another and is such manner that the panels are separated by a distance less than the thickness of the panels; and

(b) at least one elastomeric strip of substantially uniform thickness extending the length of adjacent sur-

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faces on said panels and disposed on the rear surfaces of said panels in such manner as to bridge the seam between two adjacent panels in a manner such that said elastomeric strip is concealed from view when said structure is installed, a portion of each of said strips being bonded directly to each of two panels in such manner as to provide a width of unbonded strip, covering the seam, and forming an elastomeric hinge with sufficient stretch to allow said panels to be folded about the axis formed by the seam between the panels into any angular relation with one another and with sufficient tension to insure that at least when said panels are folded to the position where their front surfaces are within an angle of less than or equal to 180° of one another, these front surfaces will be contiguous.

2. The structure of claim 1 wherein said panels are arranged in seriatim.

3. The structure of claim 1 wherein at least two of said panels are arranged with edges abutting one or another, and wherein said elastomeric strip is disposed in a manner such that the adjacent front surfaces of the abutting panels are contiguous when they are at an angle of 180° with respect to one another.

4. The structure of claim 1 wherein said panels and said elastomeric strip are made from water resistant materials and wherein the bonds between said strip and said panels are impervious to water and extend the entire length of said strip.

5. The structure of claim 1 wherein at least one elastomeric strip is divided into two or more sections.

6. The structure of claim 1 wherein the edges of at least two of said panels are shaped in a manner such that

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said edges mate with one another when the panels are positioned in the desired angular relation.

7. The structure of claim 1 wherein the edge of at least one of said panels and the front surface, near the edge, of the panel adjacent to that edge are shaped in a manner such that said edge mates with said front surface when the panels are positioned in the desired angular relation.

8. The structure of claim 1 wherein said panels have decorative front surfaces and the patterns on adjacent panels are matched in a manner such as to appear substantially continuous when said structure is assembled.

9. The structure of claim 1 wherein at least two of said panels are arranged in spaced relationship and wherein said elastomeric strip is disposed in a manner such that the adjacent front surfaces of the abutting panels are contiguous when they are within an angle of less than or equal to 120° of one another.

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PRICE C. FAW, JR., Primary Examiner

U.S. Cl. X.R.

52—35, 309, 311, 417, 468; 160—231