

Oct. 20, 1970

J. B. AITKEN

3,534,513

COLLAPSIBLE BUILDING UNIT

Filed Jan. 21, 1969

3 Sheets-Sheet 1

FIG. 1

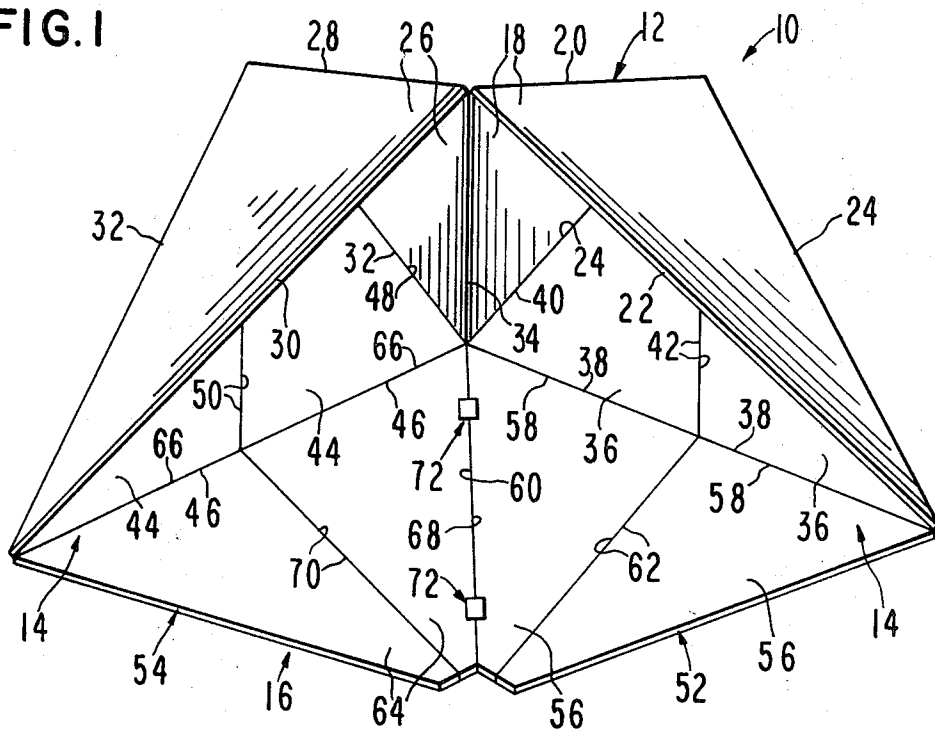


FIG. 2

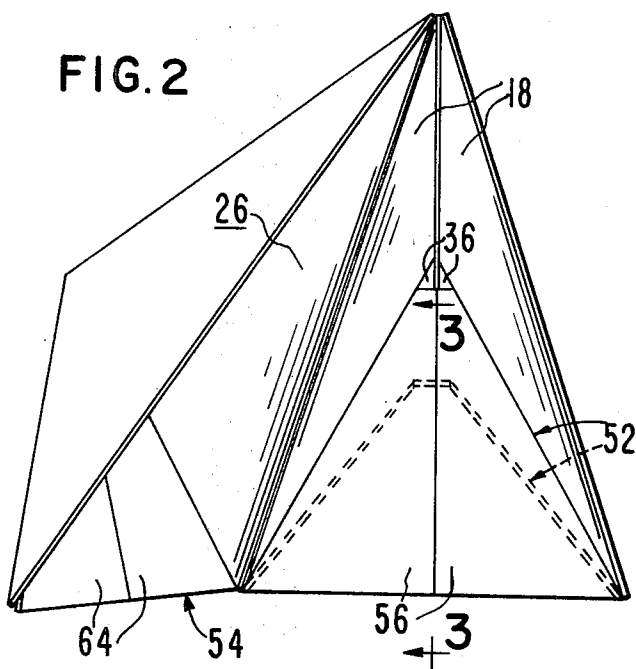
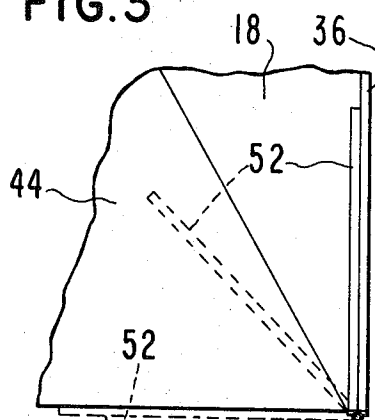


FIG. 3



INVENTOR.

JAMES B. AITKEN

BY

Townsend & Townsend

ATTORNEYS

Oct. 20, 1970

J. B. AITKEN

3,534,513

COLLAPSIBLE BUILDING UNIT

Filed Jan. 21, 1969

3 Sheets-Sheet 2

FIG. 4

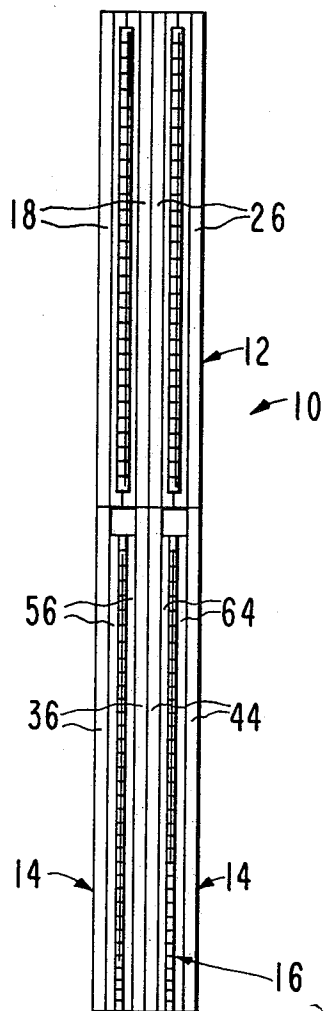
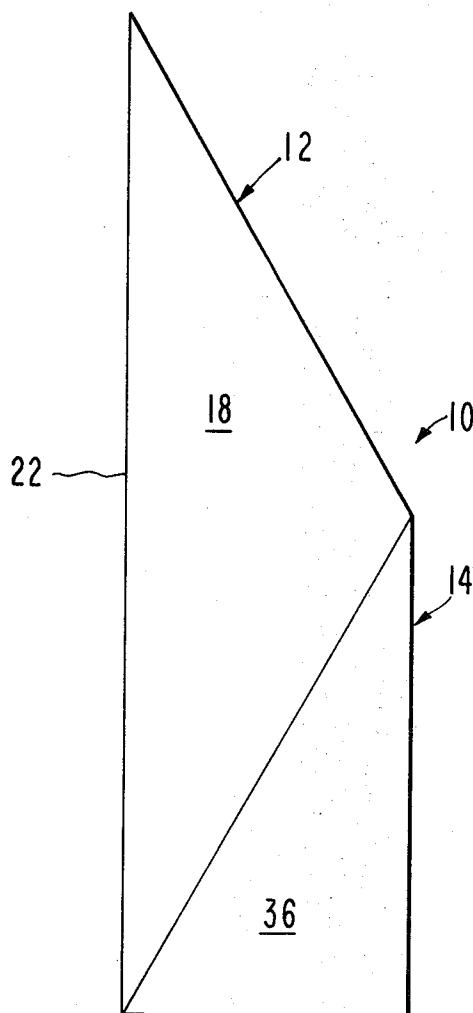


FIG. 5



INVENTOR.

JAMES B. AITKEN

BY

Townsend Townsend

ATTORNEYS

Oct. 20, 1970

J. B. AITKEN

3,534,513

COLLAPSIBLE BUILDING UNIT

Filed Jan. 21, 1969

3 Sheets-Sheet 3

FIG. 8

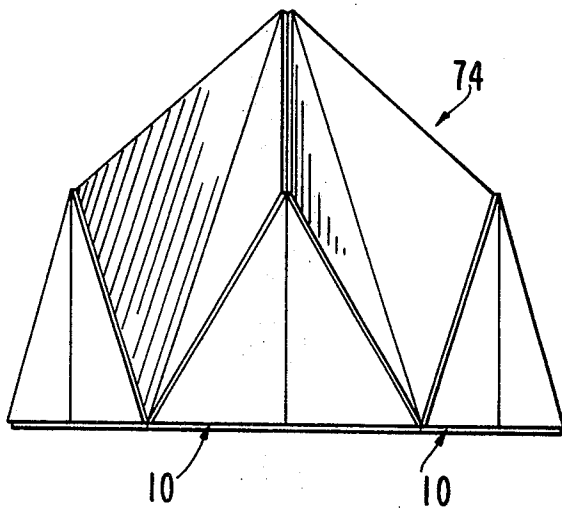


FIG. 6

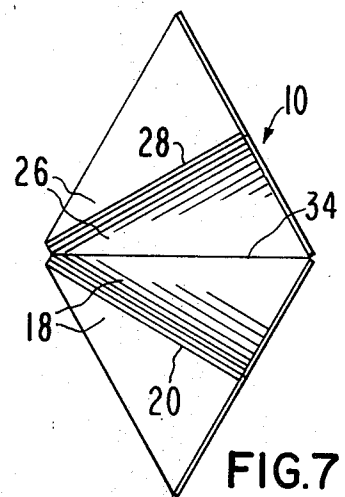
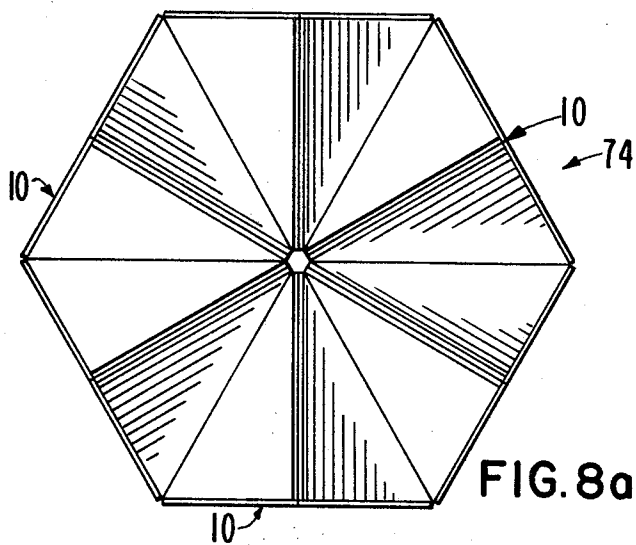
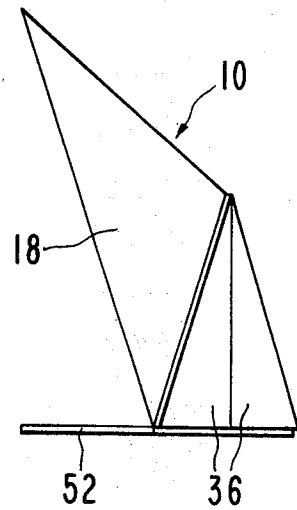
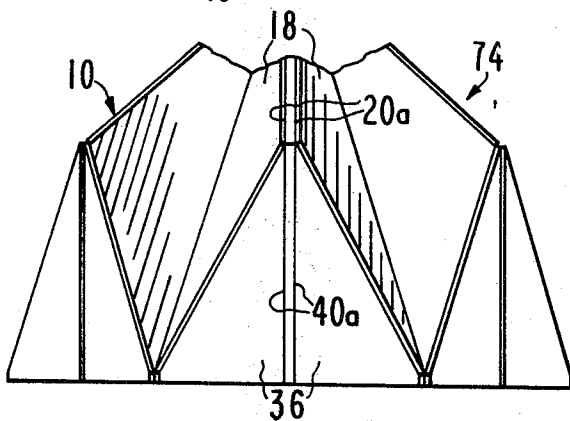


FIG. 9



INVENTOR.
JAMES B. AITKEN
BY *Townsend and Townsend*
ATTORNEYS

1

2

3,534,513

COLLAPSIBLE BUILDING UNIT

James B. Aitken, Walnut Creek, Calif., assignor to
Instant Structures, Inc., Albany, Calif.

Filed Jan. 21, 1969, Ser. No. 792,681

Int. Cl. E04b 1/344; E04h 1/12

U.S. Cl. 52—70

13 Claims

ABSTRACT OF THE DISCLOSURE

A building unit comprised of a number of hingedly interconnected roof sections, floor sections and sidewall panels forming a unitary, open shell construction wherein the floor sections are hinged to the bottom margins of respective sidewall panels and the roof sections are hinged to side margins of corresponding sidewall panels. The sections and panels can be moved from collapsed positions with the sections and panels substantially parallel with each other to expanded positions with the roof sections overlying the floor sections and the sidewall panels extending upwardly from the floor sections to the roof sections. The building unit can be used by itself, or as a part of an enclosed building.

This invention relates to improvements in portable and collapsible buildings and, more particularly, to an improved building unit having an open shell configuration.

The present invention provides an improvement for the invention set forth in copending patent application Ser. No. 747,215 filed July 24, 1968, and entitled Portable Building Construction. In that disclosure, a collapsible enclosure or building is described wherein a collapsible roof and a collapsible floor are interconnected and cooperate with each other in a manner to move together from a collapsed condition with the floor and roof panels in generally parallel, side-by-side relationship to an expanded condition with the roof sections overlying the floor sections to form, except for a number of outer peripheral openings, an enclosed building. The openings can be closed by sidewall means, if desired.

The present invention provides an improvement on the invention disclosed in the above pending application by providing a part of a building of the type described. To this end, the present invention, in its expanded condition, forms a unitary building unit which, when mated with other building units of the same type, can form an enclosed building of the type set forth in the above application. The building unit has an open shell-like configuration which is suitable for use as a shelter if the building unit is to be used by itself.

The essential difference between the building unit of the present invention and the building of the above pending application resides in the way in which the floors of the two inventions are connected to the roof sections. In the application, the floor sections are described as being hinged to the roof sections at spaced points about the outer periphery and lowermost extremities of the building. The floor, therefore, defines the means by which the roof is stabilized and maintained against further collapse. The stabilizing character of the floor is provided by the interconnection of the various floor sections, such interconnection being achieved by hinge means extending into the center of the building to thereby provide a spider-like construction for maintaining the rigidity of the building in its expanded condition.

The present invention, on the other hand, utilizes floor sections which are hingedly connected to the bottom margins of corresponding sidewall panels rather than to the lowermost extremities of the roof sections. In this way, the floor sections can be moved into proximity to the side-

wall panels before the roof sections and sidewall panels are collapsed to thereby facilitate the complete collapse of the building unit. The building unit can also be readily expanded by the use of this construction since the roof sections and sidewall panels can first be expanded before the floor sections are moved into their operative positions.

In its collapsed condition, the building unit is compact and structurally rigid to facilitate storage and transit and to withstand rough handling. The various panels and sections thereof can be of lightweight, rigid construction to facilitate handling. The construction of the building unit is such that any suitable hinge structure can be used and single and double hinge lines can be provided depending upon the size and the strength characteristics which the building is to have. The panels and sections can be of any suitable construction and may be made from relatively inexpensive materials to minimize production costs.

The primary object of this invention is to provide a collapsible building unit having an open shell-like configuration and capable of being used by itself as a shelter or the like or as a part of an enclosed building when it cooperates with other building units of substantially the same configuration.

Another object of this invention is to provide a collapsible building unit having hingedly interconnected roof sections, floor sections and sidewall panels wherein the floor sections are coupled to the sidewall panels to facilitate expansion and collapse of the building unit and to provide a coupling between the floor sections and roof sections which does not depend upon connection between the roof and floor sections at their junction points.

A further object of this invention is to provide a building unit of the type described wherein the various sections and panels are movable from collapsed positions in substantial parallelism with each other to expanded conditions wherein the roof sections overlie the floor sections and the sidewall panels close one side of the building unit.

Another object of the invention is to provide a building unit of the aforesaid character wherein the building unit is simple and rugged in construction and capable of withstanding rough handling when it is collapsed and expanded and is sufficiently compact when collapsed to facilitate storage and transit thereof.

Other features and advantages of the present invention will become apparent as the following specification progresses, reference being had to the accompanying drawings for a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a perspective view of the building unit of this invention when the same is expanded;

FIG. 2 is a front elevational view of the building unit;

FIG. 3 is a fragmentary, cross-sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is an end elevational view of the building unit when it is collapsed;

FIG. 5 is a side elevational view of the collapsed building unit;

FIG. 6 is a side elevational view of the building unit;

FIG. 7 is a top plan view thereof;

FIG. 8 is an elevational view of a building formed from three of the building units;

FIG. 8a is a top plan view of the building of FIG. 8; and

FIG. 9 is a view similar to FIG. 8 but showing a building unit having a double hinge line at certain locations thereon.

The building unit of the present invention is broadly denoted by the numeral 10 and includes a roof portion 12, a pair of sidewall portions 14 and a floor portion 16. The various portions of the building unit are hinged to-

gether so that the building unit can be alternately collapsed and expanded. In FIG. 1, the building unit is expanded to form an open shell-like configuration and the building unit can be used by itself as a shelter or the like or it can be used as a part of a building in the manner shown in FIGS. 8 and 8a. FIGS. 4 and 5 illustrate the configuration of the building unit when the latter is collapsed. In the latter condition, the various portions thereof, which will generally comprise flat, panel-like structures, will be in substantial parallelism with each other and in side-by-side relationship to form a compact, rugged construction of sufficient structural rigidity to withstand rough handling.

Roof portion 12 includes first and second pairs of roof sections 18 and 26 of generally triangular construction. The upper, inclined, juxtaposed edges of room sections 18 are hinged together to form an inclined hinge line 20 which permits movement of roof sections 18 from the angularly disposed, expanded positions shown in FIGS. 1 and 2 to the substantially parallel, collapsed positions shown in FIG. 4. Each roof section 18 has a pair of angularly disposed side edges 22 and 24 which diverge as they approach the ends of the upper, inclined edge.

Roof sections 26 are substantially identical to roof sections 18 and have upper, inclined, juxtaposed edges which are hinged to form an inclined hinge line 26. Roof sections 26 collapse and expand in the same way as roof sections 18 and each roof section 26 has a pair of angularly disposed side edges 30 and 32 which diverge as the upper, inclined edge is approached.

The inner roof section 18 is adjacent to and hingedly interconnected with the inner roof section 26 to present a hinge line 34 which is at the junction of the corresponding edges 22 and 30 of inner roof sections 18 and 26, respectively. In the expanded condition of the building unit, edges 22 and 30 of roof sections 18 and 26 are all inclined. Moreover, inner sections 18 and 26 are angularly disposed relative to each other in the manner shown in FIGS. 1 and 2. Moreover, the outer edges 22 and 30 of outer roof sections 18 and 26, respectively, define the side opening of the building unit which presents the open feature of the open shell-like configuration thereof. In this way, the building unit, when it is expanded, can be used as a shelter or the like with the roof portion 12 essentially overlying an area therebelow, such area being the same as that covered by floor portion 16 in a manner hereinafter described.

Sidewall portion 14 includes a pair of sidewalls which are used to close the openings defined by respective side edges 24 and 32 of roof sections 18 and 26. The sidewall corresponding to roof sections 18 includes a pair of generally triangular panels 36, each of which has a lower margin at edge 38 and a pair of inclined side edges 40 and 42 as shown in FIG. 1. Panels 36, when in their expanded positions are coplanar and substantially complementary to the corresponding opening defined by edges 24 of roof sections 18. In these positions of panels 36, edges 42 thereof are in juxtaposition relative to each other and edges 40 are in juxtaposition with and hinged to respective side edges 24 of roof sections 18. Thus, panels 36 can expand and collapse relative to roof sections 18. No hinge is needed at the junction between edges 42 of panels 36 because lowermost edges 38 of panels 36 are hinged to floor portion 16 in a manner to be described.

The sidewall corresponding to roof sections 26 includes a pair of generally triangular panels 44 which are substantially identical in configuration and size to panels 36. Each panel 44 has a lowermost marginal edge 46 and a pair of inclined side edges 48 and 50. Each side edge 48 is hinged to the adjacent side edge 32 of the corresponding roof section 26 whereby panels 44 can expand and collapse relative to roof sections 26. The lowermost edge 46 is hinged to floor portion 16 in a manner to be described. Thus, there is no need for a hinge at the junction between juxtaposed side edges 50.

Since the sidewalls are hinged to the roof sections, the

sidewalls are able to collapse and expand in response to the collapsing and expansion of the roof sections. When the sidewalls collapse, adjacent sidewall panels move from coplanar positions to side-by-side positions between the corresponding roof sections as shown in FIG. 4. The hinge means interconnecting each pair of roof sections corresponding to a sidewall is constructed so that the roof sections are separated when they are in their collapsed positions to form a space for receiving floor portion 16 in a manner to be described. The hinge means connecting the sidewall panels to adjacent roof sections is constructed so that the sidewall panels are substantially coplanar with respective roof sections, as shown in FIG. 4, when the roof and sidewall portions are collapsed.

Floor portion 16 comprises a pair of floor members 52 and 54 which correspond to roof sections 18 and 26, respectively, and underlie the same when the building unit is expanded, as shown in FIG. 1. Floor members 52 and 54 also correspond to respective sidewall panels 36 and 44.

Floor member 52 includes a pair of generally triangular floor sections 56 which form right triangles. Each floor section 56 has a first edge 58 which is hinged to the lowermost edge 38 of a respective sidewall panel 36 and second and third edges 60 and 62 which extend away from respective ends of edge 58 and converge toward each other. Edges 62 of floor sections 56 are hinged together and move from their expanded positions shown in FIG. 1 to collapsed positions with the bottom surfaces of floor sections 56 in face-to-face relationship. Floor member 52 can be collapsed after it has been pivoted into juxtaposition to the inner surface of the corresponding sidewall. At this location, the floor member can collapse with the sidewall, the sidewall panels moving outwardly and apart to form a space for receiving the floor sections 56, in the manner shown in FIG. 4.

Floor member 54 includes a pair of floor sections 64 which are substantially identical to floor sections 56. Each floor section 54 includes a first edge 66 hinged to the adjacent edge 46 of the corresponding sidewall panel 44 and second and third edges 68 and 70 which extend away from respective ends of edge 66 and converge toward each other. Also, edges 70 of floor section 64 are hinged together in the same manner as edges 62 of floor sections 56. Thus, floor sections 64 can be moved from expanded, substantially coplanar positions to collapsed, side-by-side positions between the adjacent sidewall panels 44 as shown in FIG. 4.

In the foregoing discussion, reference has been made to the various hinge lines between adjacent sections and panels. While the construction of the hinge means along each of these hinge lines has not been specified, any suitable hinge means can be utilized to perform a desired collapsing and expanding function. The hinge means disclosed in the above-mentioned copending patent application can be used as can other hinge means if deemed suitable for the intended purpose.

In use, building unit 10 will be assumed to be initially in a collapsed condition as shown in FIG. 4 wherein all of the roof sections 18 and 26 will be in substantial parallelism with each other with inner roof sections 18 and 26 and their corresponding sidewall panels 36 and 44 in juxtaposition to each other. Roof sections 18 are spaced apart from each other, as are roof sections 26, by a distance at least equal to the thickness of the corresponding, side-by-side floor sections 56. In the collapsed condition, sidewall panels 36 and 44 are substantially coplanar with respective roof sections 18 and 26 whereby panels 36 and 44 accommodate respective floor sections 56 and 64 in nested relationship therebetween.

FIG. 5 shows the side view of the building unit 10 in its collapsed condition and illustrates the relatively compact nature of the collapsed building unit. Moreover, the building unit is essentially structurally rigid when it is collapsed since there are no sections or panels which can

5

readily articulate relative to each other. This is due to the fact that the floor sections and sidewall panels form a stack with adjacent sidewall panels and floor sections in substantial engagement with each other.

When the building is to be expanded, the roof sections are separated from each other and the sidewall panels follow the movement of the roof sections until the sidewall panels are substantially coplanar with each other. When this occurs, the roof sections will be in their proper positions and will overlie a space to be covered by the floor sections. The floor sections of each floor member will be coplanar with each other and directly adjacent to the corresponding sidewall as shown in FIGS. 2 and 3.

The next step in expanding the building unit is to cause floor members 52 and 54 to be moved away from the corresponding sidewalls and downwardly about the hinge lines along the bottom edges of the sidewalls. In FIG. 2, floor member 52 is shown in full lines in a first position adjacent to and parallel with the corresponding sidewall. Floor member 52 is also shown in dashed lines in FIG. 2 when it is in a second position intermediate the first position and its expanded position. FIG. 1 shows each floor member in its operative position wherein it becomes substantially coplanar with the other floor member and extends laterally from the corresponding sidewall. The adjacent edges 60 and 68 of the inner floor sections 56 and 64, respectively, can then be connected together by suitable locking structure broadly denoted by the number 72 whereby the floor members releasably remain coplanar with each other.

In the expanded condition of building unit 10, it can be used by itself to form a shelter or the like. It also can be returned to its collapsed condition and returned to storage or to a new building site as desired. To collapse the building unit, the locking means 72 is released to allow the floor members to be pivoted back into positions adjacent to and parallel with the corresponding sidewalls, following which the roof sections are moved toward each other and into the collapsed positions thereof shown in FIG. 4. The sidewalls and floor members collapse and move into their respective, generally parallel positions with the collapsing of the roof sections.

Building unit 10 can also be used with two other substantially identical building units to form an enclosed building 74 (FIGS. 8 and 8a). Since the open shell-like configuration of building unit 10 defines a third of a hexagonal structure, it can be moved, when it is expanded, into mating relationship with the other two building units to form building 74. For this use, the three building units are brought together so that the roof portions and floor portions thereof mate together. Some suitable locking means can be provided to interconnect the three building units to render building 74 substantially unitary and structurally rigid. FIG. 8 shows a side elevation of a pair of building units 10 which are mated to form building 74. FIG. 8a shows a top plan view of building 74 comprised of the three building units 10.

FIG. 6 further shows one sidewall of the building unit with the sidewall panels thereof being substantially coplanar with each other. FIG. 7 shows the angularity between each pair of adjacent roof sections.

Building unit 10 can have hinge means providing a single hinge line at each location where a hinge is needed. It may be deemed necessary or desirable to use a double hinge line arrangement at certain of these locations. FIG. 9 illustrates how this can be done on each of a number of building units 10 which form building 74. To this end, a hinge structure providing a double hinge line is shown connecting each pair of adjacent sidewall panels. Also, each pair of adjacent roof sections corresponding to each sidewall has hinge structure providing a double hinge line. The adjacent floor sections of each floor member will also be provided with such hinge structure. Using this structure, the building unit collapses and expands

6

in the same manner as described above with single hinge line structure.

I claim:

1. A collapsible building unit comprising: a roof having first and second pairs of roof sections, each roof section being substantially triangular and having an upper edge and a pair of side edges, the upper edge of the roof sections of each pair being hingedly connected together, one of the side edges of a roof sections of one pair being hingedly connected to the corresponding side edge of a roof section of the other pair, the other side edges of the roof sections of each pair defining an opening, a sidewall for each opening, respectively, each sidewall comprising a pair of generally triangular panels, with each panel having a bottom edge and a pair of side edges, one side edge of each panel being hingedly connected to the other side edge of a respective roof section; and collapsible floor means hingedly connected to the bottom edges of the sidewall panels of each sidewall, respectively, said roof, said sidewalls and said floor means being movable from collapsed positions with the roof sections in side-by-side relationship with the sidewall panels and the floor means to expanded positions with the sidewall panels in closing relationship to respective openings and with said roof sections in substantially overlying relationship to the floor means.

2. A building unit as set forth in claim 1, wherein said floor means comprises a pair of floor sections for each sidewall, respectively, each floor section having a generally triangular configuration and an outer edge hingedly connected to the bottom edge of a respective sidewall panel.

3. A building unit as set forth in claim 2, wherein each floor section has a pair of side edges, one of the side edges of each floor section being hingedly connected to the corresponding side edge of the adjacent floor section.

4. A building unit as set forth in claim 1, wherein said roof sections are spaced apart when the same are in said collapsed positions to define a space for receiving the floor means.

5. A building unit as set forth in claim 1, wherein each roof section and the sidewall panel hingedly connected thereto are substantially coplanar with each other when the same are in said collapsed positions.

6. A building unit comprising: a roof having a plurality of sections, certain of the roof sections being adjacent to each other, the adjacent roof sections being hingedly connected together to permit the roof to be expanded and collapsed; a floor for underlying the roof when the latter is expanded and including a plurality of sections, there being a floor section for each roof section, respectively, a number of the floor sections being adjacent to each other when the floor underlies the roof, certain of said adjacent floor sections being hingedly connected together, each floor section having an outer peripheral margin; and means hingedly coupling the outer edge margin of each floor section to a respective roof section at a location to permit the adjacent sections to move into side-by-side relationship when the roof is collapsed to thereby cause collapsing of said floor.

7. A building unit as set forth in claim 6, wherein said coupling means includes a sidewall for each pair of hingedly connected floor sections, respectively, each pair of roof sections corresponding to a pair of hingedly connected floor sections having a side opening, each sidewall being hingedly connected to the adjacent roof sections for closing a respective side opening when the roof is expanded.

8. A building unit as set forth in claim 7, wherein each sidewall includes a pair of sidewall panels, there being a side wall panel for each floor section respectively, each floor section being substantially equal in size and configuration to the respective sidewall panel.

9. A building unit as set forth in claim 6, wherein

said coupling means includes a sidewall for each pair of hingedly connected floor panels respectively, each sidewall including a pair of sidewall panels, each panel having a side margin hingedly connected to a respective roof section and a bottom margin hingedly connected to the outer margin of a respective floor section.

10. A building unit as set forth in claim 6, wherein the roof sections corresponding to each pair of hingedly connected floor sections are spaced apart when the roof is collapsed, each pair of hingedly connected floor sections being movable from a location with said floor sections substantially coplanar to each other into the corresponding space in response to the collapsing of the roof sections and as said floor sections move into side-by-side relationship with each other.

11. A building unit as set forth in claim 6, wherein floor sections are substantially coplanar with each other when the floor underlies said roof.

12. A collapsible building unit comprising: a roof having four generally triangular roof sections including a pair of outer roof sections and a pair of inner roof sections between the outer sections, each roof section having an upper margin and a pair of side margins, the upper margin of each inner roof section being hingedly connected to the upper margin of an adjacent outer roof section, a first side margin of each inner roof section being hingedly connected to the corresponding side margin of the other inner roof section, whereby all of the roof sections are coupled together and the roof can move from an expanded position with adjacent roof sections being angularly disposed relative to each other to a collapsed position with the roof sections substantially parallel with each other, the second side margin of each inner roof section and the corresponding side margin of the adjacent outer roof section defining an outer side opening when the roof is in said expanded position; a sidewall for each side opening, respectively, each sidewall including a pair of generally triangular panels, each sidewall panel having a pair of side margins and a bottom margin, one side margin of each sidewall panel being hingedly connected to the second side margin of an adjacent roof section, the sidewall panels of each sidewall being substantially coplanar with each other and in closing relationship to the corresponding opening when the roof is in said expanded position; and a floor member for each sidewall respectively, each floor member including a pair of generally triangular floor sections with each floor section having a pair of side margins and an outer margin, a first side margin of one floor section of each floor member being hingedly connected to the corresponding side margin of the other floor member thereof, the outer margin of each floor section being hingedly connected to the bottom margin of a

respective sidewall panel, each floor member being movable from a first location with the floor sections thereof extending laterally from the respective sidewall to a second location with the floor sections in juxtaposition to the respective sidewall, said sidewall panels of each sidewall being movable in so spaced, substantially parallel relationship to each other and into substantially coplanar relationship with respective roof sections when said roof moves into said collapsed position, said floor sections of each floor member being movable from said second location thereof into the space between the sidewall panels of a respective sidewall when the roof is collapsed.

13. In a building unit: a pair of generally triangular roof sections, each roof section having an upper margin and a pair of side margins, the upper margins of the roof sections being hingedly connected together whereby the roof sections can be moved from expanded positions angularly disposed relative to each other to collapsed positions substantially parallel with each other, a first side margin of each roof section forming a side opening with the corresponding side margin of the other roof section; a sidewall for closing said opening, said sidewall including a pair of generally triangular sidewall panels, each panel having a side margin and a bottom margin, the side margin of each panel being hingedly connected to the first side margin of a respective roof section; and a floor section for each sidewall panel respectively, each floor section having an outer margin and a side margin, the outer margin of each floor section being hingedly connected to the bottom margin of a respective sidewall panel, the side margins of the floor sections being hingedly connected together, the floor sections being movable together from first locations underlying the roof sections when the latter are expanded to second locations adjacent to respective sidewall panels, the floor sections and the sidewall panels being movable together into substantial parallelism with each other as the roof sections move into their collapsed positions after the floor sections have been moved into said second positions.

References Cited

UNITED STATES PATENTS

1,912,502	6/1933	Stotzer et al.	52—70
2,670,986	3/1954	Presnell	52—71 X
3,016,115	1/1962	Harrison et al.	135—1 XR
3,332,178	7/1967	Foster	52—70
3,346,998	10/1967	Nelson	52—81 X

PRICE C. FAW, JR., Primary Examiner

U.S. Cl. X.R.

52—80