United States Patent

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[73] Assignee **Haskill H. Grodberg**

[54] **COLLAPSIBLE MULTI-STORY MOBILE HOME STRUCTURE**
9 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **52/66,** 52/79, 52/219, 52/236, 216/27
[51] **Int. Cl.** **E04b 7/16**
[50] **Field of Search** 296/23, 23.6, 26, 27; 52/64, 79, 66, 219, 70, 71, 236, 234

[56] **References Cited**

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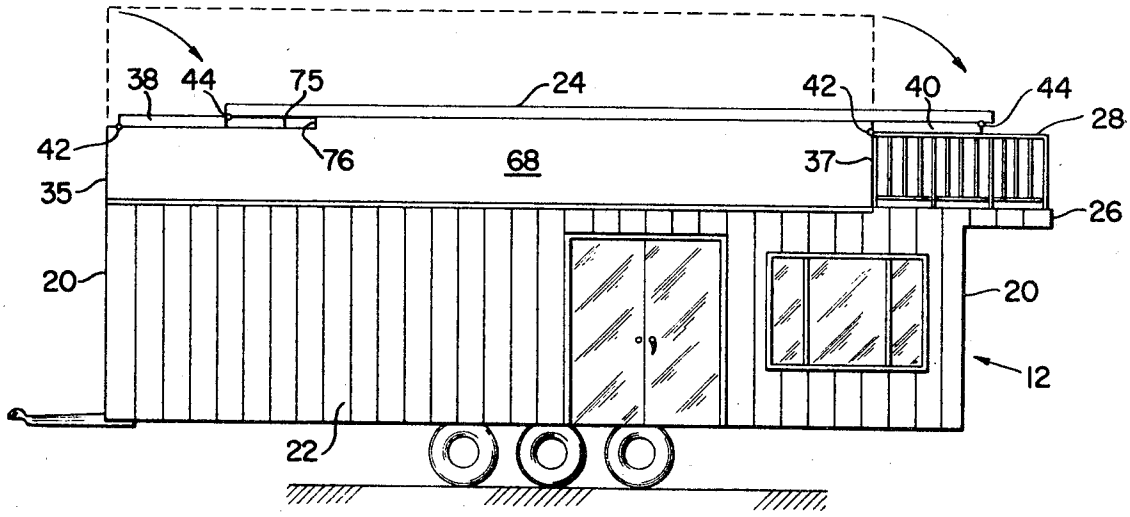
ABSTRACT: A mobile home structure typically including two sections which are joined together along a vertical plane extending longitudinally through the structure matching doorway and common wall portions of each section. Each section includes a foldable second level portion having a roof which is pivotally attached to be raised and lowered on two hinged opposite wall portions. The foldable portion of the second level has removable sidewall panels adapted to be inserted between the roof and a fixed lower portion of the sidewall, with one of the sidewall panels being dimensioned to interlock against longitudinal movement.



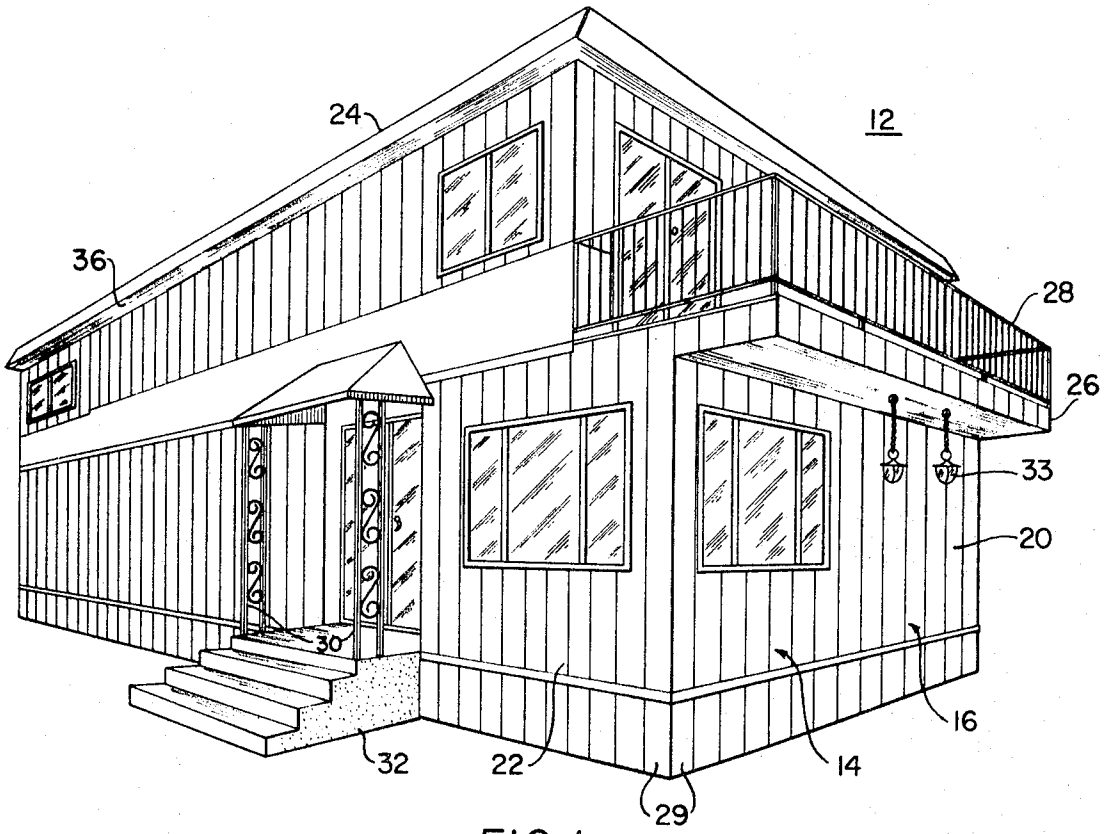


FIG. 1

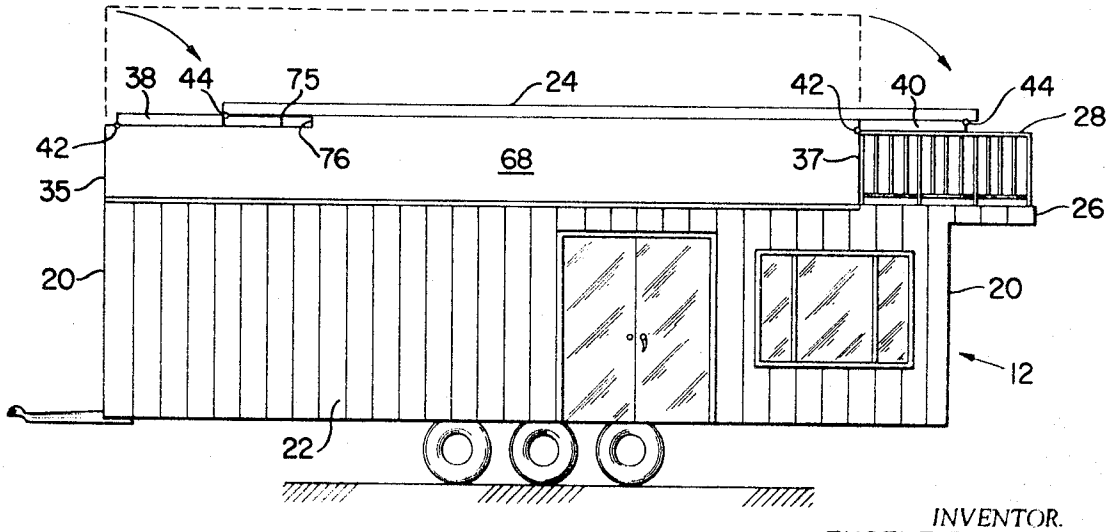


FIG. 2

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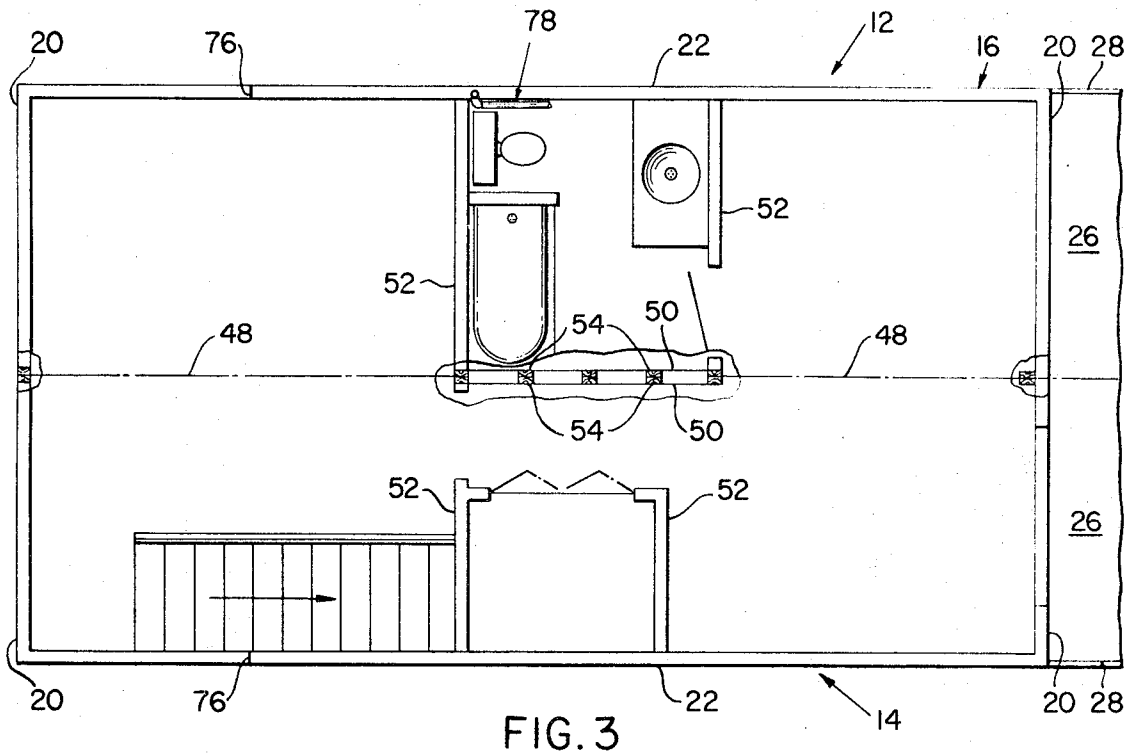

FIG. 3

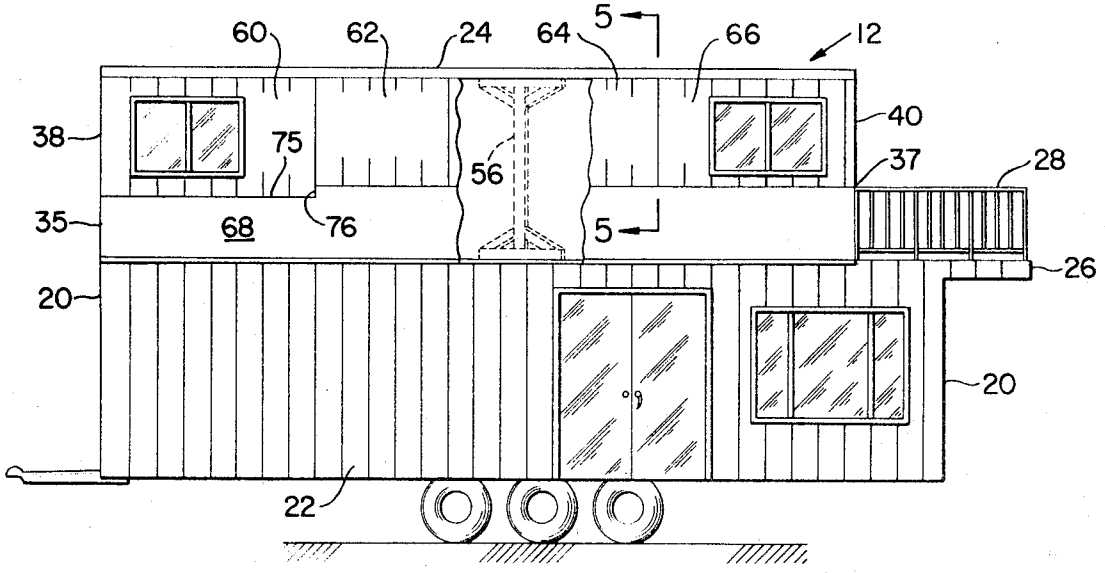

FIG. 4

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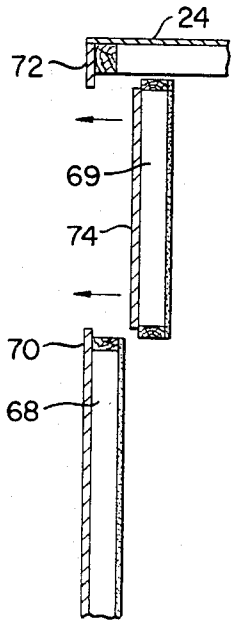

FIG. 5

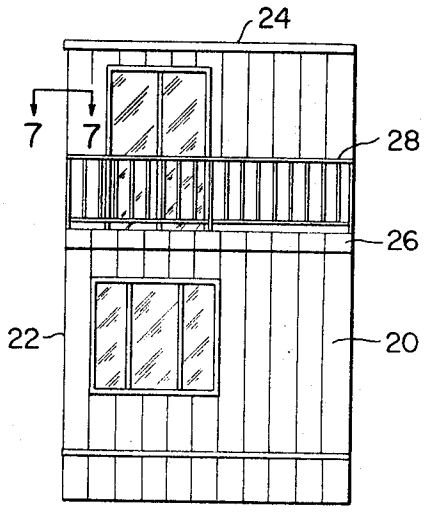

FIG. 6

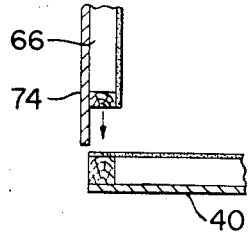

FIG. 7A

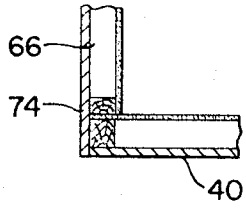

FIG. 7B

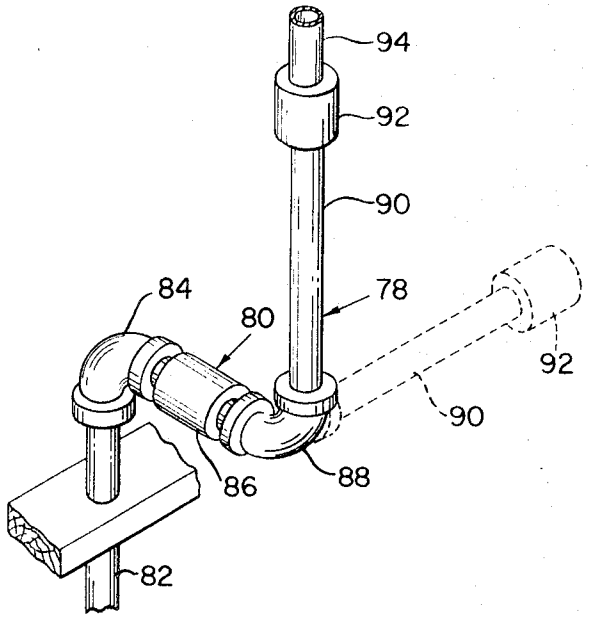

FIG. 8

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COLLAPSIBLE MULTI-STORY MOBILE HOME STRUCTURE

BACKGROUND OF THE INVENTION

This invention relates generally to mobile home structures and relates more particularly to a collapsible multistory mobile home structure.

In view of the size limitations placed on vehicles which are permitted to use the highways and streets, it is not feasible to manufacture large mobile home structures unless their overall dimensions can be reduced during transportation. Heretofore, many techniques have been used to reduce these overall dimensions. These techniques include, for example, expandable and telescoping sidewalls, matching half sections, folding walls, telescoping and otherwise raisable roofs, and disassemblable walls and roof sections.

SUMMARY OF THE INVENTION

A general object of the invention is to provide a multistory mobile home structure.

Another object of the invention is to provide a multistory mobile home structure having a foldable roof portion to permit transportation with standard highway clearances.

Other objectives of this invention can be attained with a provision of a mobile home having two complementary sections which are joined together along one wall of each section to form doorways and a common wall between the section. The common wall studs are oriented so that the width dimension is parallel to the plane of the common wall and are positioned in the common wall of each section so that each stud in one common wall is adjacent or contiguous with a stud in the other common wall section to form coacting pairs of studs when the two sections are connected together, for added structural strength and support of the roof when it is in the lowered position.

The second story of each section includes a foldable roof which is hingedly connected to the top edges of two further hinged end wall sections. When in the folded or lowered position the roof and end wall sections are supported by the top edges of a fixed lower sidewall, fixed lower interior walls, and a porch railing. When the roof is raised as the result of a vertical force being applied to even a single pressure point, the roof and the hinged end wall sections form a parallelogram with the force required to unfold and raise the roof decreasing as the roof rises. After the roof is fully raised to form a rectangle and temporarily supported with a minimum of one vertical brace, rectangular sidewall and interior wall panels are inserted between the top edges of the fixed lower sidewalls and fixed lower interior wall and the lower surface of the roof to form planar walls. One panel of each sidewall is dimensioned to interlock the end walls and the other sidewall panels against longitudinal movement or pivoting. In addition, such structural features as collapsible or telescoping plumbing vents are included in the wall panels.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention may be obtained from a consideration of the following detailed description, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a multilevel expandable home structure in accordance with the invention, showing the structure in its fully unfolded, expanded, and assembled state;

FIG. 2 is a side elevation view of the mobile home of FIG. 1 showing the upper level and roof portion in a folded or lowered position;

FIG. 3 is a top plan view, partially cut away, illustrating the floor plan of the upper level of the mobile home of FIGS. 1 and 2 with the upper wall sections and roof removed;

FIG. 4 is a side elevational view of the mobile home structure of FIGS. 1—3 illustrating the upper level and the roof in the raised position with the removable sidewall panels inserted therein;

FIG. 5 is a partial sectional view taken through the plane 5–5 of FIG. 4, illustrating the manner in which a removable wall panel is inserted between the fixed wall portion and the roof;

FIG. 6 is an elevational view of one end of a single unit, included to show the position of the sectional views of FIGS. 7A and 7B;

FIGS. 7A and 7B are sectional views taken along the line 7–7 of FIG. 6 and showing the interlocking of wall panels at a corner of the upper level; and

FIG. 8 is a perspective view of a pivoted action plumbing vent which is used in the mobile home structure of the invention.

Referring now to the drawings in more detail, FIG. 1 illustrates an assembled, two-level mobile home structure 12 in which two matching half sections 14 and 16 are joined along a vertical plane extending longitudinally therethrough to form a structure having end walls 20, sidewalls 22 and a roof 24. When so joined in this fashion, the juncture line is unnoticeable as it is covered by masking trim and decoration, both inside and outside. As will be explained in more detail subsequently, removable wall panels have been inserted in the upper level sidewalls to form the planar sidewalls 20. In addition, a partially cantilevered porch 26 is constructed on the upper level and includes a railing 28 which extends around the porch's perimeter for conventional purposes of constraint and also to support the folding portion of the upper level when folded down for transport, as will be explained in more detail with reference to FIG. 2. In addition, the structure may include siding skirts 29, trim 30, an entry porch 32, outside lights 33 and eaves 36 as indicated.

Referring now to the structural details of the depicted mobile home structure, FIG. 2 illustrates the mobile home 12 in a folded or collapsed position wherein the height of the structure is significantly reduced to accommodate the limited clearances of highway transport. Structurally, the two end walls 20 of the structure include fixed lower wall sections 35 and 37 which extend vertically from the floor and upper portions or sections 38 and 40 which are pivoted or hingedly connected to the roof 24 and the fixed lower wall sections 35 and 37 respectively. Both of these fixed lower wall sections 35 and 37 are generally rectangular and have substantially the same vertical dimension; and both of the hinged upper wall sections 38 and 40 are rectangular and have substantially the same dimensions. Hinges 42 are fastened between the upper edge or plate of the fixed lower end wall sections 35 and 37 and the lower edge or plate of the upper end wall sections 38 and 40. These hinges 42 can be a double leaf hinge which extends the entire length of the end wall sections, can be a plurality of individual hinges, or can be other conventional pivot devices. Screws or other types of fasteners can be used to secure the hinges to the end wall sections and the roof.

The roof 24 is hingedly fastened to the upper edges of the upper end wall sections 38 and 40. More specifically, hinges 44 are fastened to the upper edges of the upper end wall sections 38 and 40. More specifically, hinges 44 are fastened to the upper edge or plate of the upper end wall sections 38 and 40 and to the lower surface and toward the ends of the roof 24, such as by screws or other types of fasteners as indicated above. The distance between the connection centers of the two upper hinges 44 to the roof is equal to the distance between the lower hinges 42 or the distance between the two end walls. Furthermore, the lower hinges 42 are oriented to pivot in a first direction and the upper hinges 44 are oriented to pivot in the opposite direction. As a result, the upper end wall sections 38 and 40 and the roof 24 form a portion of a parallelogram with one another.

When the roof is in its folded or lowered position, it rests or is otherwise supported upon the top edges or plates of a fixed lower wall portions located between the end walls 20. That portion of the roof and upper end wall section which folds out-

ward and extends beyond the fixed lower end wall section is supported by the top edge of the railing **28** on the porch **26** when fully folded.

Before proceeding further with the detailed description of the folding roof, reference is made to the floor plan of the upper level illustrated in FIG. 3. As previously stated, the mobile home **12** includes the first matching section **14** and the second matching section **16** which are joined together along a vertical plane which extends longitudinally through the structure. The two sections are transported as separate units to accommodate the width restrictions on highway vehicles. Additional sections may be installed to provide even more space in the finished home. In addition to the end walls **20** and the sidewalls **22**, each section includes matching doorway openings (not shown in the depicted plan), room openings **48** and common walls **50** along the plane between sections **14** and **16**, thereby dividing the interior of the structure. Similarly, the lower level (not shown) includes openings and common wall portion along the plane between the two sections. In addition other interior walls **52** are constructed to form other rooms.

Referring to the common wall section **50** (FIG. **3**) in more detail, studs **54** are shown therein which are substantially rectangular, such as standard 2×4 wood members, and oriented with their width dimension or surface substantially parallel to the vertical plane between the two sections **14** and **16**. In addition, the spacing between studs **52** and their locations are such that when the two sections **14** and **16** are joined together, two studs, one in each section, are positioned contiguous to one another so that they effectively form a coacting wall stud which is twice as thick as a single stud. In other words, they effectively form a 4×4 stud for vertical support. Consequently, additional structural strength can be attained. However, when the units are separated for transport, one-half the partition is retained with each unit for added support of the folded-down roof. As will be explained in more detail shortly, the common walls **50** and the interior walls **52** located between the end walls **20** include a fixed lower section which is rigidly fastened to extend vertically from the floor and includes removable upper panels which can be removed to effectively reduce the height of the walls so that the roof **24** can be lowered to the position illustrated in FIG. **2**. In addition the top edge of the fixed lower portions of the common walls **50** and the interior walls **52** support the roof **24** when it is folded.

Referring now to FIG, **4**, when the roof **24** is fully raised, it and the upper end wall sections **38** and **40** form a substantially rectangular structure with the fixed lower portions **35** and **37** of the end walls **20**, the second level's floor, and the sidewalls **22**. It should be noted that when the roof **24** is unfolded or raised, the hinged upper sections **38** and **40** of the end walls **38** and **40** are positioned directly over the fixed lower end wall portions **35** and **37** respectively. Thus, no shear force is exerted on the hinges **42** or **44** (FIG. **2**). In addition the substantially flat surface or plates of the two sections of the end walls provide some restraint against pivotal motion to prevent the roof **24** and the end wall sections **38** and **40** from folding back down.

It should be noted that the roof **24** can be raised with a vertical force applied to a minumum of one pressure point thereof and that the roof can thereafter be temporarily supported by a single vertical brace **56** having a horizontal base and a horizontal arm attached to its upper end. Use of the brace for support is only appropriate while the roof is being raised or lowered and while the removable sidewall and partition panels are being inserted or removed. Ideally, when the brace **56** is in place, it will cause the roof **24** to be deflected slightly upward so that the distance between the roof's lower surface and the upper edge of a fixed lower wall portions is slightly greater than the vertical dimensions of the removable wall panels **60** through **66**, thus permitting ready insertion or removal of the panels.

The removable sidewall panels **60** through **66**, which are slidably inserted between the top edge of a fixed lower sidewall portion **68** and the lower surface of the roof **24** illustrated in FIG. **4**, are substantially rectangular. The siding **70** of the fixed lower sidewall portion **68** (see FIG. **5**) is constructed to project above the top surface or plate of the fixed wall. In addition, the roof **24** similarly has a siding **72** which extends down below the lower surface of the roof. Each of the removable sidewall panels **60** through **66** has a substantially flat lower edge and upper edge which contacts the upper edge of the fixed lower sidewall portion **68** and the lower surface of the roof **24** respectively when the removable panels are inserted in place. The outer surface of the removable wall panels has siding **74** fastened thereto. The siding **74** is dimensioned vertically less than the height of the removable panel so that when the removable wall panels are inserted in place the siding **74** will match with the projecting portions of siding **70** and **72** to form a unitary wall in lap-butt construction. The projecting portions of the sidings **70** and **72** also serve to prevent the removable wall panels such as **64** from being inserted too far by effectively stopping them when the siding surface and the interior wall surfaces are planar. In addition, as indicated in FIGS. 7A and 7B, which are sections taken along the line **7–7** of FIG. **6**, when the removable wall end panels such as **66** are inserted in place, they are slid longitudinally so that the endmost wall panels **60** and **66** are positioned with the outermost vertical edges abutting the interior edge of the hinged upper end wall sections such as the section **40**, as is illustrated in FIG. 7B.

It should be further noted with reference to FIGS. 7A and 7B that the siding **74** on the two endmost removable panels such as **66** is wider than the panel and projects beyond one end. As a result, siding **74** lap-butts the side edge of the upper end wall portion **40** to hold the panel **66** in place and to match with the siding **72** and **74** (FIG. **5**).

In order to interlock the removable wall panels against longitudinal motion and thus provide added rigidity to the collapsible structure when it is extended for use, an end one of the removable wall panels **60** is dimensioned larger than the other wall panels. In addition, the top edge of a complementary portion **75** of the fixed sidewall **68** is stepped or dimensioned lower than the remaining top edge of the fixed sidewall to form a larger opening which receives the larger removable wall panel **60**. As a result of the vertical abutment **76** (best shown in FIG. **4**) the entire set of removable sidewall panels **60** through **66** is interlocked in place and prevented from moving longitudinally in one direction whereupon the upper end wall sections **38** and **40** cannot be pivoted to lower the roof **24**. It should also be noted (see FIG. **2**) that the stepped portion **75** of the fixed sidewall **68** will support the upper end wall section **38** when the roof **24** is fully lowered.

The interior walls **50** and **52** (FIG. **3**) located between the end walls **28** and the sidewalls **22** are constructed similarly to the sidewalls **22** in that they include a fixed lower portion and removable wall panels. The removable wall panels for the interior walls are also substantially rectangular and are similarly inserted between the top surface of the fixed wall portions and the lower surface of the roof **24**. Thus, when all of the removable wall sections or wall panels are in place, the braces such as **56** are removed and the roof **24** lowers to rest upon the walls and partition. As a result, all of the weight of the roof is supported vertically through the wall sections, including the end walls **20** the sidewalls **22** and the interior walls **50** and **52** and the porch railing **28**; and the entire folded structure is held in place by friction and its own weight.

With the collapsible roof structure as described, some provision is needed for a plumbing vent to accommodate the change of roof position from folded to extended. A plumbing vent **78**, illustrated in detail in FIG. **8**, extends vertically through an upper level wall of the structure to the roof **24**. For example, as illustrated in the plan view of FIG. **3**, the plumbing vent **78** extends vertically upward through the outside wall **22** of the section **16** and then into the bathroom so it can be raised or lowered as needed as the roof is raised or folded. The plumbing vent **78** can be pivoted about a horizontal axis next to a first elbow **84** by means of a sealable coupling **80** illus-

trated in FIG. 8. More specifically, a vertical vent pipe 82 is fastened to a 90° elbow 84. The coupling 80 provides a pivotal seal joining the pipe portions between the elbows 84 and 88. The other end of the elbow 88 is connected to a section of vent pipe 90, which in turn has another sealable coupling member 92 secured to its other end. A slidable pipe 94 is inserted in the coupling 92 for extending through the roof 24. This section of vent pipe 90 and the coupling 92 can be raised and lowered by rotating it about the horizontal axis of the sleeve 86. For example, when the vent pipe is assembled as shown in solid outline in FIG. 8, it is in the vertical upright position and the additional section of vent pipe 94 is slid out of the coupling 92 to extend up through the roof 24. When, however, the roof is to be folded, the upper section of vent pipe 94 is retracted and the section of vent pipe 90 is rotated to its lowered position, as illustrated by the broken outline.

Although there have been described hereinabove a specific arrangement of a collapsible multistory mobile home structure in accordance with the invention for the purpose of illustrating the manner in which the invention may be used to advantage, it should be readily apparent that the invention is not limited thereto. Accordingly, any and all modifications, variations, or equivalent arrangements falling within the scope of the annexed claims should be considered to be a part of the invention.

I claim:

1. A mobile home structure comprising:

a first and a second end wall, each including a fixed lower portion and an upper portion pivotally connected to said lower portion;

fixed lower wall means located between said first and second end walls;

roof means pivotally attached to said upper end wall portions of said first and second end walls, said roof and said end walls being operable to be folded between a lowered position and a raised position forming a parallelogram in a raised position; and

wall panel means for being inserted between a top surface of said fixed wall portions and a lower surface of said roof; one end of said structure further including a porch having a railing thereon, the railing being operable to support a portion of the roof and an upper end wall portion when folded.

2. The mobile home structure of claim 1 comprising side by side units adapted to be transported separately and further including separable partition sections for being joined together along a vertical plane extending longitudinally through the structure to form a central interior partition common to both units when joined together, the partition sections having studs each spaced and located therein to be contiguous a stud in the other section when the partition sections are joined together.

3. The mobile home structure of claim 2 in which said studs are of a substantially rectangular cross section with the longer cross section dimension being oriented parallel to the longitudinal vertical plane.

4. A multistory structure having a roof adapted to be lowered for purposes of transport or the like comprising;

an upper story having walls and interior partitions with distinct upper and lower portions, the upper portions of the sidewalls and partitions being divided into sections and removable from the respective lower portions; and

hinged fastening means connecting the upper portions of the end walls to the end wall lower portions and to the roof, respectively, the hinged fastening means being adapted to permit the respective upper end wall portions to pivot about the lines of connection with the respective lower end wall portions as the opposite legs of a collapsing parallelogram to lower the roof to a position of rest on the lower portions of the sidewalls and partitions.

5. A multistory structure in accordance with claim 4 wherein at least one of the lower sidewall portions has a recessed section and at least one of the removable upper sidewall sections is dimensioned to fit the recessed section in order to lock the hinged upper end wall sections and roof against collapse.

6. A multistory structure in accordance with claim 5 wherein the recessed section is at the end of the lower sidewall portion so that the upper wall section dimensioned to fit therein abuts against the adjacent end wall portion when it is installed in place.

7. A multistory structure in accordance with claim 4 further including siding positioned along the sides of the roof and the upper edge of the lower sidewall portions in overlapping juxtaposition to restrain the upper sidewall sections from falling outward during installation, the upper sidewall sections having siding positioned thereon so as to matingly engage the overlapping siding of the roof and lower sidewall portions.

8. A multistory structure in accordance with claim 4 wherein the end sections of the upper sidewall portions are provided with exterior siding extending beyond the ends of said sections so as to cover the ends of the end wall hinged portions when the sidewall sections are installed.

9. A multistory structure in accordance with claim 4 further including a plumbing vent for extending above the roof when in the raised configuration, the plumbing vent having a pivotable section comprising a pair of elbows and a rotatable, sealing joint in a substantially horizontal section connected between the elbows, the first of the elbows being connected to a portion of the vent fixed in position within the portion of said structure below the line between the upper and lower portions of the walls, and the second of the elbows being connected to an extension which is rotatable with the second elbow about the rotatable joint between a lowered, substantially horizontal position when the roof is lowered and a raised, substantially vertical position when the roof is raised.