United States Patent [19]

Laue

[11] **3,768,855**

[45] **Oct. 30, 1973**

[54] **COLLAPSIBLE AND EXPANDABLE ENCLOSURE**

[76] Inventor: **Jay H. Laue**, 803 Mira Vista Dr. S.E., Huntsville, Ala. 35802

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[52] **U.S. Cl.** **296/27**, 52/66

[51] **Int. Cl.** **B60p 3/34**

[58] **Field of Search** ..... 296/23 R, 23 F, 23 G, 296/27; 52/66

[56] **References Cited**

UNITED STATES PATENTS

3,632,153	1/1972	Knudsen	296/23 R
3,363,932	1/1968	Mann	296/23 R

Primary Examiner—Philip Goodman
Attorney—John W. Malley et al.

[57] **ABSTRACT**

A collapsible and expandable enclosure is made of rigid panels. Two rectangular panels form the top and bottom. Other panels form side and end walls of sectional construction. The end walls are in two upper and lower rectangular sections which are hinged to each other on a horizontal axis and also to the end edges of the top and bottom. The side walls are in six sections, three upper and three lower. The center side wall sections are trapezoidal in shape and are hinged to the side edges of the top and bottom. The end side wall sections are in the shape of isosceles triangles and are hinged to adjacent end wall sections and also to adjacent center side wall sections. In the collapsed condition of the enclosure all the end and side wall sections are folded inwardly between the top and bottom. In the expanded condition the wall sections unfold outwardly, with the side wall sections being pulled outwardly automatically by their hinged connection with the end wall sections until the three upper and three lower side wall sections abut along a horizontal parting line.

18 Claims, 22 Drawing Figures

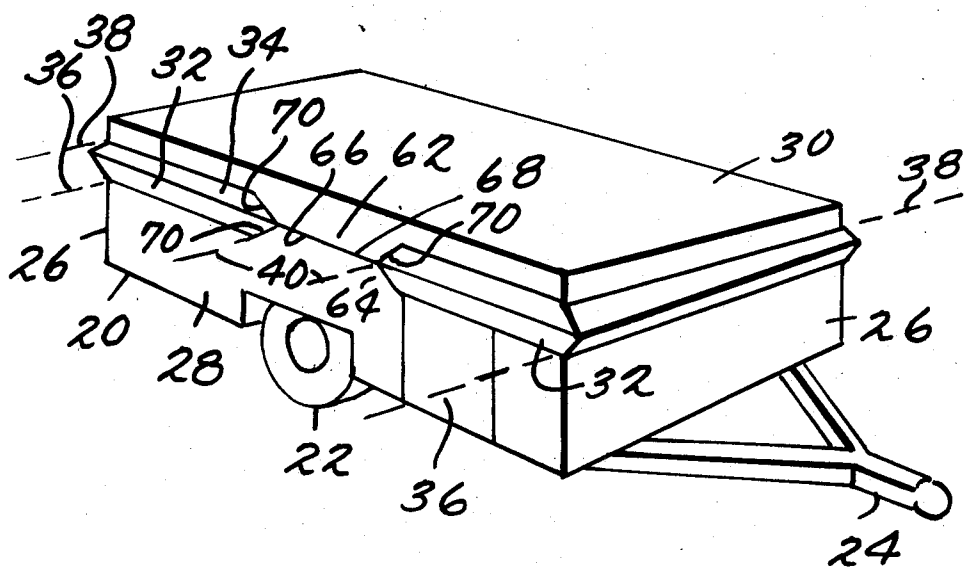
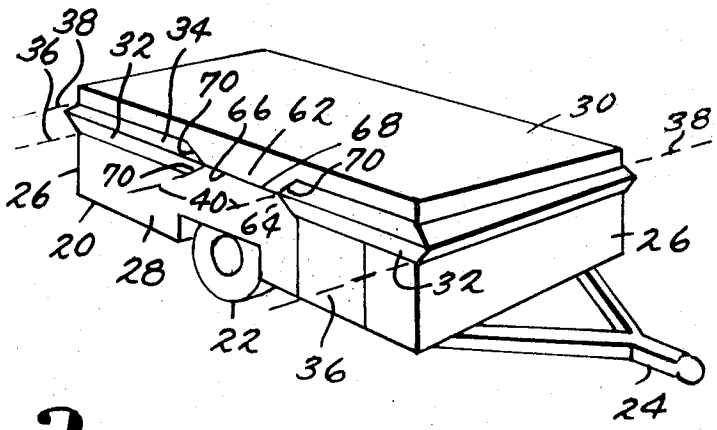


Fig. 1.



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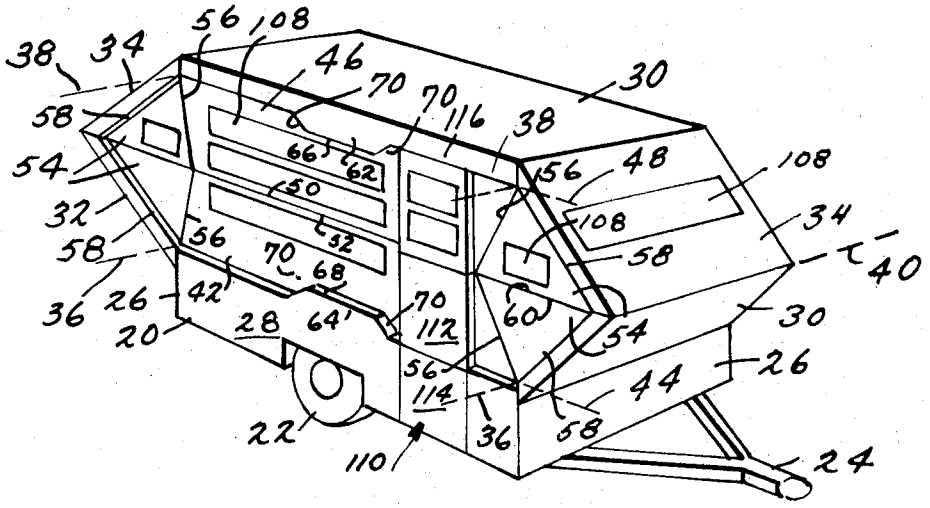

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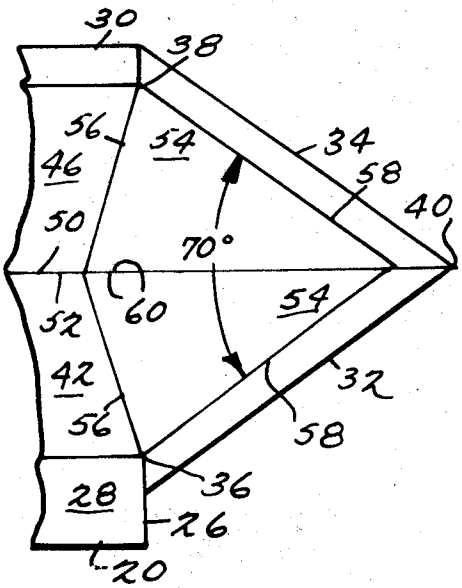
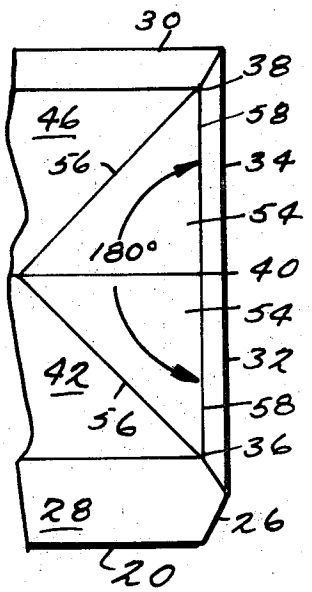


Fig. 10.



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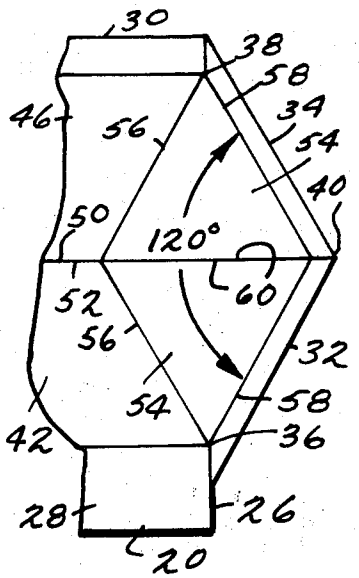
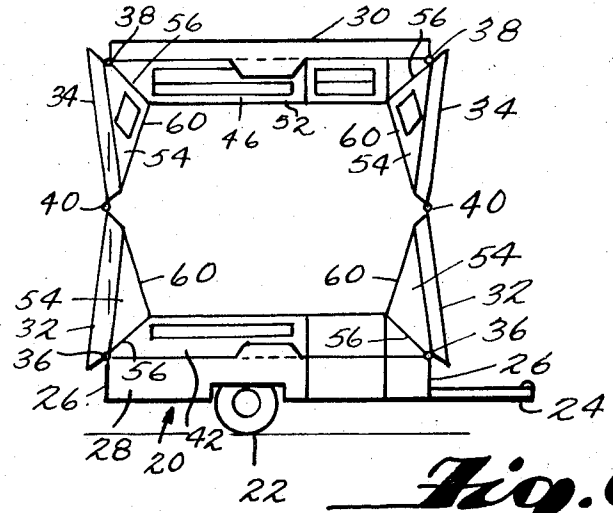


Fig. 5.



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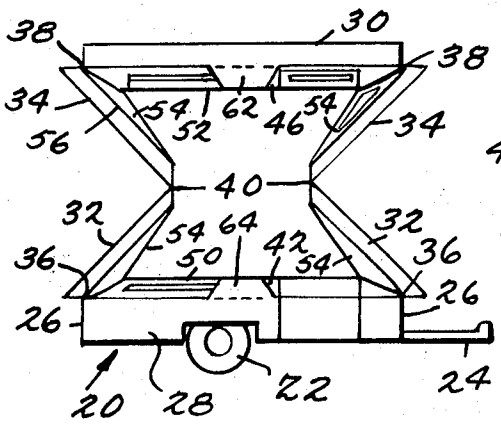


Fig. 6.

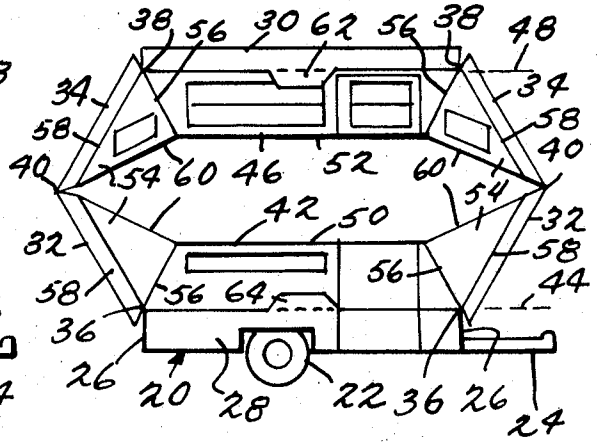
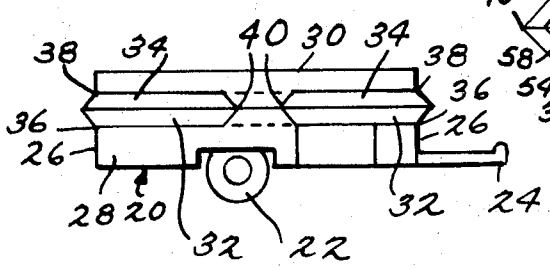


Fig. 7.

Fig. 3.



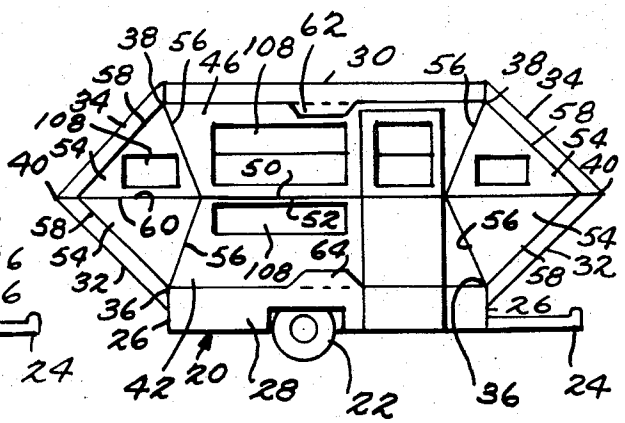
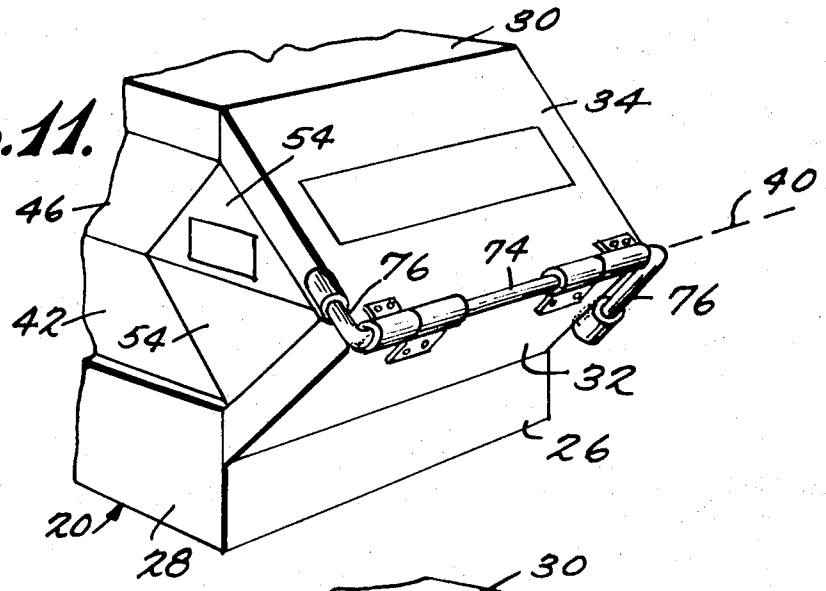


Fig. 11.



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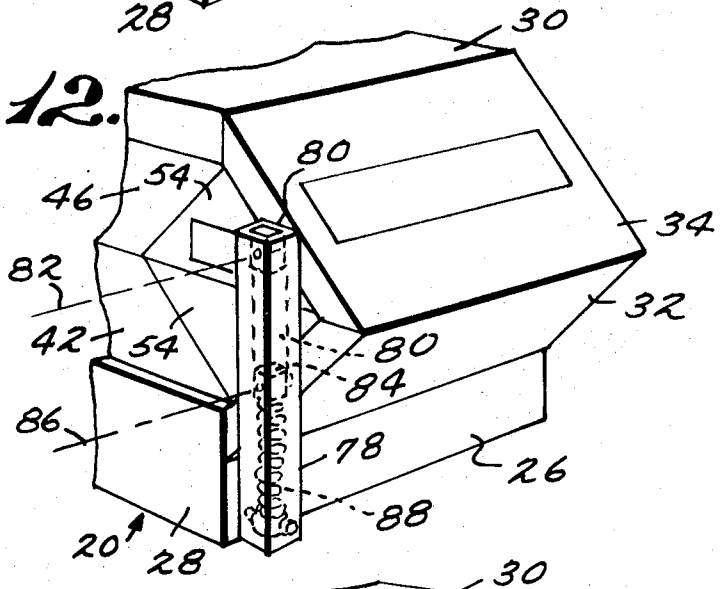

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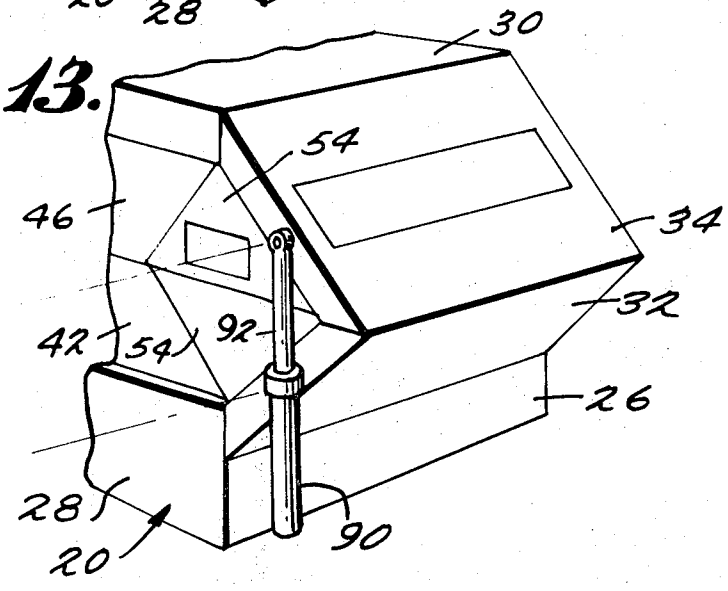

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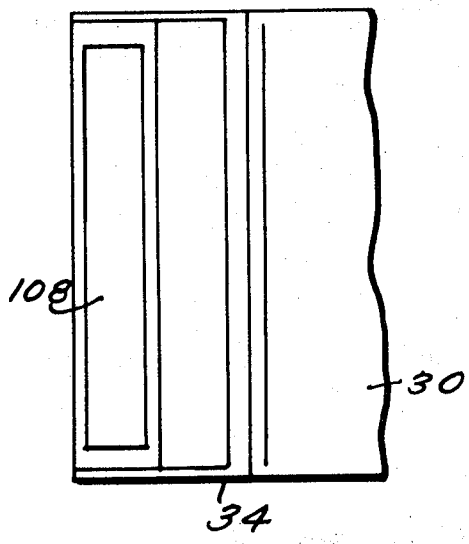

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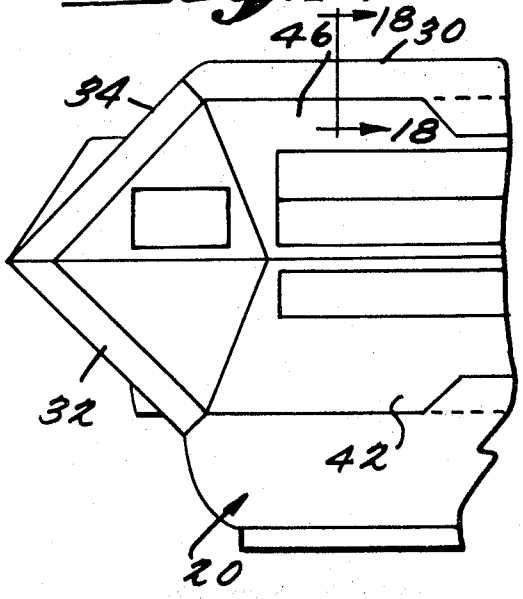
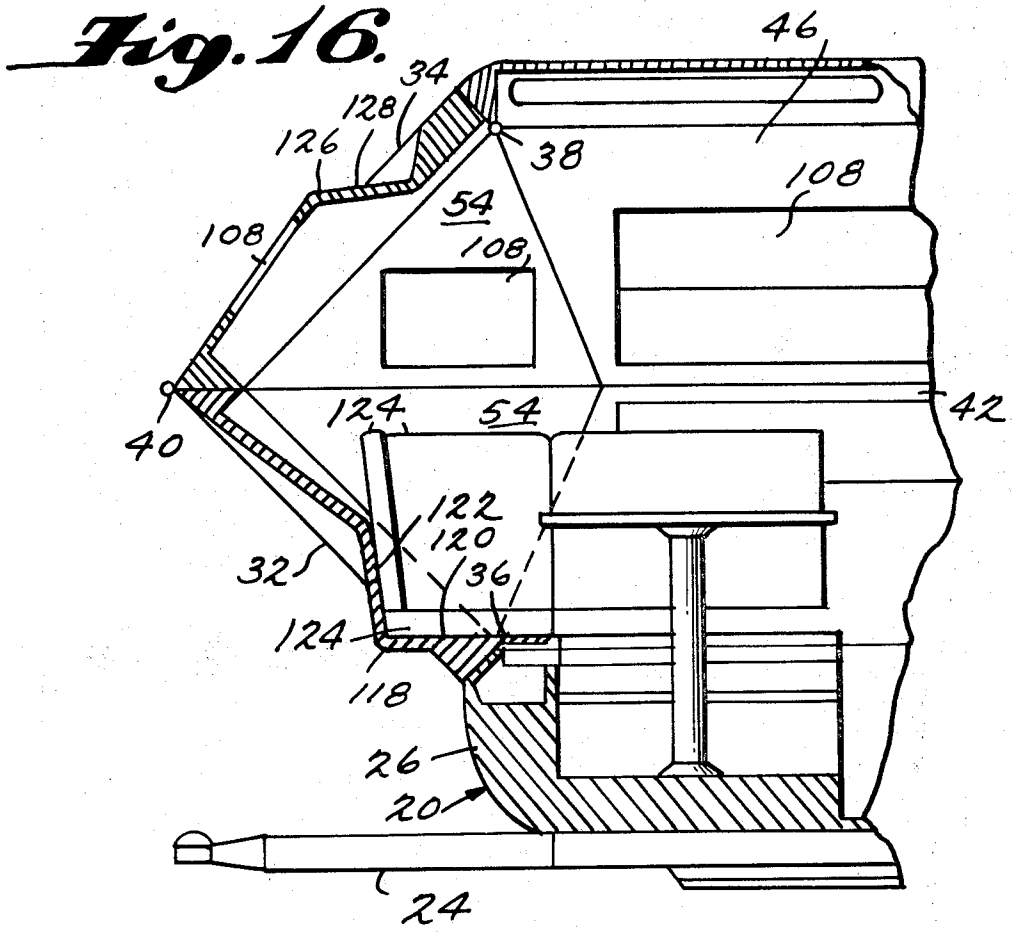


Fig. 16.



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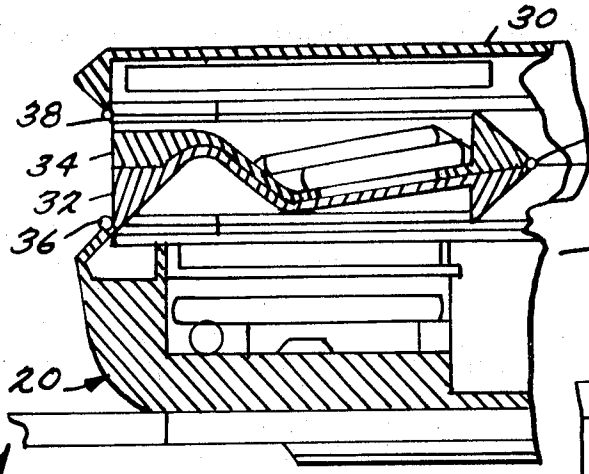


Fig. 20.

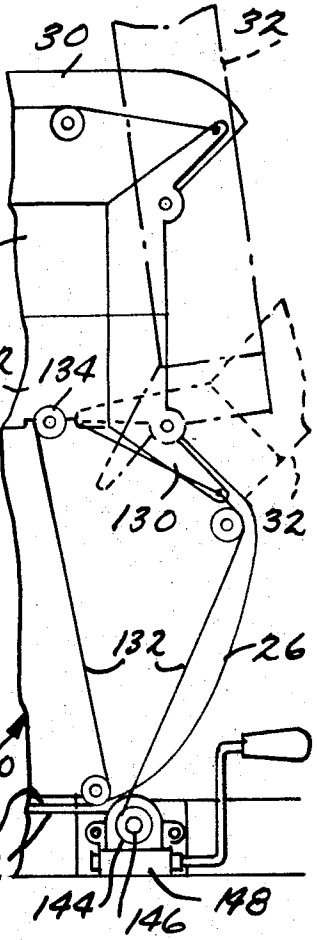
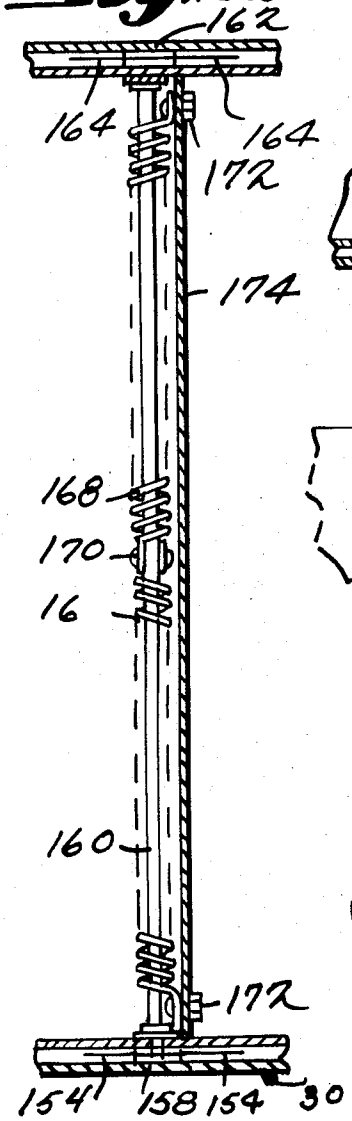


Fig. 21.



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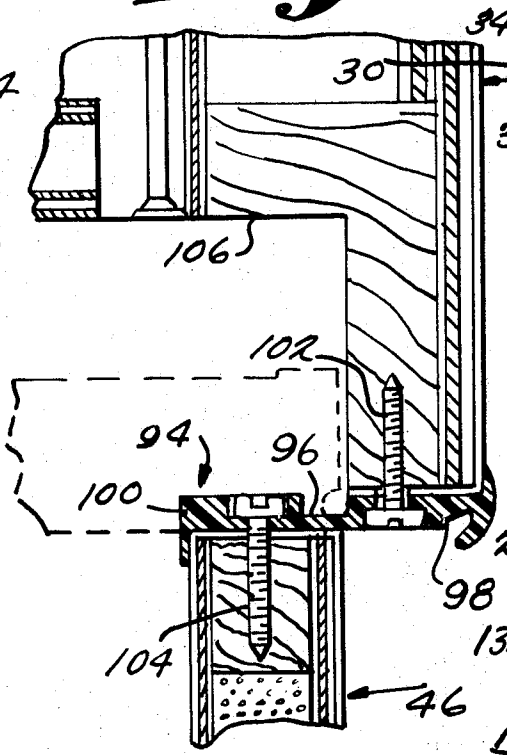
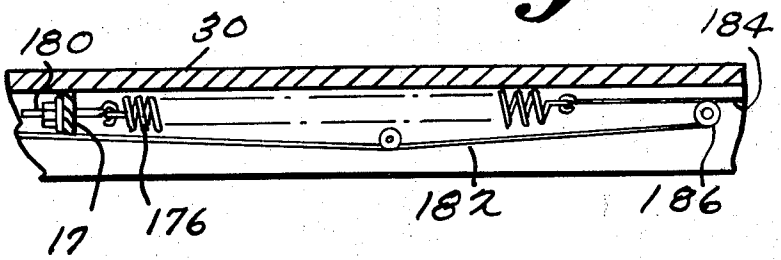


Fig. 22.



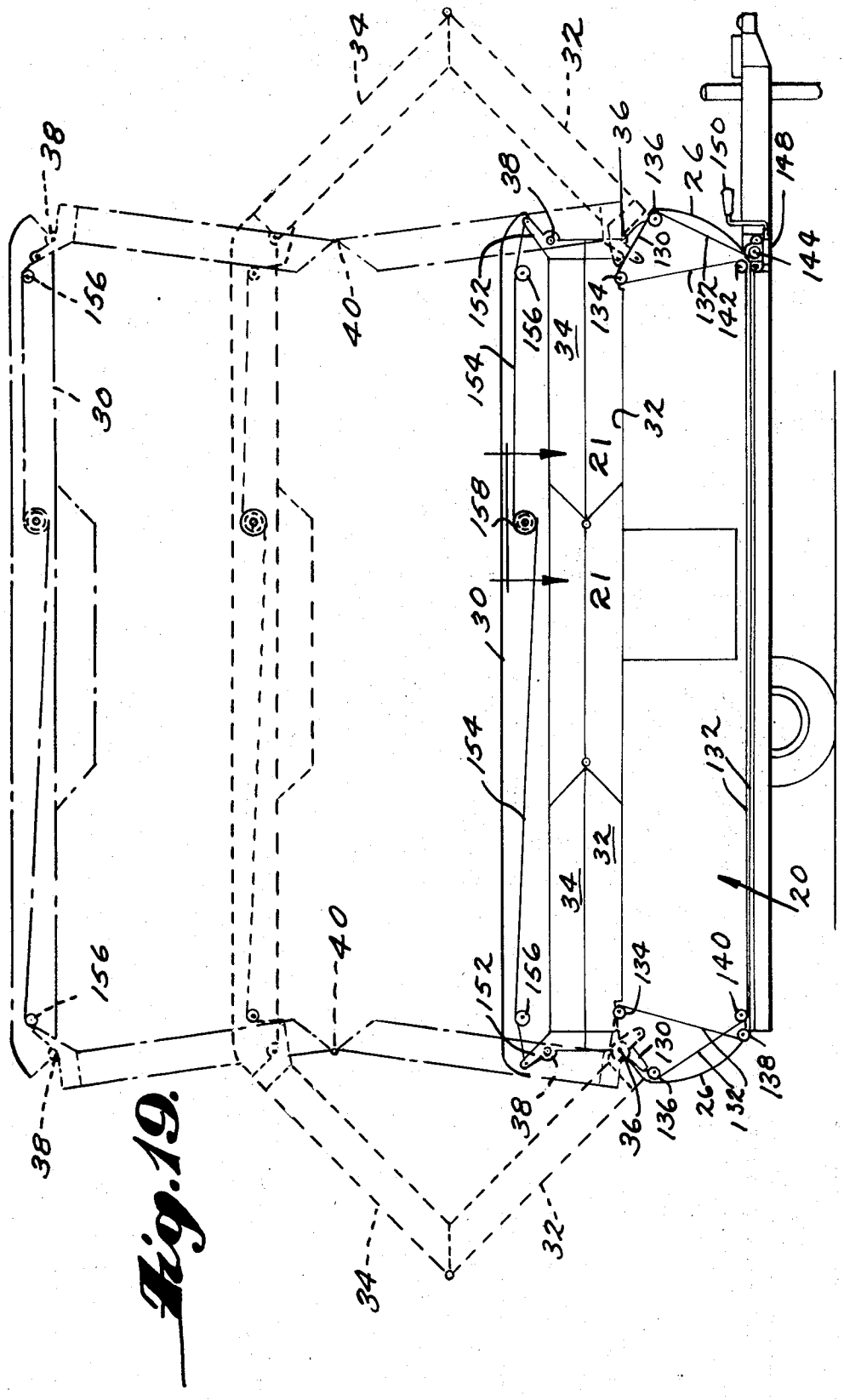

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Fig. 19.

COLLAPSIBLE AND EXPANDABLE ENCLOSURE

BACKGROUND OF THE INVENTION

1. Field Of The Invention

This invention relates to expandable and collapsible enclosures and, more particularly, to an improved enclosure especially useful as a shelter which combines hard wall construction with a low profile in the collapsed state. Although the invention will be disclosed with relation to mobile trailers of the so-called "camper" type, it will be realized that the invention is applicable to many other types of enclosures, especially other types of shelters.

2. Description Of The Prior Art

Collapsible and expandable shelters have been known to mankind since ancient times. Most often such shelters had a roof and walls of a flexible material such as cloth or animal hides. The problems generated by soft wall construction, such as high heat loss from the shelter's interior, limited privacy and protection against intruders, poor noise insulation characteristics, poor adaptability to glass window installations and poor adaptability to roof or wall mounted interior accouterments have caused the almost universal abandonment of soft wall shelters in favor of hard wall shelters for permanent residences.

Now a great number of people are attempting to escape to the blandishments of the countryside and forest without completely abandoning the comfort of the city. Some of these people find the soft wall tent which has been the mainstay of the camper to be inferior to hard wall constructions for the reasons set forth above. Yet, at least in the travel-trailer or camper class of recreational vehicles, the tent camper has traditionally offered advantages over hard wall constructions which usually had no collapsed state. For example, the tent camper in its collapsed state has a low center of gravity and a low profile for less resistance to both head and cross winds for improved towing stability and visibility, and for greater ease of road handling and parking due to compact dimensions. In order to combine the advantages of the tent camper with those of a hard wall construction, a certain type of camper has been developed having a hard roof and base sections but soft wall sections. In this camper, of course, the walls retain the disadvantages listed above for soft wall construction.

Other collapsible camper type structures have been devised in an effort to combine the advantages of hard wall construction and collapsibility. Prior structures of this nature, however, have certain disadvantages concerning deployment or conversion of the structure from its collapsed to its expanded state. In a first type of such a structure, the deployment operation requires basically as much manual work and operations as the soft-walled camper. Specifically, hard slide-out end wings are used in this type of construction to constitute horizontal flat bunk surfaces. In order to assure sufficient structural rigidity for these horizontal end wings, external braces are affixed as part of the development process. In conjunction with the end wings a number of side, roof and end panels are subsequently moved into position to effect the resultant fully-enclosed hard wall expanded configuration. The time required to perform the foregoing manual deployment operations is approximately the same as that required for the more conventional soft-walled tent camper. In addition, the slide-out end wings involve relatively complicated and expensive channels, tracks and/or guides to effect the slide-out operation. Finally, there are a number of mating edges or surfaces between the various side, roof and end panels. Butt-type, or overlapping panel-to-panel interfaces between the various surfaces are thus required and, as such, present certain design and mechanical complexities attendant with sealing and/or "weatherproofing" these joints or interfaces.

Other attempts to provide collapsible hard wall camper constructions involve "telescoping" and "infolding wall" arrangements. These also generally require channels, guides, tracks, and/or the mechanical equivalent for the erection or deployment operation. In addition, these constructions also generally involve a number of edges which must be mated or sealed against one another to effect the closed, fully-expanded configuration. Such constructions do not, however, offer a very large ratio of fully-expanded volume to stowed volume as compared with the slide-out end wing type. For this latter type, such ratio can easily exceed two because of the extra volume realized by the deployable "wing" sections of the unit. The "telescoping" and "infolding wall" units have a deployed volume of, at best, only twice that of the stowed volume.

SUMMARY OF THE INVENTION

The applicant's invention combines hard wall construction, high ratio expanded to collapsed volume, and ease of deployment in a single enclosure. This combination provides advantages heretofore not singularly available in the prior art.

Over known prior art arrangements which offer both hard-walled construction and low profile stowability, such as those described above, it is an object of the applicant's invention to offer greater ease of deployment due to the absence of slide-out mechanisms, telescoping members, and externally mounted end wing supports or braces.

Another object is to provide more simplicity of construction by the extensive use of an ultra-simple self-sealing hinge device in lieu of more complex sliding guides and telescoping members. This makes for less complicated panel-to-panel sealing or weatherproofing requirements and less complicated panel-to-panel mechanical interfaces.

Another object is to provide a unique over-the center arrangement of articulated hard wall panels to form an expandable and collapsible enclosure which is gravity retained or locked in expanded as well as in collapsed condition.

In summary, it is the object of the applicant's invention to permit incorporation of virtually all of the advantages of the prior art into one structural embodiment.

The applicant's invention accomplishes the above stated objects by a unique articulated arrangement of hard wall panels which can be transformed rapidly and easily from a collapsed (stowed) configuration into a fully-expanded (deployed) configuration.

The entire articulation arrangement requires no sliding or telescoping elements — only a single folding of hinges between adjacent panels. The individual panels, being rigid elements, comprise the basic mechanical "links" of the articulation mechanism. The primary links in the mechanism are a base, two base end wall sections, a roof or top, and two roof end wall sections. The base and the two base end wall sections constitute

an open three-bar linkage mechanism which is, in effect, a kinematic "mirror image" of the roof and its two roof end wall sections. Two hinge joints interconnect the respective base and roof end wall section to form a six-bar linkage. Side wall panels constitute secondary elements which are articulated in slave-fashion by motion of the respective end wall sections. The motion of these side wall panels has the reciprocal effect of restraining the opposing end wall sections to articulate in a "synchronous" or complementary type motion, as will be discussed in greater detail subsequently.

The six-bar linkage mechanism desirably is arranged to have an over-the-center position in expanded condition to provide a gravity lock to retain the enclosure in this condition.

The deployment of the panels may be manually accomplished if the size of the enclosure and the weight of the materials of construction so allow. Alternatively, the deployment may be accomplished by well known force-multiplying or power-actuated mechanisms.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the applicant's invention will now be described with reference to the drawings wherein:

FIG. **1** is a perspective view of a camper-trailer unit embodying this invention with the unit being shown in a fully-collapsed condition.

FIG. **2** is a view corresponding to FIG. **1** but showing the unit in a fully-expanded condition.

FIGS. **3** through **7** are side views of the unit shown in FIGS. **1** and **2** showing successive stages in a deployment sequence.

FIGS. **8** through **10** are fragmentary side views of enclosures embodying this invention showing various end configurations in the expanded condition.

FIG. **11** is a fragmentary perspective view of an end portion of an enclosure embodying this invention in its expanded condition and showing a torsion spring arrangement for facilitating movement between collapsed and expanded conditions.

FIG. **12** is a view corresponding to FIG. **11** but showing a tension coil spring arrangement.

FIG. **13** is a view corresponding to FIG. **11** but showing a power-operated linear actuator arrangement for moving the enclosure between collapsed and expanded conditions.

FIG. **14** is a fragmentary side view of an end portion of an enclosure embodying this invention in its expanded condition showing a modified configuration of the end wall sections.

FIG. **15** is a fragmentary plan view of the enclosure shown in FIG. **14**.

FIG. **16** is a fragmentary vertical sectional view of the enclosure shown in FIG. **14**.

FIG. **17** is a view corresponding to FIG. **16** but showing the enclosure in its collapsed condition.

FIG. **18** is an enlarged fragmentary sectional view taken substantially on line **18—18** of FIG. **14** to illustrate details of construction.

FIG. **19** is a somewhat diagrammatic elevational side view of an enclosure embodying this invention showing another spring arrangement for facilitating movement between collapsed and expanded conditions and another actuator arrangement for effecting such movement.

FIG. **20** is an enlarged fragmentary view of a portion of FIG. **19**.

FIG. **21** is a fragmentary sectional view taken substantially on line **20—20** of FIG. **19**.

FIG. **22** is a fragmentary view corresponding to a portion of FIG. **19** showing another spring arrangement.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGS. **1** to **7** of the drawings there is shown a camper-trailer unit embodying this invention. The unit includes the usual base **20** having ground-engaging wheels **22** and a towbar **24** adapted to be attached to a towing vehicle (not shown). The base **20** is generally rectangular in plan view, has a floor (not shown), and preferably is provided with upstanding fixed end and side wall portions **26** and **28**, respectively, so that it generally has a tray-like configuration. The unit has the usual roof or top **30** that is coextensive with the base **20**, normally arranged parallel thereto, and is separable vertically upwardly from the base from the collapsed position, shown in FIG. **1**, to the fully-deployed or expanded condition shown in FIG. **2**. Both the base **20** and top **30** are of rigid or hard wall construction.

The unit also includes a pair of generally rectangular panel-like end wall sections **32** for the base **20**, and generally rectangular panel-like end wall sections **34** for the top or roof **30**. All of these wall sections **32** and **34** are of generally the same planar dimensions and are of rigid or hard wall construction. The base end wall sections **32** are hinged along generally parallel horizontal axes **36** to the upstanding fixed end wall portions **26** of the base **20**, while the roof end wall sections **34** are similarly hinged about parallel horizontal axes **38** to the opposite ends of the roof **30**. The two end wall sections **32** and **34** at each end of the unit are also hinged to each other along parallel horizontal axes **40**. Thus, the base **20**, top **30**, and four end wall sections **32** and **34** form a six-bar linkage arrangement.

The arrangement is such that in the stowed or fully-collapsed condition of the unit, the end wall sections **32** and **34** are folded inwardly and are disposed between the base **20** and the top **30** and generally parallel thereto, as shown in FIG. **1**. In this condition the fixed wall portions **26** and **28** of the base **20**, together with its floor, provide a storage compartment in the base beneath the infolded wall sections **32** and **34**. In the expanded condition of the unit, the end wall sections **32** and **34** associated with the base **20** and with the top **30** are extended at an angle of at least 90° with respect thereto, as shown in FIG. **2**. In this latter figure the base and top end wall sections **32** and **34** extend respectively at equal obtuse angles with respect to the base **20** and with respect to the top **30**, but as will be described hereinafter, this angle may be of the order of 90° or more. In the arrangement shown in FIGS. **2** to **7**, the end wall sections **32** and **34** which are hinged together are at an angle of the order of 90°, when the unit is fully expanded but, again, this angle may vary from an acute angle to one which is of the order of 180°.

Associated with the base **20** are a pair of panel-like side wall main sections **42**, one on each side of the unit. These sections **42** are hinged to the upper edges of the corresponding upstanding fixed side wall portions **28** for pivotal movement about longitudinal horizontal parallel axes **44**. The top **30** is similarly provided with panel-like side wall main sections **46** which are hinged

to the longitudinal side edges of the top for pivotal movement about longitudinal horizontal parallel axes **48.** All the side wall main sections **42** and **46** are of hard wall construction, of essentially the same planar dimensions and are arranged for pivotal movement from a stowed or collapsed position wherein they are folded inwardly into a position generally parallel to and between the base **20** and top **30** of the unit to an expanded position at an angle of substantially **90°** to the base and top, as shown in FIG. **2.** In this position the two side wall main sections **42** and **46** on each side of the unit are coplanar and have opposed edges **50** and **52,** respectively, which are substantially abutting.

As will be seen from the showings of FIGS. **2** and **7,** the side wall main sections **42** and **46** are generally trapezoidal in shape having longitudinal short and long parallel edges, with the long edge being hinged to the associated base **20** or top **30.**

Associated with each side wall main section **42** and **46** are a pair of panel-like side wall end sections **54** of hard wall construction, all triangular in configuration and of the same planar dimensions. Each side wall end section **54** is in the shape of an isosceles triangle, as shown best in FIG. **7,** having its base **56** hinged to the corresponding end edge of the associated side wall main section **42** or **46** for folding movement relative thereto. One of the other edges of the triangle, i.e., edge **58,** is similarly hinged to the associated end wall section **32** or **34** for inward and outward folding movement relative thereto. The other edge **60** of the triangle defined by each side wall end section **54** is arranged to be substantially horizontal and in opposed relation to the corresponding edge of the adjacent side wall end section when the enclosure is in the expanded condition shown in FIG. **2.**

As stated above, when the unit is in its collapsed condition, all of the aforedescribed hinged wall sections, i.e., end wall sections **32** and **34,** side wall main sections **42** and **46,** and side wall end sections **54,** are arranged to be folded inwardly into a position generally parallel to and arranged between the base **20** and top **30** of the unit, as shown in FIGS. **1** and **3.** In order to enable the folding of the hinged wall sections to such collapsed condition, the underside of the top **30** and the upper side of the base **20** are recessed (the base by its upstanding fixed wall portions **26** and **28**) to accommodate the thickness of their associated side wall main sections **46** and **42.** Similarly, the inner sides of the end wall sections **32** and **34** are recessed to accommodate the thickness of their associated side wall end sections **54.**

In the collapsed condition the base **20** and top **30** are separated by the folded thickness of the two end wall sections **32** and **34** at each end. This would leave a gap between the base **20** and top **30** along each side between the folded end wall sections **32** and **34.** To close this gap the top **30** and base **20** are provided along their sides with depending and upstanding vertical extensions **62** and **64,** respectively, which exteriorly overlap their associated side wall main sections **46** and **42** in the expanded condition of the unit. These extensions **62** and **64** have opposed horizontal edges **66** and **68** that substantially abut, and end edges **70** complementary to and which substantially abut the exposed edges of the folded end wall sections **32** and **34,** in the collapsed condition of the unit, as shown in FIGS. **1** and **3.**

In moving from collapsed to expanded position, the top **30** of the unit normally is translated upwardly to an initial position, shown in FIG. **4,** by outward pivotal movement of the end wall sections **32** and **34** about their respective hinges **36** and **38.** During this movement it will be seen that the side wall main sections **42** and **46** also commence to pivot outwardly about their longitudinal horizontal hinge axes **44** and **48** while at the same time the side wall end sections **54** tend to pivot outwardly about their hinged connections with their corresponding end wall sections. The movement continues until the roof **30** and the end wall sections **32** and **34** reach the positions shown in FIG. **5** wherein the roof is at a position of maximum separation from the base **20.** In this position the hinge axes **36, 38,** and **40** at each end of the unit are coplanar, while the end wall sections **32** and **34** which are hinged together attain a nearly coplanar position at an angle of 180° with each other. Desirably, however, the hinged wall sections are proportioned so that outward movement of all of the wall sections continues to the "over-the-center" position shown in FIG. **6** wherein the roof **30** commences to move back downwardly toward the base **20.** In this position it will be seen that the side wall end sections **54** are at an angle less than 180° to their associated side wall main sections **42** and **46,** and the latter are at an angle less than 90° to their associated base **20** and top **30.** Outward movement of the hinged wall sections continues, however, to an over-the-center expanded condition shown in FIG. **7** wherein the end wall sections **32** and **34** of each hingedly connected pair are at an angle less than 180° to each other, all of the side wall main sections **42** and **46** are at an angle of the order of 90° to the base **20** and top **30,** and wherein the side wall end sections **54** are coplanar with their associated side wall main sections.

In this fully-expanded position it will be seen that the side wall sections **46** and **54** associated with the roof **30** have edges **52** and **60,** respectively, which are in abutting relation with corresponding edges **50** and **60,** respectively, of the side wall sections **42** and **54** associated with the base **20.** This abutting relationship constitutes stop means which prevents further downward movement of the top **30** relative to the base **20** and constitutes means for retaining, under the weight of the roof **30** and the wall sections **32, 46,** and **54** associated therewith, the unit in its fully-expanded condition without any further means which requires adjustment. Preferably, all the free edges of the side wall sections associated with the roof **30** are in abutting relationship with all the free edges of the corresponding side wall sections associated with the base **20** but it will be seen that an abutting relation between the free edges of any pair of upper and lower corresponding side wall sections will perform the aforedescribed stop function. This stop function can also be attained by providing end wall sections **32** and **34** with bevelled edges adjacent their hinge axes **36, 38,** and **40** which come into abutting relation with the base **20** and top **30** and with each other adjacent the hinge axes **44** and prevent further outward movement of the end wall sections once the latter have reached the expanded condition shown in FIG. **7.**

With the proportion of the various wall sections shown in FIGS. **1–7,** when the unit is in its fully expanded condition, the end wall sections **32** and **34** of each hingedly connected pair are of the order of an angle of 90° with each other. By suitably proportioning

the wall sections, however, this angle can be varied. For example, as shown in FIG. **8**, this angle can be less than 90°, e.g., of the order of 70° to provide for a construction which has a rather extended overhang at each end in the expanded condition of the unit. On the other hand, the angle can be increased greater than 90° so as to considerably reduce the overhang, as shown in FIG. **9** wherein the angle between the sections **32** and **34** of each hingedly connected pair is of the order of 120°. The angle can even be increased to the point where it is of the order of 180° and the end wall sections **32** and **34** of each hingedly connected pair are coplanar so that there is no overhang at the ends in the expanded condition of the unit as shown in FIG. **10.** In this arrangement, however, it will be seen that the linkage does not provide for an over-the-center expanded condition so that the aforedescribed stop function, achieved by the weight of the parts, is not fully realized.

Obviously depending upon the weight of the roof **30** and wall sections, the unit can be deployed manually from a collapsed condition. Such manual deployment can be facilitated, to some extent, by the use of springs. For reasons later explained such springs desirably are associated with the end wall sections **32** and **34** of each hingedly connected pair to maintain the angle therebetween at that corresponding to some condition between collapsed and expanded condition of the unit.

For example, referring to FIG. **11**, there is shown a torsion bar spring **74**, one at each end of the unit, constituting the hinge axis **40** between a pair of hingedly connected end wall sections **32** and **34.** Opposite ends of the spring **74** are provided with right angle bends **76**, one of which is secured to one end wall section, e.g., **32**, and the other to the other end wall section, e.g., **34.** Other structural arrangements for anchoring opposite ends of the spring **74** to the respective end wall sections **32** and **34** obviously can be had. In the arrangement shown, it will be seen that the springs **74** at each end of the unit can be proportioned and arranged so that they will retain the unit, when under no restraint, in a condition somewhere intermediate collapsed and expanded conditions, for example in the approximate condition shown in FIG. **5**, i.e., wherein the roof **30** is in its position of maximum separation from the base **20** and the end wall sections **32** and **34** at each end are nearly coplanar. With such a spring arrangement, depending upon the size and weight of the parts, not too much manual effort would be required, after initially pushing the end wall sections **32** and **34** slightly inwardly, to force the roof **30** downwardly, against the restraining force of the springs **74** to fully collapsed condition of the unit and to retain the unit in collapsed position by some appropriate restraining means, such as a latch (not shown). When such restraining means is released, however, the unit will reassume the position shown in FIG. **5**, and in this position not too much manual effort would be required, after initially pushing the end wall sections **32** and **34** slightly outwardly, to move the roof **30** downwardly, against the restraining force of the springs **74**, to the expanded condition shown in FIG. **7** in which the unit would be retained by some appropriate restraining means (not shown). If necessary, appropriate manually operated force-multiplying means, such as jack screws having hand cranks (not shown), appropriately connected to the end wall sections **32** and **34** of each hingedly connected pair, could be used to overcome the spring forces.

Referring now to FIG. **12**, there is shown another type of spring arrangement which can be used to retain the unit in a condition somewhere between collapsed and expanded conditions. This arrangement includes an elongated housing **78**, rectangular in cross section, having a longitudinal slot **80** along one side. The upper end of the housing **78** is connected to a lateral edge of an upper end wall section **34** for pivotal movement about a transverse horizontal axis **82.** Longitudinally slidable within the housing **78** is an element **84** connected, through the housing slot **80**, to the lateral edge of the lower end wall section **32** for pivotal movement about a transverse horizontal axis **86.** Connected between the element **84** and the lower end of the housing **78** is a coil spring **88.** The spring **88** is proportioned and arranged so that when the unit is in a predetermined condition intermediate collapsed and expanded conditions, any relative angular movement between the two hingedly connected end wall sections **32** and **34** is restrained by the spring **88.** The spring force can be overcome, however, either manually or by manually operated force-multiplying devices of the type described heretofore.

Manual development of the unit can be completely dispensed with, however, and replaced by appropriate power-operated means. Such may constitute any appropriate type of power-operated linear actuator, which can be either mechanical, hydraulic, pneumatic or electric. Thus, for example, an appropriate power-operated actuator may constitute a single acting reciprocating hydraulic motor of the cylinder and piston type. Although such power actuators could be directly connected between the base **20** and roof **30** to raise the latter, it is preferable to connect them to vary the angle between the two hingedly connected end wall sections **32** and **34** at each end of the unit, as shown in FIG. **13.** It has been found that synchronous variation of this angle deploys the unit with the top **30** desirably maintained in parallel coextensive overlying relation with the base **20.** In this arrangement the cylinder **90** of the motor may be pivotally connected to a lateral edge of the lower **32** of two hingedly connected end wall sections, while the outer end of the piston rod **92** is pivotally connected to the lateral edge of the upper **34** of the two end wall sections. Hydraulic fluid can be supplied under pressure to the cylinder **90** from any appropriate source (not shown) under the control of appropriate valves (not shown).

The various hinge connections of the articulated panels desirably are effected by continuous water-tight hinges which require no additional sealing arrangements at the hinge joints between the parts. A desirable hinge for this purpose is of the type shown in U. S. Pat. No. 3,320,225, to which reference is made for a detailed description of such a hinge. A hinge of this type, however, is shown in FIG. **18** which illustrates its use to connect a side wall main section **46** to the roof **30.**

The hinge is in the form of an elongated strip **94** of tough but flexible plastic material having a central longitudinal portion **96**, which is thinned or of reduced thickness for enhanced flexibility, substantially constituting a hinge axis while the longitudinal portions **98** and **100** of greater thickness on opposite sides of the thinned portion constitute flanges for securement of the strip to the panels to be hinged. One of these flanges, e.g., **98**, is secured, as by appropriate screws **102**, beneath and along the undersurface of the roof **30**

along its longitudinal edge. The outer flange **100** is secured, as by screws **104,** along the top edge of the side wall main section **46** which is offset inwardly from the longitudinal edge of the roof **30.** As shown in FIG. **18,** the underside of the roof **30** is recessed as at **106** for reception of the side wall main section **46** when the latter is folded inwardly and upwardly, to the position shown in dotted lines, about the thinned portion **96** which constitutes the hinge axis **48** for the wall section **46.** From this construction it will be seen that the flexible plastic strip **94** forms a continuous sealed hinge which eliminates the necessity for other types of seals between hingedly connected parts of the unit. Thus, substantially the only edges which need be sealed are the abutting edges **50, 52** and **60** of the side wall sections which meet at a substantially horizontal parting line when the unit is in its expanded condition. These abutting edges can be sealed by any simple conventional type of compression or interfitting resilient weathertight sealing means (not shown) secured to one or both of the abutting edges.

At that longitudinal extent of each side wall main section **42** and **46** which is exteriorly overlapped by the vertical extensions **64** and **62** along the sides of the base **20** and roof **30,** the outer flange **98** of the hinge strip **94** can be shaped for appropriate securement to the interior side of such extensions.

The various end and side wall sections may be provided with windows, e.g, **108,** at any desired location. These windows **108** may have glass panes because of the hard wall construction of these sections rather than being formed of a flexible but less transparent and less enduring material which usually is necessitated for soft wall constructions. The enclosure also is readily adaptable for the provision of a sectional side door **110** having two lower sections **112** and **114** which may be hingedly connected together along an axis coaxial with the hinge axis **44** of the corresponding lower side wall main section **42** so that the upper **112** of these door sections can be folded inwardly along with the side wall section **42.** The lower two door sections **114** and **112** may be hinged along one side to the fixed side wall portion **28** of the base **20** and to the lower side wall main section **42,** respectively, for outward swinging movement. The door **110** may be divided horizontally at the parting line between the lower and upper side wall main sections **42** and **46** to provide an upper door section **116** that is hinged to the upper side wall main section **46** to function in the manner of a Dutch door.

Referring now to FIGS. **14** to **17** of the drawings there is shown a non-planar configuration for the end wall sections **32** and **34** which has the effect of increasing the usable space within the unit. In this configuration the lower end wall section **32,** when the unit is in its expanded condition, is provided, intermediate its lateral sides, with a transversely extending exterior bulge **118** having a generally horizontal bottom portion **120** adjacent the lower hinge **36** axis which merges with a generally vertical wall portion **122.** These portions **120** and **122** are contoured so as to form a seat and to accommodate removable bottom and back seat cushions **124,** as shown in FIG. **16.** The upper end wall section **34** also is provided, intermediate its lateral ends, with a transversely extending exterior bulge **126** having a generally horizontal portion **128.** The contours of the upper and lower end wall sections **32** and **34** are complementary so that they will closely interfit when the unit is in its collapsed condition and the two end wall sections are folded inwardly, as shown in FIG. **17.**

While the top **30** of the unit has been described as having its underside recessed only for accommodation of the side wall sections, it will be seen that such recess can be made deep enough to serve as a storage compartment above the folded side wall sections when the unit is in its collapsed condition. The recess **106** shown in FIG. **18** is an example of such a construction.

Referring now to FIGS. **19–21** of the drawings, there is shown therein another type of actuating mechanism for moving the enclosure between collapsed and expanded conditions, along with another type of spring mechanism for normally maintaining the enclosure in a neutral position intermediate collapsed and expanded conditions. In this arrangement the actuating mechanism is connected to both of the end wall sections of the pair **32** or **34** associated with either the base **20** or the top **30** of the unit so as to synchronously vary the angle between each such end wall section and the base or the top, as the case may be.

In the system illustrated, the actuating mechanism is shown to be connected to the two end wall sections **32** associated with the base **20.** Each of these sections **32** is provided, preferably adjacent a lateral edge, with a crank arm **130** which, in the collapsed position of the unit, depends below the axis **36** of the hinge connecting the corresponding section to the base **20.** As shown best in FIGS. **19** and **20,** these crank arms, when the unit is collapsed, preferably are confined within the peripheral outline of the base **20** and extend downwardly and outwardly toward the corresponding fixed end wall sections **26** of the base. Connected to the ends of both crank arms **130** is an endless cable **132** trained over idler pulleys **134** and **136,** there being a pair for each arm, one adjacent each end of the arc of operative swinging movement of the end of the arm when the corresponding end wall section **32** moved between collapsed and extended positions, as shown in solid and dotted lines respectively in FIGS. **19** and **20.** From these pulleys **134** and **136** the cable **132** is trained over a pair of idler pulleys **138** and **140** at the one end and within the lower portion of the base **20** and over another pulley **142** within the lower portion of the base adjacent its other end. Adjacent the pulley **142** is a drum **144** around which the cable **132** is wrapped so that rotation of the drum will mobe the cable selectively in opposite directions. The cable is arranged to move the crank arms **130** in opposite directions through the arcs necessary to move the end wall sections **32** between their collapsed and their expanded positions. The drum **144** is connected to an end of a transverse shaft **146** (FIG. **20**) which extends through a worm and gear drive unit **148,** that may be operated by a manually-operable crank **150** or by any suitable power-operated motor, e.g., electric, hydraulic, or the like (not shown).

The shaft **146** desirably extends transversely across the unit to the other side and has a similar drum (not shown) connected to its other end for operating a cable trained over pulleys and connected to crank arms on the end wall sections **32** on the other side of the unit to duplicate the actuating mechanism on that side.

Also shown in FIG. **19** is a spring-operated counterbalance arrangement for yielding resisting movement of the unit from a position somewhere between collapsed and expanded positions. In the arrangement

shown in the drawings in dot-dash lines this intermediate position is one wherein the top or roof **30** of the unit is in its position of maximum separation from the base **20**, and where the hinge axes **36, 40,** and **38** of the end wall sections **32** and **34** at each end are coplanar, as also shown in FIG. **5.**

This counter-balance system also includes crank arms **152** on and adjacent the lateral edge of the end wall sections **34** associated with the top **30.** These crank arms **152** in the collapsed position of the unit, extend above their respective axes **38** and outwardly at an angle toward the respective ends of the unit. Preferably, the arms **152** are maintained, in all positions of the unit, within the peripheral outline thereof. A cable **154** is connected, at each end thereof, to the outer ends of both crank arms **152** and trained over idler pulleys **156,** one cloasely adjacent the end of each arm when the unit is in its neutral position as shown in dot-dash line in FIG. **19.** The cable **154,** intermediate its ends, is wrapped around a drum **158** on one end of a transverse shaft **160** preferably having a similar drum **162** (FIG. **21**) on its other end around which is wrapped the intermediate part of another cable **164** connected to crank arms (not shown) on the other sides of the end wall sections, **34** in order to duplicate the arm, pulley, cable and drum counter-balance arrangement on each side of the unit. Wrapped around the shaft **160** in end-to-end relation are two coil torsional springs **166** and **168.** The adjacent ends of the springs **166** and **168** are secured to the shaft **160** by any appropriate means, e.g., a rivet **170,** while the opposite ends of the springs, i.e., adjacent each end of the shaft, are fixed to the top **30,** as by being fastened by bolts **172** to a transverse stiffening member **174.** It will be seen that rotation of the shaft **160** is yieldingly resisted by the springs **166** and **168.** These springs **166** and **168** are arranged so that they normally will retain the parts of the unit in the position shown in dot-dash lines in FIG. **19,** i.e., intermediate collapsed and expanded positions.

As shown in FIG. **21,** the torsion spring arrangement can be replaced by an appropriate coil tension spring **176,** which may extend longitudinally of the unit and have one end anchored to the tope **30,** as by being secured to a transverse stiffening member **178** by a bolt **180** having a hook on one end. The other end of the spring **176** is connected by two cables **182** and **184,** one of which is trained over an intermediate idler pulley **186** to the outer ends of the crank arms **152** of the end wall sections **34** associated with the roof **30.** Of course, the counter-balance spring arrangements could easily be mounted within the base **20** and connected to the crank arms **130** of the end wall sections **32** associated with the base.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the specific embodiment shown and described is susceptible to modification without departure from the principles of the invention. Hence, the invention encompasses all modifications within the spirit and scope of the following claims.

What is claimed is:

1. A collapsible and expandable enclosure comprising:

generally rectangular, generally coextensive, and generally parallel top and bottom members movable vertically apart from a closely-adjacent collapsed position to a spaced-apart expanded position, each of said members having associated therewith:

a pair of generally rectangular end wall sections;

a pair of generally trapezoidal side wall main sections; and

two pairs of generally triangular side wall end sections one for each end of each of said side wall main sections,

the planar dimensions of the wall sections associated with one of the members being substantially the same as those of the corresponding wall sections associated with the other of said members,

all of said sections being movable from collapsed positions between and generally parallel to said members,

said end wall sections being hinged to the ends of their associated member for pivotal movement about parallel axis from said collapsed positions to expanded positions at an angle of at least 90° to said member,

the end wall sections associated with one of said members being hinged to the corresponding end wall sections associated with the other of said members for relative pivotal movement about axes parallel to said first-mentioned axes,

said side wall main sections being hinged to the sides of their associated member for pivotal movement about parallel axes from said collapsed positions to expanded positions at an angle of substantially 90° to said member,

said side wall end sections each being generally in the shape of an isosceles triangle having its base hinged to the side of the adjacent end wall section and having one of its sides hinged to the end of the adjacent side wall main section for movement with said sections to which hinged from said collapsed position to an expanded position generally coplanar with said adjacent side wall main section.

2. The structure defined in claim **1** including stop means operative when the end wall sections are in their expanded positions to maintain their said expanded angle of at least 90° with their associated member.

3. The structure defined in claim **2** in which the stop means comprises abutting edges of a side wall section associated with one of said members and of the corresponding side wall section associated with the other of said members.

4. The structure defined in claim **3** in which the end wall sections in their expanded positions are at an angle greater than 90° to their associated members.

5. The structure defined in claim **1** in which the end wall sections in their expanded positions are at an angle greater than 90° to their corresponding members.

6. The structure defined in claim **1** including actuator means connected to each two corresponding hingedly connected end wall sections for adjusting the angle there between to expand or collapse the enclosure.

7. The structure defined in claim **6** including means for synchronizing the operation of both of the actuator means.

8. The structure defined in claim **1** including spring means connected to each two hingedly connected end wall sections for yieldingly resisting relative angular movement therebetween from a neutral relative angular position between collapsed and expanded positions of said end wall sections.

9. The structure defined in claim 1 in which the enclosure is a mobile wheeled shelter adapted to travel in an endwise direction.

10. The structure defined in claim 1 in which the bottom member includes a peripheral upstanding fixed wall to which are hinged the end wall sections and side wall main sections associated with the bottom member to provide a stowage compartment beneath said sections when the enclosure is collapsed.

11. The structure defined in claim 1 in which at least one of the members is provided with fixed sidewall portions along its opposite side extending between the associated end wall sections when the latter are in their collapsed positions to at least partially close peripheral gaps between the members when the enclosure is collapsed.

12. The structure defined in claim 1 in which at least one of the end wall sections hinged to the lower member is contoured intermediate its sides to define in its expanded position an exterior bulge and an interior recess having intersecting generally horizontal and generally upright portions and the end wall section hinged to said one end wall section is complementarily contoured to conformingly interfit with said one end wall section when said sections are in their collapsed condition.

13. The structure defined in claim 1 in which the members and sections are formed of rigid material.

14. The structure defined in claim 1 in which the top member includes a peripheral depending fixed wall to which are hinged the end wall sections and side wall main sections associated with said bottom member to provide a stowage compartment above said sections when the enclosure is collapsed.

15. The structure defined in claim 1 including actuator means connected to at least one of the members and to the pair of end wall sections associated therewith for synchronously adjusting the angle between said one member and each of said end wall sections to expand or collapse the enclosures.

16. The structure defined in claim 15 in which the actuator means includes a crank arm on each of the sections, and cable means connected to both of said arms, and drum means for moving said cable means.

17. The structure defined in claim 1 including spring means connected to the pair of end wall sections associated with one of the members for yieldingly resisting relative angular movement between said sections and said one member from a neutral relative angular position between collapsed and expanded positions of said sections.

18. The structure defined in claim 17 including a crank arm on each of the sections and cable means connected to said arms and to both of said arms and to the spring means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,768,855 Dated Oct. 30, 1973

Inventor(s) Jay H. Laue

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE DRAWINGS:

Figure 2, reference character "30" at the right-hand side and adjacent reference character "26" should be --32--.

Figure 22, reference character "17" should be --178--.

IN THE SPECIFICATION:

Column 4, line 4, "20-20" should be --21-21--.
Column 6, line 46, "32" should be --34--.
Column 9, line 1, "outer" should be --other--.
Column 10, line 34, "mobe" should be --move--.
Column 11, line 43, "tope" should be --top--.

IN THE CLAIMS:

Column 12, line 32, "its base" should be --one of its sides--.
Column 12, line 34, "one of its sides" should be --its base--.

Signed and sealed this 14th day of May 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents