

Jan. 22, 1957

E. J. PFEIFFER  
COLLAPSIBLE BOX

2,778,560

Filed Nov. 5, 1954

3 Sheets-Sheet 1

FIG. 1.

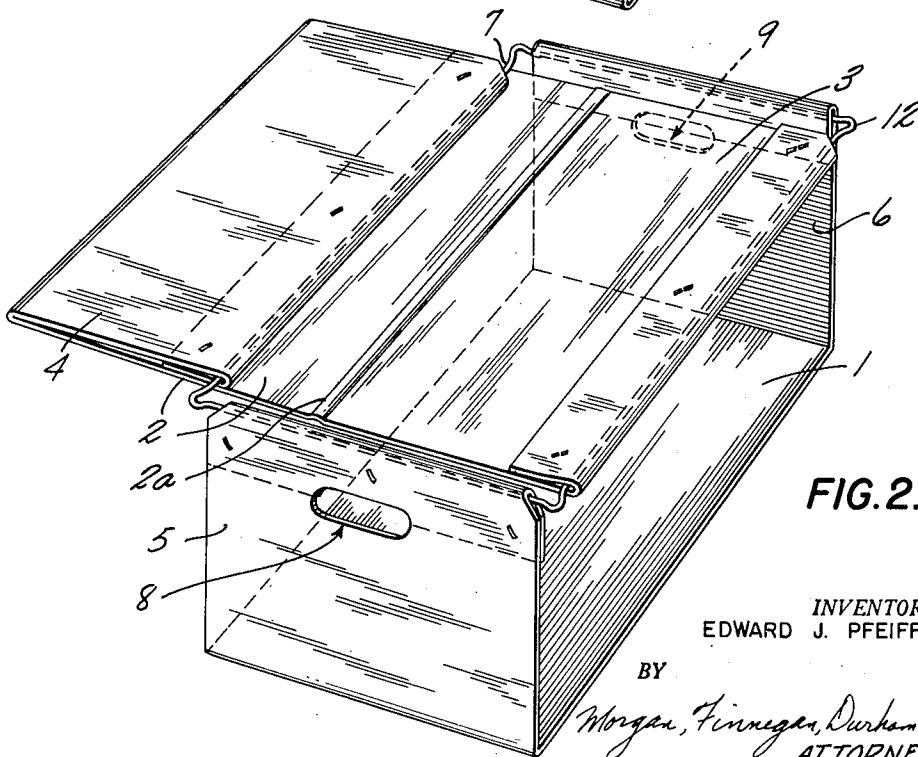
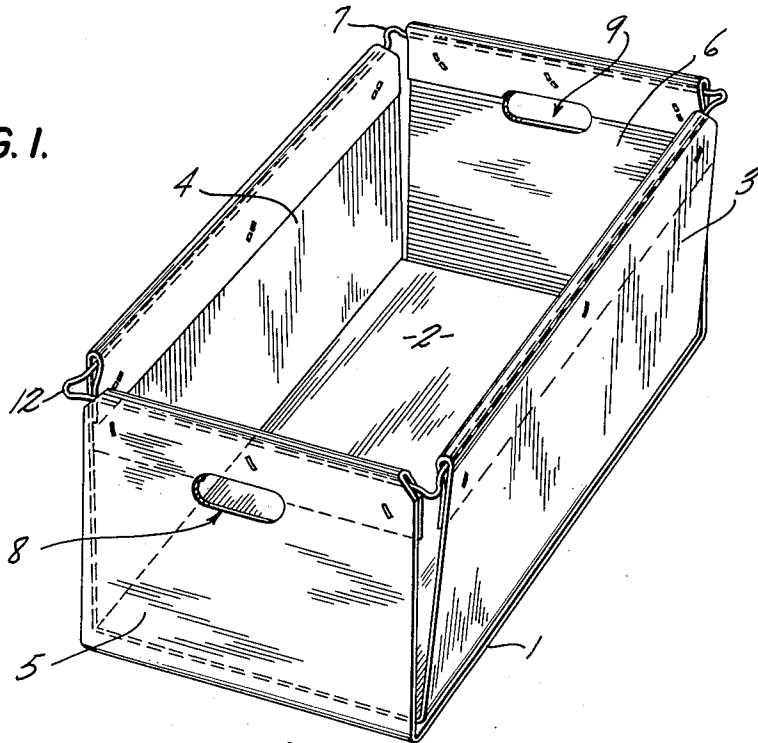


FIG. 2.

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3 Sheets-Sheet 2

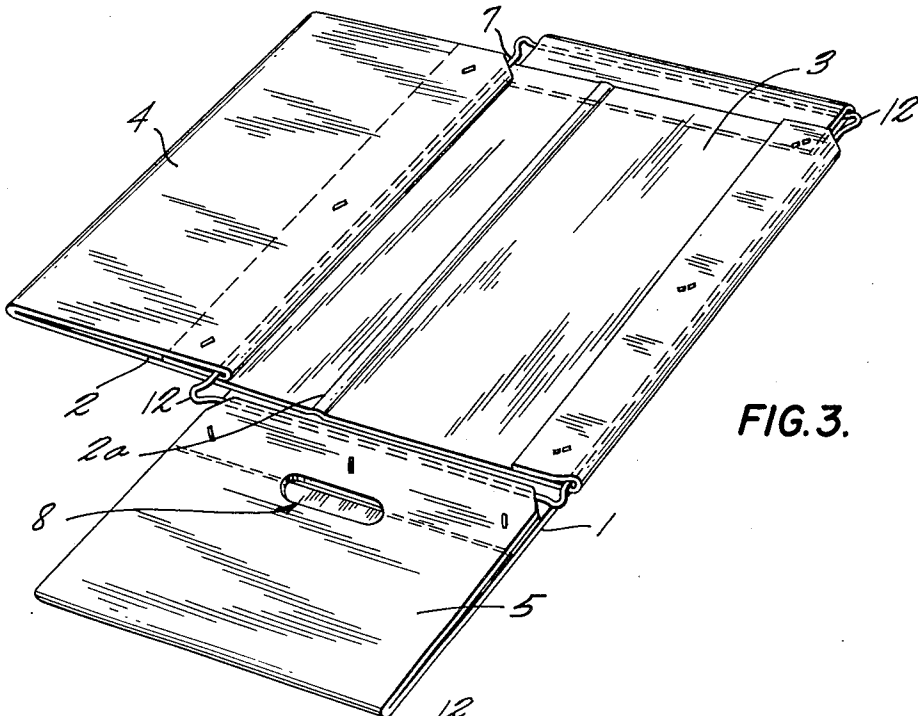


FIG. 3.

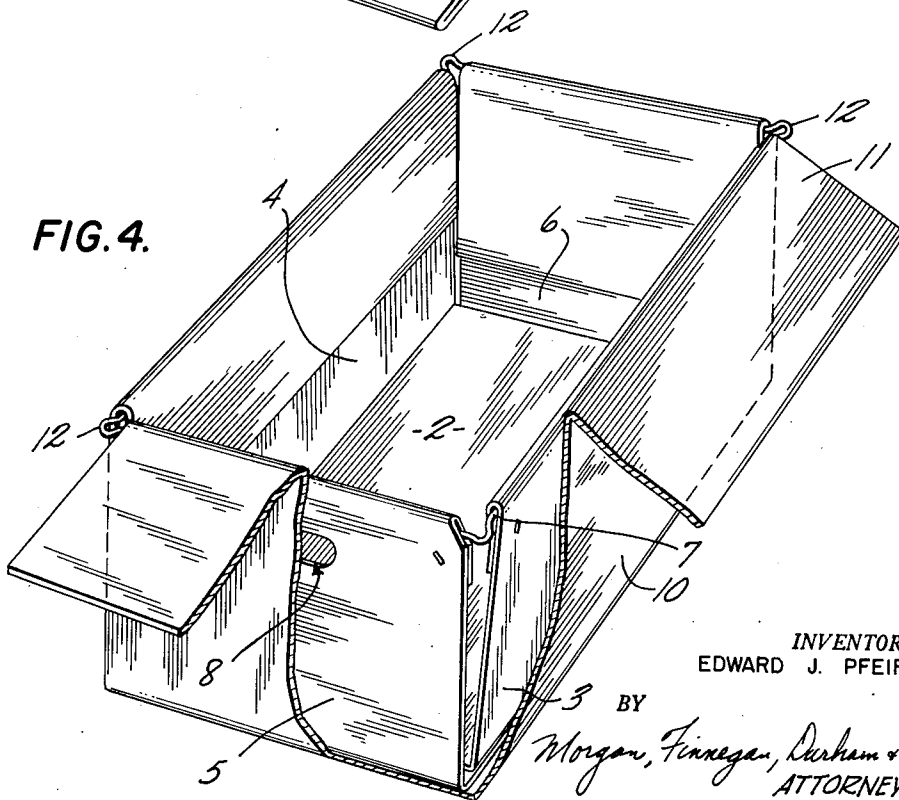


FIG. 4.

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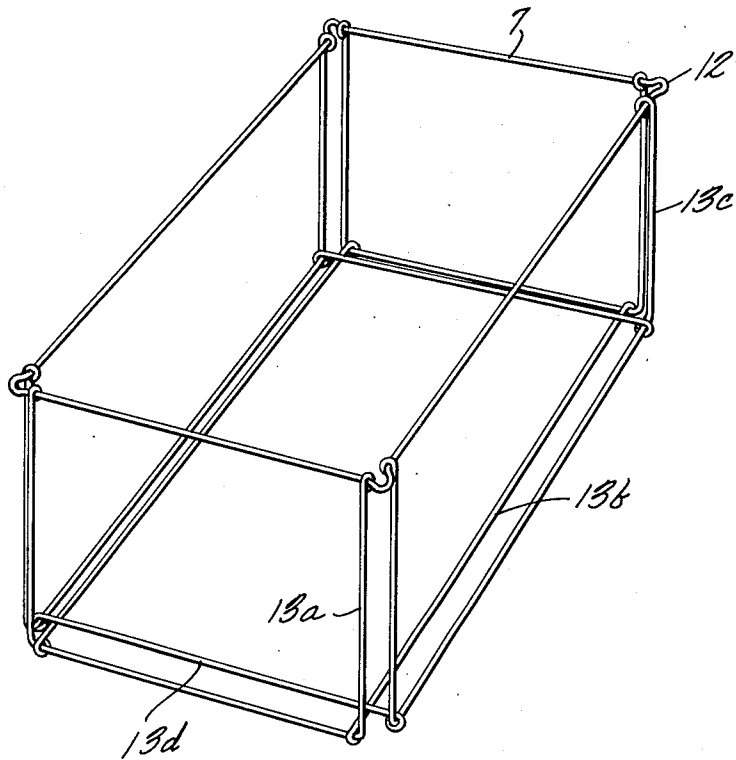


FIG. 5.

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1

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**COLLAPSIBLE BOX**

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Application November 5, 1954, Serial No. 457,056

8 Claims. (Cl. 229-41)

The invention relates to folding or collapsible boxes and more especially to collapsible boxes having durable and sturdy construction which are intended to be reused a great number of times with numerous collapsing and unfolding operations.

According to present practice, it is generally desirable that collapsible boxes be foldable to form a flat structure with an extremely small thickness to facilitate stacking thereof in a small storage space, during shipment, storage and handling. It is also of importance that the box, when so folded, present a minimum of protruding or exposed members which can be bruised, torn, or focibly ripped from the box as a result of handling during unfolding, collapsing or storage thereof lest the reusable life of such boxes be short. It is also particularly desirable that the box be composed of a minimum of moving parts and that only a small amount of rearrangement thereof be required prior to collapsing or unfolding.

Heretofore the practice has been to employ a length of rectangular material as the horizontal bottom of the box, with foldably connected side panels extending vertically therefrom and rotatively connected at their upper portions to a rectangular wire frame. Two end panels pivotally connected to the wire frame extend downwardly therefrom between the side panels and by means of inwardly extending flaps rest in loose engagement with the box bottom when the box is not collapsed.

The above box and other boxes of the present practice fold substantially flat but with a total thickness equal to about four or five times the thickness of the paneling material used. In addition such boxes of the present practice present many members exposed to ripping and tearing during the unfolding, collapsing, or storage operations. Moreover, members of such boxes must be substantially rearranged prior to collapsing or unfolding the box. Decreasing the number or size of the members might obviate some of these difficulties. However such a modification also decreases the strength and durability of the box and gives it a tendency to collapse at undesired times, and has not been followed.

Speaking generally, the present invention provides a foldable box that collapses completely flat to a total thickness equal substantially throughout to only twice the thickness of the panel material used, and it exposes no members to ripping, tearing or bruising whatsoever during handling operations. Further it provides a box having improved strength and durability and which does not collapse prematurely. Further it is collapsed and unfolded readily and quickly without any need for re-arrangement of the various parts thereof. Still further the operative parts of the box can consist of only two moving members.

Briefly this is accomplished by providing two lengths of rectangular material, one positioned above the other, to comprise two bottoms of the box. A quadrilateral side panel is foldably connected to and extends upwardly from each longitudinal edge of one of the box bottoms to form two opposing box sides; and, a quadrilateral end panel is

2

foldably connected to and extends upwardly from each lateral edge of the other box bottom to form two opposing box ends. The upper portion of each box side and box end is pivotally connected to a rectangular wire frame spanning the space between said sides and between said ends. The wire frame is positioned in a plane parallel to the plane of the box bottoms.

Preferably the upper box bottom is suspended closely adjacent to but not in contact with the lower box bottom when the box is empty, so that there is clearance therebetween. More preferably the upper bottom is coextensive with the lower bottom. Still more preferably each box side and box end is rectangular and extends upwardly at a right angle to the plane of its respective bottom.

The accompanying drawings illustrate preferred forms of my invention. In these drawings Figure 1 is a perspective view of the unfolded box ready for loading. Figure 2 is a perspective view of the box of Figure 1 after the first step of the collapsing operation showing one of the portions thereof folded flat. Figure 3 is a perspective view of the box of Figure 1 completely collapsed. Figure 4 is a perspective view of an alternative form of the invention showing the addition of an envelope to provide sealing at the corners of the box, and to provide a cover. Figure 5 is a perspective view of a frame for a box constructed in accordance with the teachings of the invention.

Referring in detail to the preferred embodiments shown in the drawings, the box is provided with two rectangular sheets of stiff and relatively rigid paperboard or corrugated cardboard which are each scored or prepared with fold lines to form a double bottom 1 and 2 for the box, bottom 2 being positioned directly above and coextensive with bottom 1 and preferably not resting thereon but with clearance therebetween. Lower bottom 1 may have greater length or smaller width, or both, than upper bottom 2 but preferably the bottoms are coextensive. Quadrilateral side panels 3 and 4 extend upwardly, preferably at right angles to the plane of bottom 2 as shown, from the fold-lined longitudinal edges of upper bottom 2 and comprise oppositely facing sides of the box and are preferably integral with the upper bottom 2. Quadrilateral end panels 5 and 6 are extended upwardly between side panels 3 and 4 at right angles from the fold-lined lateral edges of lower bottom 1 and comprise oppositely facing ends of the box, and are preferably integral with the lower bottom 1. In the most preferred embodiment of the invention, as shown, the box end panels 5 and 6 and the box side panels 3 and 4 are each rectangular and extend upwardly at right angles to the planes of the bottoms 1 and 2, respectively.

A rectangular wire frame 7 having spaced sides and ends is positioned in a plane parallel to the planes of bottoms 1 and 2, and spans the space between the box ends and box sides. The upper portion of each side panel 3 and 4 of the bottom 2 is rolled around the corresponding side of wire frame 7 and folded inwardly back upon itself throughout its entire length and there fastened permanently by staples, as shown, to form a pivotal connection with the wire frame. Similarly, the upper portion of each end panel 5 and 6 of bottom 1 is rolled around the corresponding end of wire frame 7 and folded inwardly back upon itself throughout its entire length and fastened permanently by staples, as shown. Alternatively other fastening means can be utilized such as strips of paper pasted over the leading edge of the panel and the face of the panel.

Cut outs 8 and 9 are provided in end panels 5 and 6 of a size suitable for hand grips.

The box as so constructed is in the unfolded posture ready for loading as shown in Figure 1. As will be seen from the drawing, upper bottom 2 is suspended above

3

bottom 1, and closely adjacent to and between end panels 5 and 6. In this position movement of either end panel 5 or 6 causes one or the other to immediately abut against bottom 2 said bottom holding the end panels against any collapsing or folding movement with respect to bottom 1, as the bottom 1 acts either as a tension member or as a compression member with respect to the end panels 5 and 6. When the box is loaded, even slightly, the weight of the load on bottom 2 precludes collapsing or folding movement of side panels 3 and 4 since such movement requires the vertical lifting of bottom 2 against the forces of gravity. Also, the bottom 2 holds the lower ends of the side panels 3 and 4 with a fixed spacing so they cannot move toward or away from each other. Conversely, with an extremely heavy load, bottom 2 rests on bottom 1 and the multiple strength of a double bottom to the box is utilized so as to provide a box of great weight carrying capacity and stability.

Collapsing of the box is as follows: Force is exerted inwardly against one of the side panels 3 or 4 thereby causing the other side panel to swing outwardly on its side of wire frame 7 and to fold inwardly on the longitudinal edge of bottom 2 to abut snugly against the face of bottom 2. Bottom 2 swings outwardly and upwardly to clear bottom 1, the first side panel swinging inwardly on wire frame 7 and unfolding at the longitudinal edge of bottom 2, as at 9. At this stage, the two side panels and bottom 2 lie flat in the plane of wire frame 7. Thereafter, force is exerted inwardly against one of the end panels, thereby causing the other end panel to swing outwardly on its end of wire frame 7 and to fold inwardly to abut snugly against the face of bottom 1 which swings vertically but at a right angle to the aforesaid swinging movement of bottom 2, the first end panel swinging inwardly on wire frame 7 and unfolding at lateral edge of bottom 1. Bottom 1 and end panels 5 and 6 have thus assumed a position in the plane of wire frame 7, see Figure 3, and the box is completely collapsed.

The flat structure presented in collapsed position has an extremely small thickness, the total thickness comprising substantially only two thicknesses of panel material. No members or portions of the box protrude or are exposed to mishandling or bruising.

Unfolding the box from the collapsed to loading position will be understood from the illustration and description above, bottom 1 with end panels 5 and 6 being first unfolded followed by unfolding of bottom 2 with side panels 3 and 4, bottom 2 swinging above and clearing bottom 1.

It should be understood that instead of being made with stiff paperboard or corrugated cardboard and the like, more rigid material such as wood, aluminum, etc. may be employed.

When the box of my invention is to be used to carry material made up of units having small outer dimensions, I prefer to provide an envelope 10 shown in Figure 4. The envelope 10 is made of paperboard or other suitable packaging material and is fitted around the box when in loading position so as to seal the openings between the end and side panels at the corners of the box but does not cover the corners 12 of the frame 7 which serve to prevent sidewise movement of the envelope. The envelope 10 has cover flaps 11 which form a cover for the box when desired.

When desired to have non-integral construction the end and side panels are constructed as members separate from bottoms 1 and 2, rather than extensions thereof. In this form of the invention, separate side panels 3 and 4 are foldably connected to the longitudinal edges of bottom 2 by hinges or the like and separate end panels 5 and 6 are similarly connected to the lateral edges of bottom 1. Collapsing and unfolding of this form of the invention is identical with collapsing and unfolding of the first form of the invention illustrated and described.

4

In another alternative form of the invention, side panels 3 and 4 are foldably connected to the longitudinal edges of lower bottom 1, and end panels 5 and 6 are similarly connected to upper bottom 2 at its lateral edges. Operation of this form of the invention to collapse or unfold the box will be understood from the illustration and description above of the first form of the invention, the upper bottom and end panels being collapsed first during the collapsing operation and being unfolded first during the unfolding operation.

Another form of the invention is shown in Fig. 5 and comprises a box frame made of parallelly-disposed tubular frame members 13 pivotally secured to each other and to the wire frame 7. The end portions of the frame are formed by U-shaped tubular members 13a having their lower sections pivotally mounted within openings formed in the rolled-over ends of a pair of parallel members 13b forming the lower bottom for the frame. The side portions of the frame are formed by similar, but wider, U-shaped tubular members 13c having their lower sections mounted within openings in the rolled-over ends of a pair of parallel members 13d forming the upper bottom of the frame. Collapsing and unfolding of this frame is identical with the other forms of invention described. Such a frame may be utilized when erected by inserting it in a box to strengthen it or may be utilized to receive box members within it so as to be a support therefor.

It should be understood that my invention is not limited to details described above and shown in the drawings, except as appears hereafter in the claims.

I claim:

1. A collapsible box structure having two rectangular bottoms one positioned above the other in parallel relationship, a rectangular wire frame positioned above said bottoms in parallel relation thereto, two quadrilateral box ends for one of said bottoms, each box end being at right angles to said bottom in its unfolded position and connected at its lower edge to said bottom and at its top edge to said frame for pivotal movement through an angle of 90° with respect to said bottom and through an angle of 90° with respect to said frame in pivoting from its unfolded to its folded position, whereby said box ends and said bottom swing as a unit on said frame during repeated folding and unfolding, and two quadrilateral box sides for the other of said bottoms, each side being at right angles to said other bottom in its unfolded position and connected at its lower edge to said other bottom and its top edge to said frame for pivotal movement through an angle of 90° with respect to said other bottom and through an angle of 90° with respect to said frame in pivoting from its unfolded to its folded position, whereby said box sides and said other bottom swing as a unit on said frame at right angles to the first mentioned swinging movement during repeated folding and unfolding of the box.

2. The subject matter of claim 1 characterized by the fact that said upper bottom is positioned above the lower bottom with clearance space therebetween.

3. The subject matter of claim 1 characterized by the fact that said box sides are connected to longitudinal edges of the upper bottom and the box ends are connected to lateral edges of the lower bottom.

4. The subject matter of claim 1 characterized by the fact that said box sides are connected to longitudinal edges of the lower bottom and the box ends are connected to lateral edges of the upper bottom.

5. A collapsible box structure having two rectangular paperboard bottoms one positioned above the other in parallel relationship, a rectangular wire frame positioned above said bottoms in parallel relation thereto, one of said bottoms having two paperboard quadrilateral box end sections each box end section being integral with and at right angles to said bottom in its unfolded position and having a fold line at its lower edge at the joint with said

5

bottom and pivotally connected at its top edge to said frame for pivotal movement through an angle of 90° with respect to said bottom and through an angle of 90° with respect to said frame in pivoting from its unfolded to its folded position, whereby said box end sections and said bottom swing as a unit on said frame during repeated folding and unfolding, and the other of said bottoms having two paperboard quadrilateral box side sections, each side section being integral with and at right angles to said other bottom in its unfolded position and having a fold line at its lower edge at the joint with said other bottom and pivotally connected at its top edge to said frame for pivotal movement through an angle of 90° with respect to said other bottom and through an angle of 90° with respect to said frame in pivoting from its unfolded to its folded position, whereby said box side sections and said other bottom swing as a unit on the wire frame at right angles to the first mentioned swinging movement during repeated folding and unfolding of the box.

6. The subject matter of claim 5 characterized by the fact that said box sides are connected to longitudinal edges of the upper bottom and the box ends are connected to lateral edges of the lower bottom, said box ends having a height greater than the height of the box sides the difference in height being at least equal to the thickness of the upper bottom.

7. The subject matter of claim 5 characterized by the fact that said box ends are connected to the longitudinal edges of the upper bottom and the box sides are connected to the lateral edges of the lower bottom said box sides having a height greater than the height of the box ends the difference in height being at least equal to the thickness of the upper bottom.

8. A collapsible box structure having two rectangular bottoms one positioned above the other in parallel re-

6

lationship each of said bottoms made up of parallel tubular members having their ends rolled over to form openings, a rectangular wire frame positioned above said bottoms, in parallel relation thereto, two quadrilateral box ends for one of said bottoms and two quadrilateral box sides for the other of said bottoms, each box end and each box side made up of U-shaped tubular members having the lower section of the U pivotally mounted in the openings in the corresponding bottom, each box end being at right angles to said bottom in unfolded position and connected at its top edge to said frame for pivotal movement through an angle of 90° with respect to said bottom and through an angle of 90° with respect to said frame in pivoting from its unfolded to its folded position, whereby said box ends and said bottom swing as a unit on said frame during repeated folding and unfolding, each box side being at right angles to said other bottom in its unfolded position and connected at its top edge to said frame for pivotal movement through an angle of 90° with respect to said other bottom and through an angle of 90° with respect to said frame in pivoting from its unfolded to its folded position, whereby said box sides and said other bottom swing at right angles to the first mentioned swinging movement during repeated folding and unfolding of the box.

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