Sept. 19, 1967 E. R. KELLEY 3,342,400

CONTAINER

Filed Sept. 22, 1965

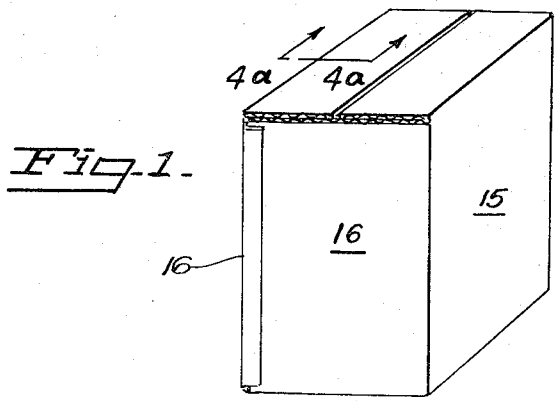


Fig. 1.

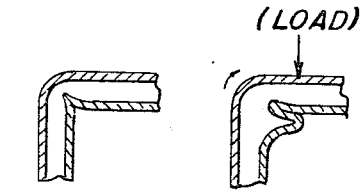


Fig. 5a. Fig. 5b.

(PRIOR ART)

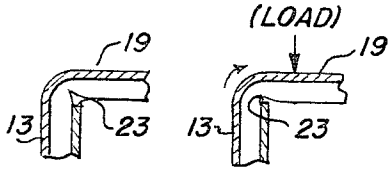


Fig. 4a. Fig. 4b.

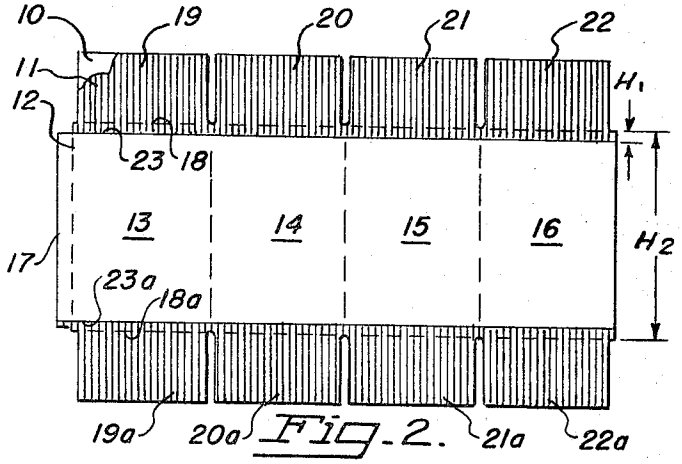


Fig. 2.

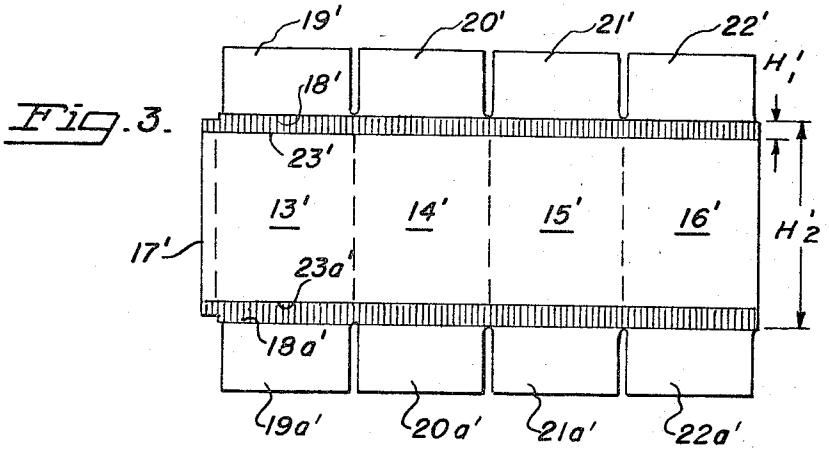


Fig. 3.

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United States Patent Office 3,342,400 Patented Sept. 19, 1967

3,342,400

CONTAINER

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Filed Sept. 22, 1965, Ser. No. 489,130
6 Claims. (Cl. 229—37)

This invention relates to a container and more particularly relates to a multi-ply container wherein portions of one of the plies adjacent a container cover flap is removed to improve the stacking strength thereof.

A basic requirement for most containers is that they provide adequate stacking strength to thus resist a tendency to collapse when loads are imposed thereupon. This requirement is particularly important with respect to corrugated, paperboard containers, for example, adapted to contain articles which are prone to crushing. When such containers are filled and stacked, the lowermost containers oftentimes support a considerable weight.

In order to enhance the compression or stacking strength of the container, plies have generally been added to various panels thereof. Another well known procedure for increasing stacking strength is to utilize a stronger container material.

This invention departs radically from the above, briefly described, accepted procedures in that the stacking strength of a multi-ply container is enhanced by removing rather than adding material adjacent to a scoreline which hingedly connects a vertically disposed panel to a horizontally disposed cover flap. The initial reaction by one skilled in the art would be that such material removal would function to decrease the stacking strength of the container. However, as will be more fully understood from the following discussions testing has proved that such removal actually increases stacking strength.

An object of this invention is to provide a multi-ply container blank which may be expeditiously erected to form a container which exhibits a greater stacking strength and utilizes less material than conventional ones.

A further object of this invention is to provide a multi-ply container wherein portions of one of the plies are removed adjacent a scoreline which hingedly connects two panels together to provide means for increasing the stacking strength thereof.

Further and more specific objects of this invention will become apparent from the following description and drawing wherein:

FIG. 1 discloses an erected, multi-ply container;

FIG. 2 is the blank utilized to form the container illustrated in FIG. 1;

FIG. 3 is an alternative blank which may be utilized to form the type of container illustrated in FIG. 1;

FIG. 4*a* is an enlarged, cross-sectional view taken in the direction of arrows 4*a*—4*a* in FIG. 1;

FIG. 4*b* discloses the corner construction illustrated in FIG. 4*a* as it would appear after a load has been imposed thereupon; and

FIGS. 5*a* and 5*b* illustrate prior art container constructions corresponding to those disclosed in FIGS. 4*a* and 4*b*, respectively.

The container illustrated in FIG. 1 preferably has a rectangular cross-section and is formed out of the multi-ply blank of FIG. 2. The blank preferably comprises an outer facing ply or sheet **10**, an intermediate corrugated ply **11** and an inner facing ply **12**, all formed of a paperboard constituent. Main body panels **13**, **14**, **15** and **16** are adapted to be attached together in a conventional manner by means of manufacturer's glue flap **17**.

A longitudinally extending scoreline **18** hingedly connects top closure or cover flaps **19**, **20**, **21**, and **22** to their

respective panel members, adjacent to edge **23** of inner ply **12**. Slots are preferably formed between the flaps in order to facilitate folding when the container is erected. The flap arrangement for the bottom closure is preferably identical to the flap arrangement for the top closure and is thus denoted by like numerals, accompanied by subscripts "*a*."

Manufacturer's glue flap **17** is secured to panel **16** by means of a conventional adhesive to form a tubular shaped container for shipping purposes. The bottom closure may be formed by attaching flaps 19_a–22_a together in superimposed relationship by a conventional fastening means, such as an adhesive. After the contents have been placed in the container, flaps **19**–**22** may be attached together in a like manner to form the top closure. It should be noted that the corrugations formed on intermediate ply **11** are preferably arranged vertically when the formed container assumes its normal FIG. 1 position.

The alternative blank arrangement illustrated in FIG. 3 differs from the afore-described blank in that the inner facing sheet is arranged to cover the closure flaps. It should be noted that the numerals in FIG. 3, accompanied by a prime symbol (′), correspond to the numerals and thus like numbered elements appearing in FIG. 2.

FIGS. 4*a* and 4*b* illustrate how the means for enhancing the stacking strength of the container appears to function when a load is imposed upon top flap **19**, for example. As therein indicated, when a load is imposed upon horizontally disposed flap **19**, a type of rolling function occurs at the corner with respect to vertically disposed panel **13**. Such rolling results in a partial collapse of the panel which is resisted due to the construction and arrangement of the means formed by the arrangement of edge **23** of inner ply **12**.

Referring now to the conventional or standard corner construction illustrated in FIGS. 5*a* and 5*b*, it can be seen that when a load is imposed upon the top panel thereof that the paperboard undergoes a severe crushing with the inner ply undergoing a fold of approximately 180°. Various tests were conducted to compare this type of prior art construction to that illustrated in FIG. 4*a*.

For example, a conventional corrugated container having a size of 27 in. x 13 in. x 7½ in. was subjected to top loading and exhibited a compression strength of approximately 1180 pounds before collapse. In comparison thereto, a similarly sized container having edge **23** of liner **12** spaced one-quarter of an inch from scoreline **18** (H_1), exhibited a compression strength of 1658 pounds, i.e., a 40% increase in compression or stacking strength over the tested standard container. In addition, a .51 pound savings in the amount of inner liner **12** utilized was realized. Additional comparative tests on containers of various sizes further indicated that application of the inventive principles herein taught gave rise to a number of new and unexpected results.

The following chart lists the results of a number of such comparative tests, conducted upon three-ply corrugated paperboard containers. Tested containers of this invention were formed out of blanks similar to those disclosed in FIGS. 2 and 3.

The "Size" column lists the container's length, width and internal height (H_2), respectively. The "Grade" notations for the paperboard utilized are standard ones, well known to those skilled in the packaging arts. For example, the numeral "275" denotes the results of a standard Mullen test conducted according to the Uniform Freight Classification, Rule 41, Section 3. The letter "A" symbolizes that thirty-six standard flutes or corrugations on ply **11** were employed per linear foot whereas the letter "C" symbolizes that forty-two such flutes were utilized.

The "Compression" or stacking strength may be gen-

erally defined as the amount of top load (lb.) the container withstood before substantial collapse.

AVERAGE MAXIMUM TOP LOAD COMPRESSION (LB.)

Container	Size (in.)	H^1/H^2 (approx.)	Grade	Comp. Str. (lb.)	Str. Inc.	Savings of Ply 12 (lb.)
Standard	27 x 13 x 7.5		275-A	1,180		
H_1=.25 in	27 x 13 x 7.5	3.33%	275-A	1,658	40%	.51
Standard	26.75 x 13 x 7.5		275-A	1,130		
H_1=.125 in	26.75 x 13 x 7.5	1.67%	275-A	1,445	28%	.51
H_1=.25 in	26.75 x 13 x 7.5	3.33%	275-A	1,577	39%	.51
Standard	24 x 15 x 22		175-A	730		
H_1=.125 in	24 x 15 x 22	.57%	175-A	877	20%	.42
Standard	25.5 x 15.5 x 22.5		175-A	819		
H_1=.125 in	25.5 x 15.5 x 22.5	.56%	175-A	984	20%	.34
Standard	17.5 x 11.5 x 11.125		200-C	641		
H_1=.25 in	17.5 x 11.5 x 11.125	2.25%	200-C	761	12%	.26
Standard	16 x 14.25 x 19.5		175-A	644		
H_1=.25 in	16 x 14.25 x 19.5	1.28%	175-A	678	5%	.24

Referring once again to FIG. 2, the vertical height of the area between edge **23** of ply **12** and the center of scoreline **18** is depicted by H_1 whereas the vertically disposed height of a panel between parallel scorelines **18** and **18***a* is depicted by H_2. Testing has shown that it is desirable to maintain H_1 from 0.1% to 20% of H_2 and preferably from 0.4% to 5%. The distance H_1 may be from 0.0625 in. to 0.5 in. and preferably from 0.125 in. to 0.25 in.

It should be noted that the above discussed inventive concepts may be also applied to a large number of non-corrugated containers having two or more plies. Also, a material other than paperboard may be utilized therefor and the container may have a non-rectangular cross-section, i.e., hexagonal, octagonal, etc. Furthermore, the means for increasing stacking strength (H_1) may be formed on any one of the container plies, although it is preferable that the same be formed on the inner ply, i.e., such as inner ply **12** of the container illustrated in FIG. 1.

I claim:

1. A corrugated container comprising superimposed outer, intermediate and inner plies forming horizontally disposed top and bottom closure flaps and vertically disposed panels, outer and inner intermediate plies substantially arranged in coextensive relationship, said inner ply arranged on said panels to terminate short of a scoreline hingedly connecting said top closure flaps to said panels, said inner ply being absent for a distance from said termination at least to said scoreline so that said panels resist crushing when a load is imposed upon said top closure thereby increasing the container stacking strength.

2. The invention of claim **1** wherein the distance from the point where said inner ply terminates to said scoreline is from 0.0625 in. to 0.5 in.

3. The invention of claim **1** wherein the distance from the point where said inner ply terminates to said scoreline is from 0.125 in. to 0.25 in.

4. The invention of claim **1** wherein said top closure flaps constitute said outer, intermediate and inner plies.

5. A multiply corrugated blank comprising a series of connected panels and a scoreline formed on said panels defining a flap arranged to extend from each of said panels, said flaps adapted to be formed into a container top closure, said panels comprising outer, intermediate and inner plies, said outer and intermediate plies arranged in substantial coextensive relationship, said inner ply arranged to terminate short of said scoreline and be absent for a distance at least to said scoreline so that said panels resist crushing when a load is imposed upon said top closure and the stacking strength is increased when the blank is erected.

6. The invention of claim **5** wherein said flaps constitute outer, intermediate and inner plies.

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