United States Patent [19]

Troth

[11] **3,727,825**

[45] **Apr. 17, 1973**

[54] **PLASTIC CONTAINER**

[75] Inventor: **John S. Troth,** Wilmington, Del.

[73] Assignee: **Panmark, Inc.,** Montchanin, Del.

[22] Filed: **Mar. 19, 1971**

[21] Appl. No.: **126,053**

[52] **U.S. Cl.** .....**229/32,** 220/31 S, 229/33, 229/DIG. 4

[51] **Int. Cl.** **B65d 5/22**

[58] **Field of Search**.....220/31 S, 62, 72; 229/2.5, 3.1, 3.5 R, 6 R, 16 R, 33, 44 R, DIG. 4, 32, 37 R, 38, 6 A; 93/36 R, 58 R

[56] **References Cited**

UNITED STATES PATENTS

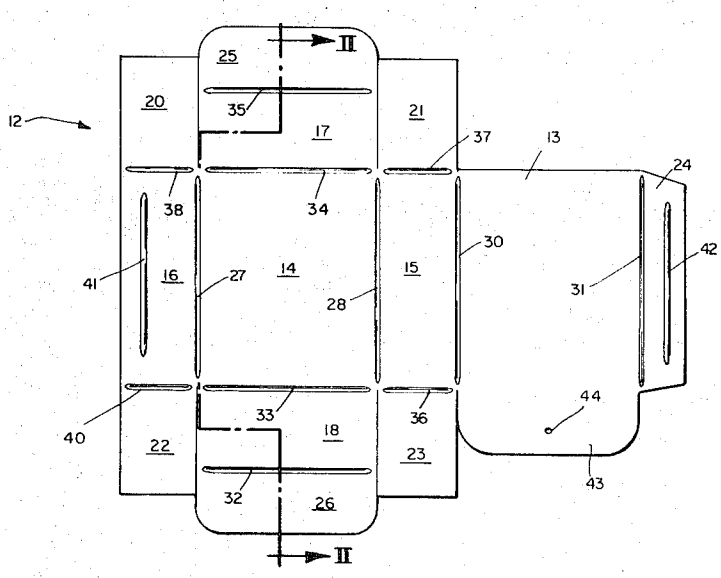
2,751,136	6/1956	Moore	229/37 R X
3,381,880	5/1968	Lewallen et al.	229/36
3,334,802	8/1967	Gooding	229/3.5 R X
3,462,067	8/1969	Shore	229/17 G X
3,393,858	7/1968	Heel	229/6 A X
2,185,604	1/1940	Moore	229/43
3,552,595	1/1971	Gerner	220/31 S X

Primary Examiner—Joseph R. Leclair
Assistant Examiner—Steven E. Lipman
Attorney—Paul & Paul

[57] **ABSTRACT**

A container of sheet plastic construction is provided, constructed generally of a single sheet of material, with fold lines thereof being applied under heat and pressure, to facilitate ready folding of the container from flattened blank form, by the use of preferably conventional folding machinery. The container corner constructions are of especially deep construction, and have "dished," or tapered ends, to facilitate handling of nested stacks of container blanks, such as ready transfer of one blank in a stack laterally thereof, by high speed machinery. A re-closable snap type lock is also provided for the container, as well as a hang tab. In the folded form, the containers have protruding corners, which cooperate, when a plurality of containers are packaged, to act as spacers, with the container corners spacing container walls against scuffing and the like.

6 Claims, 9 Drawing Figures



PATENTED APR 17 1973

3,727,825

SHEET 1 OF 2

Fig. 1

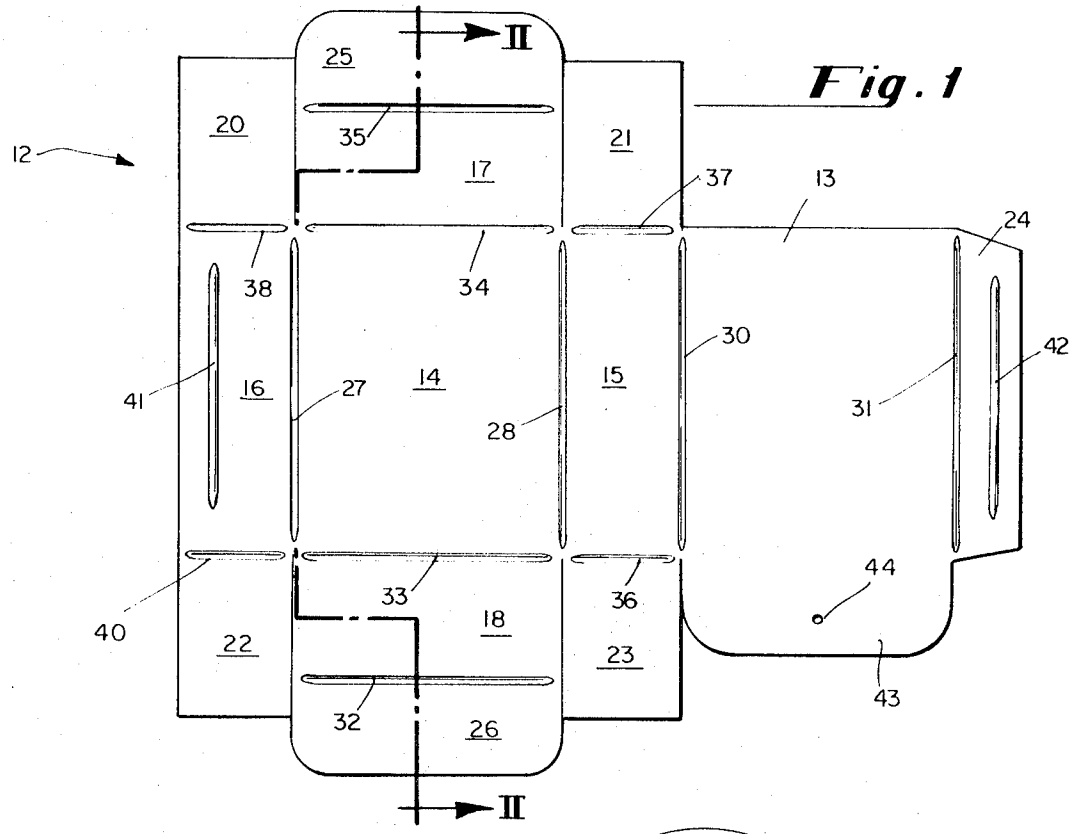


Fig. 2

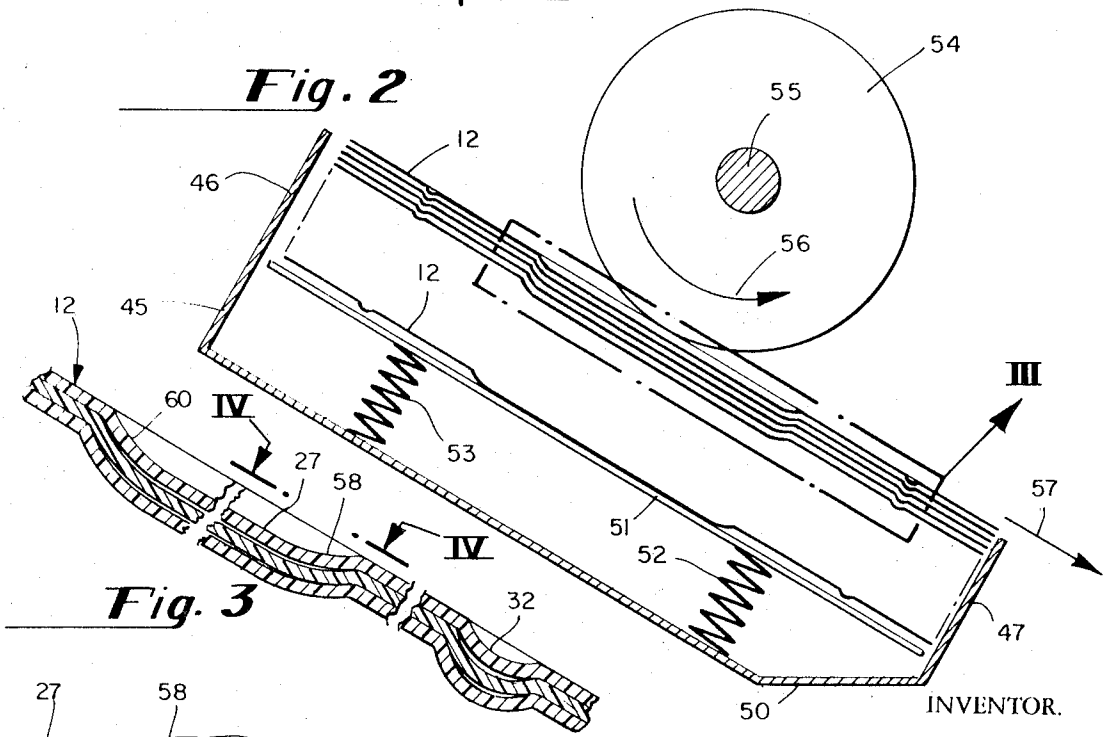


Fig. 3

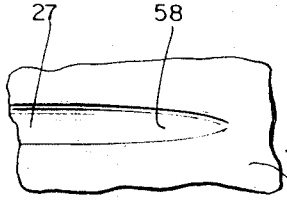


Fig. 4

INVENTOR.
John S. Troth

BY

Paul & Paul

ATTORNEYS.

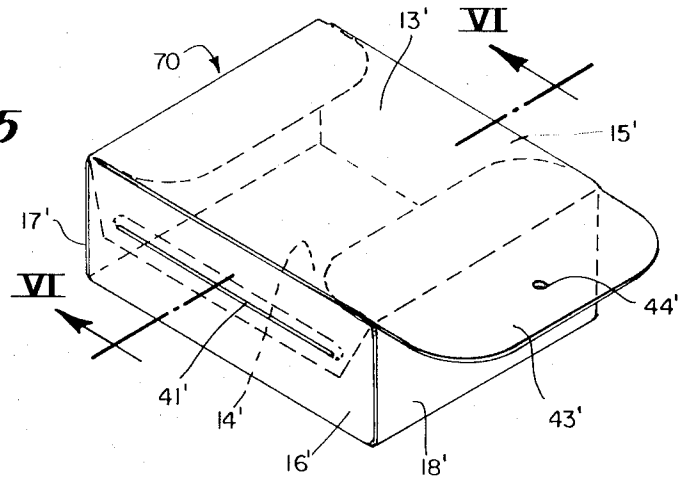


Fig. 5

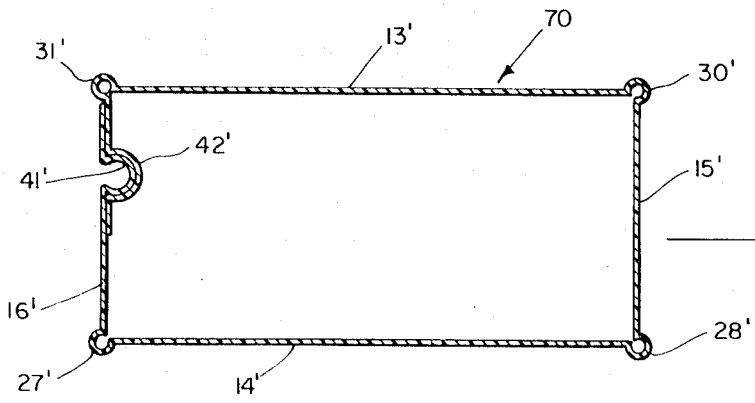


Fig. 6

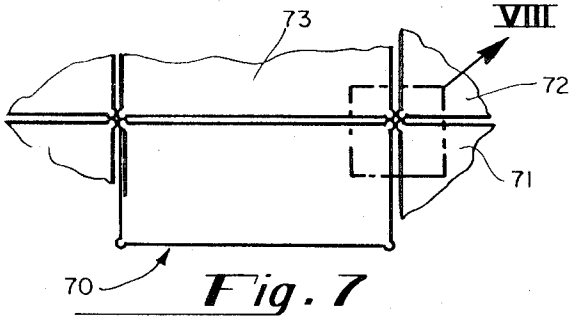


Fig. 7

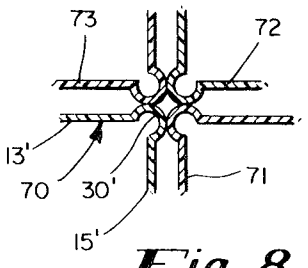


Fig. 8

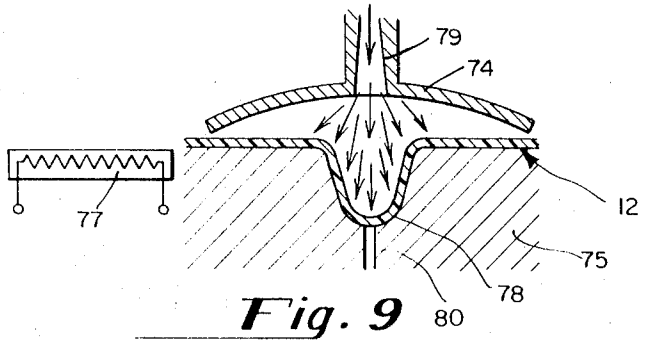


Fig. 9

INVENTOR.
John S. Troth

BY

Paul & Paul

ATTORNEYS.

PLASTIC CONTAINER

BACKGROUND OF THE INVENTION

In the past, almost all folding cartons for packaging of goods have been of paperboard, or cardboard construction, and greatly sophisticated machinery has been developed for rapidly handling cardboard blanks, and folding the same, into "set up" condition. For example, in feeding cardboard blanks, as part of a transfer operation, it has been known to handle such blanks at the rate of 120,000 per hour.

With diminishing forestry preserves, and the consequent diminution of the available supply of paperboard, it has been necessary to look for substitutes for cardboard and paperboard packaging material. In addition to this, goods are provided in our economy in packaged form, as opposed to loose or other forms, in an ever increasing tendency.

With the development of various forms of plastics, several attempts have, in the past, been made to utilize sheet plastics, for the striking of blanks with such plastics consequently being folded into container configurations. It has been thought, because of some of the characteristics of plastic materials, such containers could be a profound improvement upon the existing paperboard materials, if they could be made economically and practically. For example, while not intending to be exhaustive, some of the advantages of plastic are that it is generally water-proof, and can resist dampness, mildew and the like, as well as lending itself to various printing uses, or for transparent packaging, whereby the goods contained therein may readily be viewed, by a purchaser, for example.

However, what has consistently remained a problem, is the high speed handling and folding of containers made from sheets of plastic materials. When for example, it is desired to fold adjacent panels, the inherent "memory" in the plastic opposes such folding of adjacent container panels, and even if the panels are successfully folded along a fold line, this "memory" continues to oppose the finally formed container configuration, thereby leaving the container with bulbous sides which leads to other difficulties. However, because of such strong "memory", conventional packaging machinery, which, for the most part has been developed to date to handle cardboard and paperboard blanks, cannot satisfactorily feed, or "set-up" plastic blanks.

To a limited degree, the foldability problem of sheets of plastic has been improved upon, by the use of a heated knife for scoring the sheets of plastic prior to folding it. The heated knife may in many instances actually reduce the cross-sectional configuration of the plastic at a certain location, thereby rendering the corners to have less material, which facilitates their folding, but, at the same time, reduces their effectiveness as rigidifying members for the container, as well as increasing the likelihood of rupture along corners, because of such reduced cross-section and because the pressure under which the score is formed often causes physical destruction of the sheet in the localized area contacted by the hot knife.

SUMMARY OF THE INVENTION

The present invention overcomes the above and other problems attendant to the use of sheets of plastic

for the construction of containers, in providing a container wherein fold lines in the blanks are thermoformed, under the application of heat and pressure, to be substantially deep, without reducing their cross-sectional configuration substantially at the point of deepening, for enlarging the zone through which the molecules in the plastic sheet material must be bent upon folding-up of a corner, thereby overcoming, to a very substantial degree, the plastic "memory" that has heretofore opposed folding of the blank. Also, for facilitating handling of blanks, the ends of such longitudinal fold lines are provided with upward tapers, to define "dished" configurations, for enabling blanks in a stack, nested with respect to one another, to be readily slidable laterally of the stack, relative to each other, whereby such tapers or upward dishing will provide a means for gently camming blanks relative to each other, whereby such blanks may be handled by conventional packaging machinery.

It is a primary object of this invention to provide a novel sheet plastic blank, capable of being handled by high speed packaging machinery, and capable of being "set-up," into a container configuration.

It is a further object of this invention to provide a novel container formed from a blank as set forth above.

It is a further object of this invention to provide a novel method of making a blank adapted for handling by high speed machinery.

It is another object to accomplish the object set forth immediately above, that includes a method of making fold lines in a blank of sheet plastic by heating said blank and forcing it by vacuum or compression, or both, into or over forming dies to produce special fold lines designed to facilitate automatic handling of said blank and to produce such fold lines while retaining the flatness of the blank except in the folding areas.

Other objects and advantages of the present invention will be readily apparent to those skilled in the art from a reading of the following brief descriptions of the drawing figures, detailed description of the preferred embodiment, and the appended claims.

IN THE DRAWINGS

FIG. 1 is a top plan view of a blank, formed in accordance with this invention;

FIG. 2 is a longitudinal sectional view, taken generally along the line II—II OF FIG. 1, taken through a stack of nested blanks, made in accordance with this invention, that are disposed within a blank-handling hopper, and through a blank-removing wheel associated therewith, for illustrating the manner in which the tapered ends of the longitudinally disposed formed fold lines of the blanks of this invention may facilitate removal of a blank from a stack of blanks;

FIG. 3 is an enlarged fragmentary detailed sectional view of the zone indicated by III in the illustration of FIG. 2;

FIG. 4 is an enlarged fragmentary view taken along the line IV–IV of FIG. 3;

FIG. 5 is a top perspective view of a container made in accordance with this invention with the back of the container facing upwardly;

FIG. 6 is a transverse sectional view of the container illustrated in FIG. 5, taken generally along the line VI—VI of FIG. 5;

FIG. 7 is a fragmentary schematic view of a plurality of containers packaged together, as for example they may be packaged in a carton;

FIG. 8 is an enlarged fragmentary detailed view of a portion of the illustration of FIG. 7, represented by the zone VIII of FIG. 7;

FIG. 9 is a transverse cross-section, taken through a longitudinally disposed fold-line-forming recess of a blank of this invention, and through apparatus that is used to form a recess of the thermo-formed type, in accordance with this invention.

DETAILED DESCRIPTION

Referring now to the drawings in detail, reference is first made to FIG. 1, wherein a sheet plastic blank of polyvinylchloride or other plastic is illustrated, being designated by the numeral 12, and comprising front and rear panels 13 and 14, respectively, side panels 15 and 16, and end panels 17 and 18. Appropriate flap panels 20, 21, 22 and 23, are foldably connected to the side panels 15 and 16, as illustrated, and a tab closure panel 24 is disposed adjacent one edge of the panel 13, for connecting the same to the panel 16, as will be discussed in greater detail herein.

The end panel 17 is provided with a tuck closure panel 25, as is the end panel 18, provided with a tuck closure panel 26.

Longitudinally disposed fold lines 27, 28, 30 and 31, are provided, connecting adjacent ones of the panels 16, 14, 15 and 13, as well as a tab closure panel 24. Said fold lines 27, 28, 30 and 31 are also referred to herein as "recesses."

Transverse fold lines 32, 33, 34, 35, 36, 37, 38 and 40 are also provided, connecting associated ones of the panels 16, 14, and 15, with appropriate associated panels 17, 20, 21, 18, 22, 23, or with closure tuck panels 25 or 26.

An upstanding rib 41 is provided, in the panel 16, that is complementally configured in cross-section with another upstanding rib 42 in the closure tab panel 24.

The panel 13 is provided with a protruding extension portion 43 having a void or recess 44 therein, for a purpose later to be discussed herein.

With particular reference to FIG. 2, it will be seen that a plurality of blanks 12 are disposed within a hopper 45 having side walls 46, 47, and end wall 48, and a bottom wall 50, with said hopper 45 having a receiving plate 51, carried therein, which is upwardly spring-biased by a plurality of blanks 12 within the hopper 45, the springs 52 and 53 will compress, by an amount determined by the number of blanks in the hopper, and by the consequent space in the hopper taken up by the same, with the springs 52 and 53 thereafter maintaining an upward biasing force on the receiving plate 51 which is transferred to the blanks 12, for maintaining a desired tension between an uppermost one of the blanks 12 within the hopper, and an extraction roll 54, suitably shaft-mounted at 55, for rotation in the direction indicated by the arrow 56, for engaging an uppermost blank 12 within the hopper, and moving the same downwardly laterally of the remaining blanks within the hopper 45, in the direction of the arrow 57 of FIG. 2.

In accordance with the present invention, this machinery for handling blanks 12 within a hopper 45, may be adapted to feed blanks of the plastic type, at a rate of 50,000 per hour, as opposed to a rate of perhaps 10,000 per hour with plastic blanks not made in accordance with this invention. With particular reference to FIGS. 3 and 4, it will be seen that the ends of the longitudinally disposed recesses such as at 27, when viewed in longitudinal cross-section, as illustrated in FIG. 3, are upwardly "dished" or tapered as at 58 and 60, at opposite ends of the recess 27 that forms the fold line and corner construction for the container made from the blank 12. This gently sloped or upwardly tapered configuration has been designed as being a "-Kayak" end construction, because of its visual appearance in longitudinal cross-section. It will be seen, that by engaging an uppermost blank 12 with the outer surface of a wheel 54, as aforesaid, under the force supplied by springs 52 and 53, for example, or by the use of a sliding feed or any other means, the frictional engagement between the circumferential surface of the wheel 54 and the upper surface of a blank 12 will be sufficient to overcome any static friction forces between an uppermost blank 12 and a next adjacent blank.

The nested "Kayak" type ends of the longitudinal recesses 27, while substantially deep, as viewed in FIG. 3, are sufficiently tapered for an uppermost blank to be engaged by complementally configured surface portions of a next subjacent blank and thereby to be "cammed" upwardly and out of the recess of the next subjacent blank for removal from the stack within the hopper 45, in the direction of the arrow 57 of FIG. 2.

It will further be noted that the transversely disposed recesses, such as at 32 of the topmost blank 12 within the hopper 45, are more shallow, or less deep than the recesses 27, but are wider, as measured in the plane of the upper surface of the blank 12, for achieving substantially the same folding effect with respect to the recesses being adapted to form a fold line attendant to the construction of containers from blanks 12, without meeting substantial opposition from plastic memory forces or the like, but wherein the recesses 32 are not sufficiently deep that a blank 12 would become fixedly engaged with a subjacent blank, to the extent that it would prevent the sliding of an uppermost blank 12 in the direction of the arrow 57, relative to its subjacent blank. That is, the recesses 32 are sufficiently shallow that they will not substantially inhibit lateral sliding of an uppermost blank from a hopper 45, in the direction of the arrow 57. Ends of transverse recesses such as those 32 will generally also have the gently sloped and dished "Kayak" configuration illustrated for the ends 58 and 60 of the recess 27 illustrated in FIGS. 3 and 4.

Without a dished end configuration such as that at 58 for the recess 27 of the uppermost blank 12 within the hopper, recesses that would be as deep as a recess 27, for example, may become effectively interlocked against lateral movement in the direction of the arrow 57 of FIG. 2, and in effect, may become firmly seated in nested relation with respect to a subjacent blank.

With particular reference to FIG. 5, it will be seen that a container 70 is provided, having back and front walls 13' and 14', side walls 15' and 16', and end walls 17' and 18', corresponding, respectively, to similar panels designated for the blank 12 of the illustration of FIG. 1. Also, with particular reference to FIG. 6, it will be seen that fold lines or corners 27', 28', 30' and 31'

correspond to associated recesses 27, 28, 30 and 31 in the blank 12 of the illustration of FIG. 1. Further, the omega lock indicated by the male portion 41' and the female portion 42' of the illustration of FIG. 6 corresponds to protrusions 41 and 42 illustrated for the blank 12 of FIG. 1.

It will further be seen that the extension 43 of blank 12 becomes a hanging tab 43' of the container of FIG. 5, with a hanging hole 44' therein, for hanging of a package on a nail, peg, hook or the like, if desired.

The fold lines 27', 28', 30' and 31' are convex as viewed from externally of the container 70, and concave, as viewed from internally of the container. This is most clearly evident in FIG. 6, whereby it will be seen that, due to the particular configuration and original depth of the recesses that formed the corners, the corners 27', 28', 30' and 31' protrude outwardly along the edges of the container 70 although, if desired, the corners 27', 28', 30' and 31' may be disposed inwardly of each container 70, as for example, when spacing of adjacent containers 71 and 72 is not desired, or to accommodate the physical characteristics of some materials.

When using materials where no suitable solvent is readily available for sealing a blank tab such as at 24, to a panel at 16 an omega type lock such as that provided by the mating protrusions 41' and 42' may be utilized, which, in addition to securely sealing the container closed, may render the same re-openable, as well as reclosable. An omega-type lock may be formed in the blank 12 in the same manner as the formation of the recesses 27, 28, 30 and 31, if desired, and, once formed, and folded into the condition of the container of FIG. 6, securely matingly engages with its mating component, for providing a snap-action closure. It will be apparent that closures of the type indicated by the male 41' and female 42' portions of the closure of the container 70 may also be provided for the tabs 25 and 26, if desired, for engagement of such tabs with portions of the front wall 13' of the container 70, if desired.

The protruding nature of the corners 27', 28', 30' and 31' can best be understood by reference to FIGS. 7 and 8, wherein a plurality of containers such as at 70, and an adjacent container 71, and other containers 72 and 73 are illustrated, packaged together, with several protruding corner constructions 30' being in engagement with each other, thereby spacing container walls such as those 13' and 15' from similar container walls of adjacent containers. This is particularly desirable if the walls 13' and 15' have been printed and it is desired to avoid scuffing of the walls of packages by the walls of next adjacent packages during handling of a package containing many such containers, for example. Also, the particular cross-sectional configuration of each of the corners 30' facilitates absorption of energy upon impact, and therefore reduces breakage that may otherwise occur.

In forming the longitudinally disposed recesses 27, 28, 30 and 31 of the blank 12 of FIG. 1, the blank 12 may first be pre-heated, if desired by passing over a preheating plate 77 of FIG. 9, and then over upper die member 75, and below an air jet hood 74.

The die 75 has a recess 78 for each fold line or omega lock portion of the blank 12, each recess 78 being adapted for receiving therein a portion of the sheet plastic material comprising the blank 12, inasmuch as a stream of compressed air from a jet 79 forces plastic blank material disposed therebeneath into a recess 78. The blank 12 has already been heated to a temperature sufficient to permit the plastic material of the blank 12 to flow into the recesses 78 under the force of the jet stream. If desired, a port 80 may be disposed within the lower die 75, for evacuating the recesses 78, or, if a jet is not used, for vacuum evacuation or the like. However, it will be noted that the material comprising the die 12 is subjected to sufficient heat and pressure to result in the cross-sectional configuration illustrated for the recess 27 in the blank 12, without inducing memory stresses in the sheet of plastic material in the area of the recess 27. While it is to be recognized that there will be some slight reduction in cross-sectional thickness of the material that forms the recess 27, such is not appreciable and it is controlled, because the temperature of such portions is raised to a level to permit flowing of the material and even re-distribution of the same, without inducing stresses. It will be noted that all of the recesses are made in the same manner as at 27, but that the shallower transverse recesses such as 32, for example, are merely not made quite as deep as the longitudinal recesses 27, for the purpose disclosed above with respect to the illustrations of FIGS. 2 and 3. It will further be noted that the process set forth herein with respect to the illustration of FIG. 9, because of the application of heat and pressure as mentioned, may be referred to as a "thermoforming" process.

It will be noted that the longitudinal recesses, such as at 27 will generally be of a depth determined by the thickness of the material, but, in some instances may be approximately one thirty-second inches deep, and ranging from one thirty-second to three sixty-fourths inches wide, whereas the transverse recesses, such as at 32 may be approximately one sixty-fourths inches deep, and substantially wider than the recess 27.

It will further be noted that as used herein, "inside recess bottom portions" refers, for example, to the upper surface of recess 27 as viewed in FIGS. 3 and 4. The same general reference is made with respect to a shallower recess such as at 32.

It will be apparent from the foregoing that desired ends of this invention are met, in that it is apparent that the container 70 of this invention, when in the form of the blank 12 will maintain its flatness, in that there are no recesses formed in the blank 12 that are trying to recover their original position, thereby tending to curl the blank. Accordingly, by the use of thermo-formed recesses, as aforesaid, the blanks may be readily fed at a desired rate. Also, because of the particular construction of the corners as is illustrated in FIG. 6, once the blanks are fed, and the flap 24 engaged with the panel 16, either by the use of the omega lock taught herein, or by the use of an adhesive, such as a solvent, if the material comprising the blank 12 permits such use, other packaging machinery that would permit the erection of the container 70 from a flattened condition, to the erect condition illustrated in FIG. 6 will not meet with resistance arising from a "memory" within the corners 27', 28', 30' and 31', that might otherwise tend to maintain the container 70 in a somewhat flattened form.

In addition to the use of polyvinylchloride and other vinyl formulations, as set forth herein, other materials that may be desirable for the formation of blanks **12**, in accordance with this invention may include polystyrenes, polypropylenes, polyethylenes, various acetates, and many others.

It will be apparent from the foregoing that the objects of the invention have been met by the disclosure set forth herein, but that the invention may vary in use of materials, as well as in various packaging constructions and formations, and further in the use of equipment and processes for forming the same, all within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A sheet plastic blank for folding boxes or the like comprising a plurality of body panels, with adjacent ones of said panels connected along longitudinally disposed fold lines, and with other panels connected to body panels along transverse fold lines, with said longitudinally disposed fold lines comprising formed elongated recesses in the blank sheet material of predetermined depth relative to adjacent portions of said body panels, wherein said recesses extend substantially the length of said body panels between transverse fold lines, with at least some of the ends of said elongated recesses terminating at at least one end thereof in a tapered end portion connecting said elongated recess with body panel portions, wherein said blank is of one-piece construction, wherein said tapered end portions comprise portions that are arcuately dished in longitudinal cross-section of said recesses an amount sufficient to permit nesting of adjacent blanks together.

2. The blank of claim **1**, wherein said arcuately dished portions exist at each end of each said recess adjacent transverse fold lines.

3. A container of sheet plastic construction comprising front, back, side and end panels connected together along fold lines, means securing the container in folded condition and means comprising the construction of said fold lines facilitating ready folding of the container by machine folding, said latter means comprising elongated recesses in the plastic sheet material that forms at least some of said fold lines, wherein ends of said recesses are dished in longitudinal cross-section, between panel intersections and inside bottom portions of recesses that comprise said fold lines and with said fold lines being substantially free of memory of their pre-formed condition, wherein said recesses are of sufficient depth in a given wall portion of said container to render wall portions on the opposite side of a given said wall to protrude outwardly of said given said wall, wherein said fold lines form corners of said container between adjacent said front, side and back panels, with said corners, in transverse cross-section protruding outwardly of an imaginary line of intersection of said adjacent ones of said front, side or back panels, as generally convex protrusions, each having generally concave protrusions as viewed internally of said container, wherein fold lines of said container between end panels and other said penels are of less depth that said fold lines that form said corners.

4. The container of claim **3**, including a portion of one of said panels protruding outwardly of said container as an extension of one said wall panel.

5. A container of sheet plastic construction comprising front, back, side and end panels connected together along fold lines, means securing the container in folded condition and means comprising the construction of said fold lines facilitating ready folding of the container by machine folding, said latter means comprising elongated recesses in the plastic sheet material that forms at least some of said fold lines, wherein ends of said recesses are dished in longitudinal cross-section, between panel intersections and inside bottom portions of recesses that comprise said fold lines and with said fold lines being substantially free of memory of their pre-formed condition, wherein said recesses are of sufficient depth in a given wall portion of said container to render wall portions on the opposite side of a given said wall to protrude outwardly of said given said wall, including at least one flap comprising a portion of a panel-forming wall of a container having an elongated deep formed recess therein which mates with a complementally formed recess in an adjacent wall of said container for resilient interlocking mating engagement therewith and forming a lock therewith of transverse omega cross-section.

6. The container of claim **5**, including a portion of one of said panels protruding outwardly of said container as an extension of one said wall panel.

* * * * *