May 2, 1967 C. E. PALMER 3,317,109

CONTAINER

Filed May 10, 1965

FIG. 1

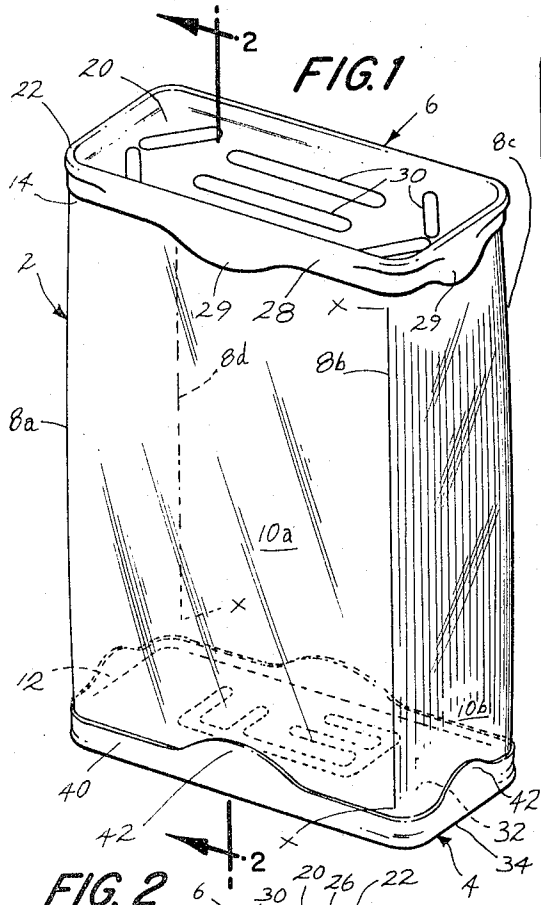


FIG. 2

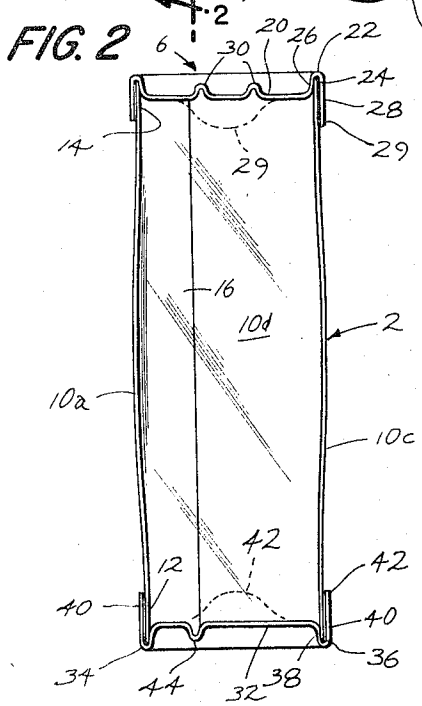
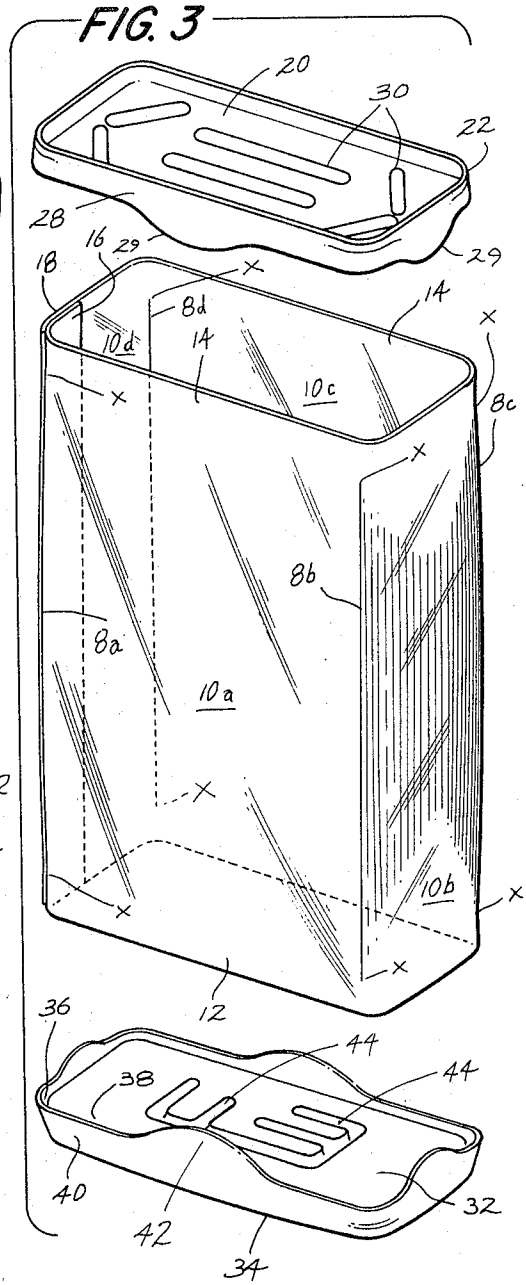


FIG. 3



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CONTAINER

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The present invention relates to containers and more particularly to novel synthetic plastic containers having a body portion formed from semi-rigid synthetic plastic sheet material with at least one corner fold therein.

It has heretofore been proposed to manufacture containers utilizing a tubular body element and end closures which were affixed thereto and generally such containers have relied upon thermoforming of the several elements or extrusion of the body element in the desired configuration. It has been recognized that biaxially oriented synthetic plastic sheet material affords high strength and efforts have been made to utilize such material in cold-folded containers as in applicant's United States Patents Numbers 2,967,654 and 3,019,957. The method of cold-folding biaxially oriented sheet material is disclosed in detail in applicant's United States Patent Number 2,954,725.

However, the folding of a tubular body element to define a sharp corner reduces resistance to heavy shocks applied at the folded edges which may cause the sheet material to rupture along the fold. It is also difficult to thermoform end closures which will closely conform to the sharp corner in the body element.

It is an object of the present invention to provide a novel container having a tubular body portion formed of synthetic plastic sheet material with at least one folded corner therein and end closures which closely conform to the ends of the tubular body element.

It is also an object to provide such a container which may be readily fabricated and which will exhibit a high degree of resistance to fracturing along the fold lines.

Other objects and advantages will be readily apparent from the following detailed specification and claims and the attached drawing wherein:

FIGURE 1 is a perspective view of a container embodying the present invention;

FIGURE 2 is a sectional view thereof along the line 2—2 of FIGURE 1; and

FIGURE 3 is an exploded perspective view of the components thereof.

It has now been found that the foregoing and related objects may be readily attained in a container having a tubular body element of semi-rigid synthetic plastic sheet material with overlapping side margins and at least one fold therein defining a corner. The fold extends axially over the major portion of the length of the body element but terminates inwardly of the ends thereof so as to provide unfolded end portions. Engaged on the end portions of the body element are end closures which define the cross-sectional configuration of the unfolded end portions and which have a portion adjacent the inner end thereof which extends about the cooperating end portion of the body element to urge the end portion into conformity therewith.

The container body element may have a multiplicity of fold lines therein defining a number of sides to the container so as to enable a wide variety of design configurations. The closure element must, of course, generally conform to the configuration of the body element defined by the folds at least insofar as the lip portion which extends about the cooperating end portion of the body element since there can be no gross distortion from the configuration defined by the folds. Accordingly, in a container having four folds therein defining a generally rectangular cross section, the end closure should have a lip portion which is similarly four-sided and of cooperating

dimension although the corners thereof may be defined by radii rather than 90° angles.

The unfolded end portions enable distribution of stresses which might be applied along the fold line so as to reduce substantially the likelihood that the body element will crack along the fold line. In addition, the end closures may be formed conveniently and relatively economically in easily constructed dies utilizing a relatively significant radius at the corners. The end closures thus urge the unfolded end portions of the body element into conformity therewith without applying any undesirable stresses to the body element. Since the body element is free between the end closures, some bowing may occur therebetween to compensate for the inherent tendency of the material to deflect under pressure, thus providing a container which has a desirable degree of resistance to impact.

The end closures may have a variety of configurations it being necessary only that they function as closures and that they provide some form of circumferential lip or abutment wall which will abut against and extend about the cooperating end portion of the body element to urge the end portion into conformity therewith. Since the end portion is unfolded and smooth-surfaced, it can be urged into close-fitting surface contact with the lip or abutment so long as the two are cooperatively dimensioned and configurated. From the standpoint of achieving a good seal and firm definition of configuration for the end portions, the end closures desirably have a channel to receive the end portions of the body element, and the walls defining the channel thereby provide a pair of lips or abutments which hold the end portions securely. However, a single lip or flange fitted externally, or less desirably internally, of the end portion of the body element may also be utilized, albeit with lesser effectiveness, so long as firm surface contact and engagement of the lip and the end portion are provided. Although the end closures may be frictionally seated upon and secured to the end portions as by heat shrinking the closure member thereon, generally it is desirable to provide firm adhesion therebetween by any suitable means such as solvent sealing, heat sealing or an interposed coating of adhesive, depending upon the nature of the materials employed. From the standpoint of providing maximum adhesion and a highly effective liquid container, a closure member providing a channel most desirable is employed with a separate adhesive inserted into the channel so as not only to bond the end closure to the body element but also to function as a liquid sealant.

Thermoforming of end closures has proven particularly advantageous in permitting a wide variety of design. If so desired, the end closures may be fabricated from more than one piece as in the case of dispenser closures which are provided with a removable cap for the dispensing aperture. However, it is also possible to fabricate the end closures by injection molding, compression molding and other techniques, albeit at greater cost. Generally the end closures are thermoformed from a shrinkable sheet of semi-rigid synthetic plastic material such as polystyrene. In forming the closures, it is generally necessary to provide a taper to the sidewalls or lips in order to permit facile forming and separation from the mold. To accommodate this taper, the lip desirably is provided with a tab or elongated portion of sufficient length to provide flexibility so that it may be bent inwardly toward the sidewall of the body element and firmly secured thereto.

The present invention further permits the elimination of the requirement for relatively close tolerances in forming the tubular body element and the closure elements when heat-shrinkable synthetic thermoplastics are employed in the fabrication of the end closures. The end closures may first be fabricated with a significant manufacturing toler-

ance, assembled to the ends of the body element and then shrunk by heat into tight-fitting engagement upon the ends of the body element, the resistance of the unfolded end portion of the body element to excessive deformation cooperating with the generally similar configuration of the end closure lip portions to provide a finished structure in which there is firm surface contact. This heat shrinkability may also be utilized to eliminate the taper which might otherwise exist in the sidewalls or lip portions of the closure element as formed.

Various materials may be used in fabricating the end closures depending upon the technique of fabrication desired, the materials to be received within the container and the compatibility thereof with the material of the body element. Among the various materials which may be employed are polystyrene, polypropylene, polyvinyl chloride, polyvinyl chloride-acetate copolymer and polyethylene. The thickness of the closure member will be dependent upon the nature of the material selected and the technique of fabrication employed. Thermoformed closure members of biaxially oriented polystyrene having a thickness of 5 to 20 mils have been found highly satisfactory.

The folds in the side of the body element should extend over at least two-thirds the length thereof and preferably over at least three-fourths the length thereof, and should terminate closely adjacent to the lower portions of the closure members which are mounted thereon. Generally an unfolded end portion of about ⅛ to 1 inch is satisfactory, although about ¼ to ¾ inch is most desirably employed to facilitate conforming and bonding of the closures thereto.

The synthetic plastic sheet material is readily cold folded in the manner disclosed and claimed in applicant's United States Patent Number 2,954,725, entitled, Method and Apparatus for Folding Plastic Sheet Stock. Herein a rigid folding blade cooperates with a die pad of resiliently deformable material so that when the folding blade presses a length of synthetic plastic sheet stock down into the die pad, the material thereof deforms or flows to press the sheet stock against the side faces of the blade edge and thereby to establish a permanent fold therein.

The synthetic plastic sheet material employed for the body element should be semi-rigid with sufficient flexibility to accommodate stresses and impacts during normal usage. As indicated, the material should be foldable about a relatively sharp angle of fold. Exemplary of such materials are biaxially oriented polystyrene, polyvinyl chloride and polyvinyl chloride-acetate copolymer. However, materials which cannot be so sharply folded may also be employed albeit with greater difficulty in control and operation such as cellulose acetate and butyrate. The most desirable material utilized to date has been biaxially oriented polystyrene of about 4 to 15 mils in thickness because of its clarity, high strength, economy and semi-rigidity, coupled with sufficient resiliency and flexibility to provide desirable folds and resistance to normal impacts.

Although the overlapping side margins of the body element may be held in overlapping relationship merely by the end closures in containers of relatively small height, generally it is necessary to provide some form of adhesion therebetween. Any suitable means may be employed including solvent sealing, heat sealing and an interposed coating of adhesive depending upon the material being employed. From the standpoint of ensuring a liquid-tight seal, generally it may be desirable to apply a separate coating of adhesive which will also act as a liquid sealant.

Referring now in detail to the attached drawing, FIGURES 1 and 2 illustrate a generally rectangular container formed in accordance with the present invention and having a tubular body element formed of semi-rigid synthetic plastic sheet material and generally designated by the numeral **2**. Engaged on the ends of the body element **2** are a bottom end closure generally designated by the numeral **4** and an upper end closure generally designated by the

numeral **6** which provide the end closures for the tubular body element **2** and which are of a cross-sectional configuration generally corresponding thereto.

The body element **2** has four inwardly directed folds **8***a*, **8***b*, **8***c* and **8***d* therein which are parallel and spaced apart to define four corners and thus provide four side wall panels **10***a*, **10***b*, **10***c* and **10***d*. The folds **8** extend over the major portion of the length of the body element **2** but terminate inwardly of the ends thereof as indicated by the letter *x* so as to provide unfolded end portions **12**, **14**. As can best be seen in the exploded view of the components in FIGURE 3, the side margins **16**, **18** of the sheet material forming the body element **2** are in overlapping relationship at the wall panel **10***d* and may be secured together by any means suitable for the sheet material employed such as solvent sealing, heat sealing or an interposed coating of adhesive.

The upper end closure **6** is thermoformed with a complex configuration and has a generally planar center wall portion **20** and a generally U-shaped peripheral portion **22** providing a channel **24** opening downwardly to receive the unfolded end portion **14** and defined by the two abutment wall portions **26**, **28** extending along the inner and outer surfaces of the body element **2**. In order to ensure firm engagement to the container body element and to compensate for any taper that may be provided in the wall portions **26**, **28** for purposes of fabrication, the outer wall portion **26** has tabs or elongated portions **29** at about the center of the several side wall panels **10** of sufficient length to be deflected inwardly readily for sealing to the body element **2**. As can be seen, the end closure **6** and its peripheral portion **22** are configured so as to provide rectilinear side portions corresponding to the side wall panels **10** but arcuate corners aligning with the folds **8** in the body element **2**. In addition corrugations **30** are provided in the generally planar top wall portion **20** to increase the rigidity thereof and these may be decorative or informational. The end closure **6** is desirably secured to the body element **2** by adhesion between the adjacent surfaces of the body element **2** and wall portion **26** such as by solvent sealing, heat sealing or an interposed coating of adhesive.

The bottom end closure **4** is formed similarly to the upper end closure **6** and has a generally planar center wall **32** and a generally U-shaped peripheral portion **34** providing a channel **36** opening upwardly to receive the unfolded end portion **12** and two abutment wall portions **38**, **40** extending along the surfaces of the body element **2**. Tabs **42** are provided on the wall portion **40** and reinforcing corrugations **44** are provided in the center wall **32**.

As is best seen in the exploded view of the components in FIGURE 3, the end closures **4**, **6** as fabricated by the thermoforming from a heat-shrinkable synthetic thermoplastic sheet material have the outer abutment wall portions **28**, **40** tapering outwardly away from the center wall portions **20**, **32** and the channels **24**, **36** are of greater width than the width of the sheet material of the body element **2**. During assembly, the taper of the wall portions **28**, **40** facilitates guidance of the end portions **12**, **14** into the channels **24**, **36** by acting as guide surfaces. After assembly of the closures **4**, **6** to the body element **2**, heat and pressure are applied to the peripheral portions **22**, **34** so as to shrink the material thereof tightly upon the end portions **12**, **14** and this same heat and pressure may be used to adhere the closures **4**, **6** to the body element **2**.

Upon assembly, it can be seen that the unfolded end portions **12**, **14** are urged into conformity with the abutment wall portions of the peripheral portions **22**, **34** so that the end portions **12**, **14** have generally straight sided portions with rounded corners.

Thus the present invention can be seen to provide a synthetic plastic container utilizing a body portion formed from semi-rigid synthetic plastic sheet material which has been folded to provide at least one corner fold therein

together with end closures which may be secured firmly thereto. The difficulties in thermoforming or otherwise forming end closures may be readily compensated for in the present invention by the urging of the ends of the folded body into conformity with the end closures. Thus the end closures and the unfolded end portions of the body element minimize the likelihood of possible breakage along the fold lines in the event of sudden shock to the container. The container may be readily fabricated and assembled from relatively economical sheet materials and affords a wide variation in design.

Having thus described the invention, I claim:

1. A container comprising a tubular body element of semi-rigid synthetic plastic sheet material and polygonal cross section having overlapping side margins and a plurality of peripherally spaced, parallel extending folds therein each defining a corner of said body element, said folds extending axially of said body element and for the major axial extent thereof, defining sharp angles which terminate inwardly of the ends of said body element and defining smooth accurate curves at said end portions and end closures engaged on the end portions of said body element and defining the polygonal cross-sectional configuration of said end portions, said end closures each having a peripheral lip portion which extends about the cooperating end portion of said body element to urge said end portion into conformity therewith.

2. The container of claim 1 wherein said body element has four parallel extending folds therein defining a generally rectangular cross section to said body element and wherein said closure elements have their peripheral wall portions of generally rectangular configuation.

3. The container of claim 1 wherein said sheet material of said body element is biaxially oriented polystyrene of about 4 to 15 mils in thickness.

4. The container of claim 1 wherein said end closures are fabricated from a heat shrinkable thermoplastic sheet material.

5. The container of claim 1 wherein said end closures have opposed generally U-shaped channels on the inner ends thereof extending about the periphery thereof and providing said peripheral lip portions, and wherein said end portions of said body element are snugly seated within said channels.

6. The container of claim 1 wherein said lip portion has a plurality of spaced apart tab portions on the free edge thereof extending along the surface of said body member and wherein said tabs are adhered to said body member.

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