Sept. 13, 1966 W. S. SCHNEIDER ETAL 3,272,324

MULTIPLE COMPARTMENT PACKAGE

Original Filed Aug. 29, 1963

FIG. 1.

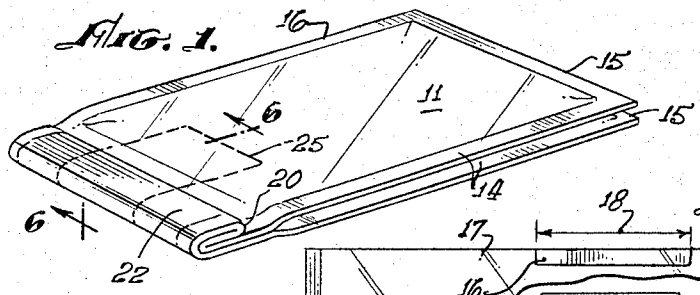


FIG. 2.

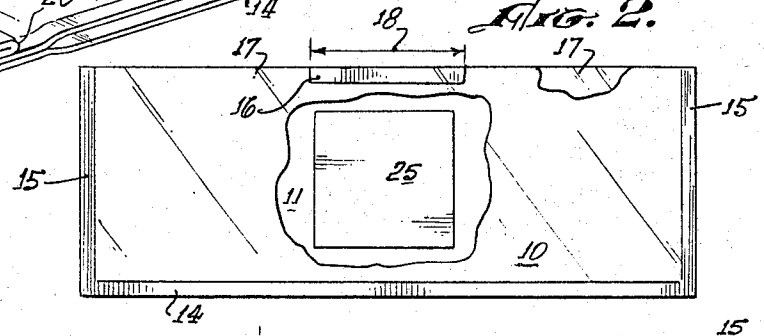


FIG. 3.

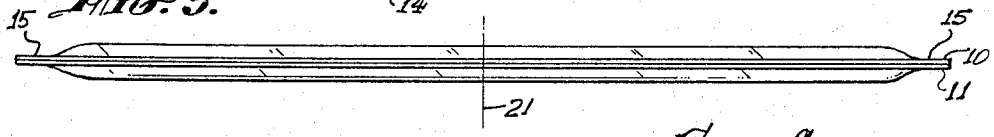


FIG. 4.

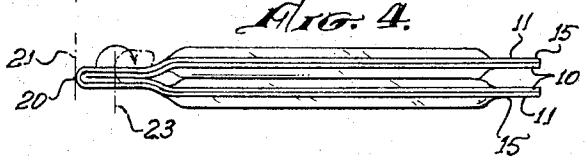


FIG. 5.

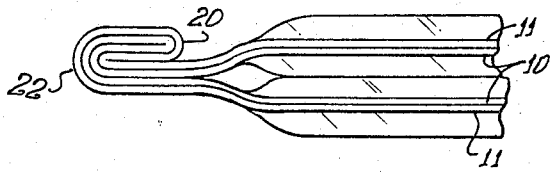


FIG. 6.

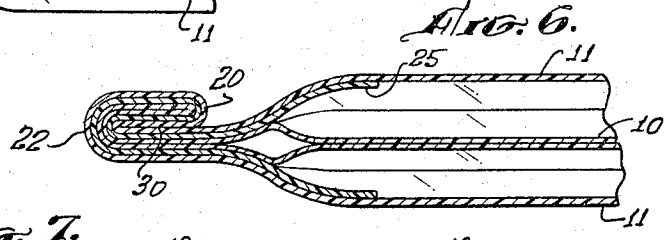


FIG. 7.

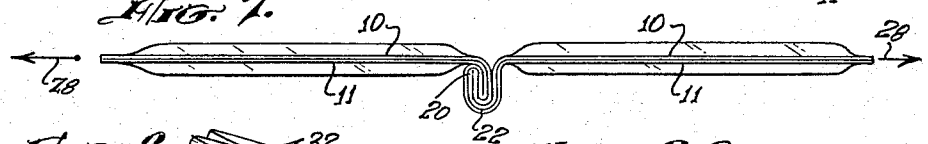
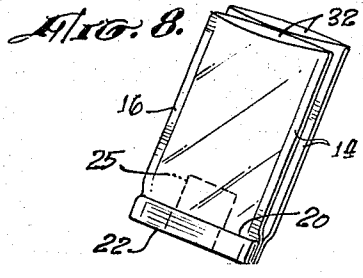


FIG. 8.



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3,272,324

MULTIPLE COMPARTMENT PACKAGE

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Continuation of application Ser. No. 305,367, Aug. 29, 1963. This application Apr. 13, 1965, Ser. No. 449,685
20 Claims. (Cl. 206—47)

This application is a continuation of our copending application Serial No. 305,367 filed August 29, 1963, for Multiple Compartment Package, now abandoned.

The present invention is concerned generally with containers and packages made from thin, flexible sheet materials; and the invention is more particularly concerned with packages of this type which initially are divided interiorly into two (or more) compartments separated from each other but which can be placed in free communication with each other, without rupturing the outer walls of the package, to permit intermingling and mixing of the contents of the two adjoining compartments prior to discharge of the mixed contents from the package.

Known packages of this type typically have two compartments disposed one at either side of rupturable barrier means. Such packages are designed to hold two different substances, one substance in each compartment, isolated from each other in such a way that the substances can be stored without any intermingling of them until needed. The substances in the package may be in the form of a dry material in powder or tablet form, or a liquid, in either or both compartments, a typical situation being a dry material in one compartment which is to be mixed with a liquid in the other compartment. By breaking the barrier while maintaining the exterior walls of the package intact, the two substances in the two different compartments can be mixed together within the interior space of the container and then discharged from the package as a mixture.

A container of this general character requires that the outer walls be flexible and strong, so that the walls can be deformed as necessary to force the contents from one compartment to the other and back again to the extent necessary to effect mixing of the ingredients. Containers for this type of use have usually provided barrier means within the package able to effect complete separation of the two compartments until mixing is desired but which can then be broken at will. Typically, the barrier means has been a separate member of some type inserted between the outer walls of the package and sealed to them. This barrier member is broken by forces applied to it. These forces may be applied directly, as by pulling apart the walls of the package at the barrier, or indirectly, as by squeezing the compartment containing the liquid to apply sufficient force to the barrier member to rupture it.

Various designs of multiple compartment packages for this general purpose have been evolved but each known design has one or more disadvantages and it is thus a general object of the present invention to provide in a package of this character means dividing the total product-holding space between the two outer walls of the package into two isolated compartments, such division means being removable without rupturing the outer walls of the package.

It is a further object of the invention to provide a package of this general character which is free of the shortcomings of known designs of such packages.

For example, in some known designs there is provided an interior wall or membrane of substantial area separating the two interior compartments. A wall of this character is often subject to premature failure as a result of flexing fatigue occurring at positions of maximum curvature. The area of the wall is so great that movement of the contents of the package, particularly liquid contents, causes repeated movement of the wall with bending or flexing at points of relatively sharp curvature. Eventually, this results in weakening of the wall and sometimes the creation of cracks or pin hole perforations which render the barrier ineffective. Another disadvantage in the large area of an interior wall of this type is that many materials used for this purpose are not entirely impermeable to vapors and, consequently, the large wall area permits significant transfer of a vapor through the wall when the package is stored for a long period of time.

Hence, it is also an object of the invention to provide means separating the two compartments that is strong and resistant to flexure to avoid failure from this cause.

It is also an object to provide a package of this character having means separating the two compartments that is a complete vapor barrier as well as a complete barrier to liquids and solids.

In some known designs with a rupturable internal barrier member, the barrier is typically ruptured by squeezing the package. Women often have found it difficult to apply manually pressure sufficient to break the barrier, especially when there is only a very small amount of liquid in a package. For example, a package containing only one ounce of liquid or less presents a very small area over which to apply pressure, and this requires a high unit force in order to develop sufficient internal pressure in the liquid contents to rupture the barrier.

Another problem with known designs of multiple compartment packages is the unpleasant and very disconcerting result that can occur when the outside wall or the seals between them break under the internal pressure generated by the force applied externally to break the barrier. When the outer wall gives way at some point before the barrier is broken, a frequent result is to spray the liquid contents over the user instead of forcing them through a ruptured barrier into the other compartment.

Hence, another object of the present invention is to provide a multiple compartment package in which little or no squeezing may be required to place the compartments in communication, this latter state being achieved without the generation of substantial internal pressure.

It has also been proposed to provide means separating the compartments by sealing the outer walls of the package together directly by a simple, narrow bar seal formed by the application of heat and pressure. The objective is to provide a seal which is sufficiently weaker than the marginal seal or seals joining together the outer walls that the central bar seal breaks first and much more easily. This type of seal illustrates another problem encountered because the seal has been found unsuitable where it is to be of reproduceable strength. The strength of the seal depends upon both the temperature reached by the outer walls and the pressure applied by the sealing head, and even small variations in either factor often result in unacceptably wide variations in the strength of the seal. If caution is exercised to prevent the seal from becoming too strong to be broken easily, then the seal produced is often too weak and breaks prematurely. From a practical standpoint, any seal or other barrier between the container compartments is highly unsatisfactory when it exhibits such a wide variation in breaking strength and is unable to be made in production machinery with closely predictable or uniform strength.

Accordingly, a further object of the invention is to provide a multiple compartment package of the character mentioned in which the means separating the compartments has a characteristic of reproduceability, within narrow limits, of a desired level of strength in production type machines.

Another object is to provide a multiple compartment

package of the character described in which the means separating the compartments can be destroyed or deactivated by manipulating the package in a manner using the greatest strength of the walls, that is, the tensile strength, and thereby exert sufficient force to overcome certainly and quickly the resistance of said separating means, even at its maximum.

The present invention is a multiple compartment package of thin, flexible sheet material, typically comprising a pair of overlying outer walls joined together to define between them a product holding space. It is characterized by means dividing the interior product-holding space into two compartments, said means including a self-sustaining fold in both walls produced by heating and cooling under pressure and extending transversely of the package across the product space holding the outer walls in mutual contact at their inner faces in the region of the fold to prevent product transfer between the compartments. A product is placed in each of the two compartments. By pulling in opposite directions on two ends of the package, the fold is straightened by tension forces applied to the package walls so that the two compartments are no longer isolated from each other and internal communication between the compartments is established.

When the package is made of sheets of material heat sealable on the inner faces, as is very commonly the case, the package may also include means preventing the walls from sealing together at their inner faces for a portion of the length of the fold when heat and pressure are applied to form the fold.

How the above objects and advantages of the present invention, as well as others not specifically mentioned, are attained, will be more readily understood by reference to the following description and to the annexed drawing, in which:

FIG. 1 is a top perspective view of a completed multiple compartment package embodying the present invention.

FIG. 2 is a plan view, at a reduced scale, of such a package as it may appear at one stage in its manufacture prior to folding, one of the outer walls being partially broken away.

FIG. 3 is an edge view looking at the near edge of the package of FIG. 2 before the folds are formed to separate the compartments.

FIG. 4 is a view similar to FIG. 3 of the package after a single fold has been made.

FIG. 5 is a fragmentary view similar to FIG. 4 showing only the region of the folds after a double fold has been made.

FIG. 6 is a fragmentary section on line **6—6** of FIG. 1 through the folded portion of the package.

FIG. 7 is an edge view of the package showing the position it occupies when the two ends are pulled apart in opposite directions to straighten the folds.

FIG. 8 is a perspective of a partially completed package folded but prior to filling, as it may appear during manufacture.

The construction of the package constituting the present invention will be most readily understood from a description of the method of making it and, consequently, there will follow a description of a sequence of operations resulting in the formation of the package shown in FIG. 1. These operations, or similar ones, in a suitable sequence, may be performed manually to produce the package, or as will be pointed out, may be performed upon production machinery. For purposes of description, it will be assumed that the package is made from two separate webs, not shown, from which portions are cut off to form respectively the two overlying outer walls **10** and **11** of the package. For obvious practical reasons, these two walls are normally of the same size and shape. While the package illustrated shows these walls to be rectangular in outline because this shape is the most convenient and practical in ordinary usage, the invention is not necessarily limited to any particular shape or outline of the package.

The web stock from which walls **10** and **11** are made is thin, flexible sheet material which is assumed to be heat sealable on one side only. Typical of such webs are films of synthetic plastics, such as cellulose acetate or polyester, known as "Cellophane" and "Mylar" respectively, which are coated on one face with polyethylene, the coating having a thickness of perhaps 2–3 mils. The polyethylene is a thermopalstic material which permits the two walls to be sealed together by the application of heat and pressure. Other suitable materials for the sealing layer are thermoplastic materials such as vinyl or rubber hydrochloride.

The two heat sealing faces of the outer walls are disposed to oppose each other so that these faces become the inside surfaces of the completed package. The two walls are then joined together by marginal heat seals at **15** along the two opposite, shorter ends of the package and at **14** along one of the longer or longitudinally extending margins of the package. The seals thus placed extend continuously around three sides of the package. At the fourth side a marginal seal **16** is placed at a central zone **18** only leaving an unsealed space **17** at each side of the central zone between it and an end seal **15**. The length of seal **16** initially is sufficient to receive the folds described later and yet leave openings at **17** at the fourth side to receive the products to be inserted later in the compartments, as will be explained.

Looking toward the edge of the partially completed package at the bottom in FIG. 2, the package appears as in FIG. 3. The package is next folded at **20** along an axis in a transversely extending plane **21**, for example bringing the upper wall **10** over on itself and thereby creating a fold at **20** where the two walls are folded through 180°. When this fold is made, the partially completed package now appears as in FIG. 4.

Fold **20** is formed and maintained initially under pressure applied to the outer walls in the vicinity of the fold while the walls undergo a heating and cooling cycle. The heating portion of the cycle may be produced by any of various known procedures which include but are not necessarily limited to the standard thermal heating procedure, impulse hot wire heating with water jacket cooling, and electronic or induction heating combined with cooling by a heat sink which may or may not be provided with water circulation.

During the heating portion of the cycle, the walls are softened, being thermoplastic, sufficiently that they do not tend to spring away from the folded configuration. During the cooling cycle, the walls are cooled sufficiently that they harden in and retain the folded configuration.

The folded region of the walls is thus molded and set thermally with the result that the fold is self-sustaining and has an inherent resistance to straightening out the walls where they have been thermally molded.

Obviously, it is preferable to conduct the heating and cooling cycles while the fold is maintained continuously under pressure; but it is within the scope of the present invention to release the pressure to a greater or lesser degree, or entirely, between the heating and cooling phases of the molding cycle if it is desired to use separate heads or pressure applying means during the heating phase and the cooling phase.

Formation of a single fold **20** about the axis **21** in the manner just described is sufficient to provide a completed package as in FIG. 4. However, the contents of the compartments, particularly liquid contents, tend to generate forces which spread the fold apart. For this reason it is preferable to reinforce the first fold **20** by making a second similar fold **22**. This is accomplished by folding over the double thickness of the walls along an axis lying in transverse plane **23**, the depth of the original thermally molded region, perpendicular to plane **23**, being sufficient to permit the formation of a second fold **22** which, when completed, appears as in FIG. 3.

The second fold not only has the advantage of mechanically reinforcing the first one so that it has greater resistance to internally generated forces tending to straighten out the fold but, as will be seen from FIG. 6, the extra fold renders any internal path of communication between the two compartments much more tortuous. Thus, there is less possibility of any liquid or gaseous constituent contained in one compartment leaking through the folded portion of the package into the other compartment.

The sequence of operation so far described produces a container having two compartments in side-by-side relationship which are both open at one and the same edge of the container. With these openings **17** of the container uppermost, the two compartments may now be filled through these openings with the products which they are to contain and then the compartments are closed by extending seal **16** along the entire side of the package, thus closing the two compartments within the package. The completed package now appears as in FIG. 1.

When the two outer walls are both heat sealable over their entire inner, opposed faces, as is normally the situation with polyethylene coated stock, it is desirable to apply to at least one of the walls some means which is more or less effective to prevent the inner faces of the walls from sealing together over at least a portion of the folded area. Without such means, the application of heat and pressure to form the fold as described would result in sealing the two outer walls together at the region of the fold with a seal of normal firmness or strength which could not be broken. Obviously, it is desired that at least some portion of the fold be characterized by no or substantially no seal or cohesion between the inner faces of the two outer walls.

In a preferred embodiment of the invention illustrated herein, this means for eliminating or reducing the effectiveness of any seal over at least a portion of the fold takes the form of small piece or patch **25** which is typically a piece of web stock similar to that forming the outer walls **10** and **11** but smaller in its dimensions so that it covers only a portion of one of the walls between the two opposite marginal seals **14** and **16**. This patch, being heat sealable on one side like the walls, can be heat sealed to one wall, typically wall **11** (FIG. 2). However, the layer of sealing polyethylene on the inner face of the other wall **10** does not adhere to the opposing face of patch **25**, or if it does so it adheres only very lightly. A light adhesion can be of advantage in perfecting a gas or vapor barrier between the two compartments.

Another possible means is painting an area on one wall, equivalent to the area occupied by patch **25**, with a suitable liquid that accomplishes the same purpose. For example, the liquid may be a lacquer or the like coating over a predetermined area of the polyethylene which adheres to the polyethylene of one wall but which when dry, does not bond to the polyethylene on the other outer wall. Another type of liquid that can be employed is a liquid which combines chemically with polyethylene to reduce its adhesiveness.

Complete elimination of any adhesion between the two walls **10** and **11** in the area of patch **25** is not necessarily required. A light tack or adhesion between the two walls may be acceptable or desired under some circumstances, but the object of treating one of the walls at this point is to prevent the formation of a heat-seal or bond between the two outer walls that approaches in strength the bond between them which normally results from the application of heat and pressure to thermally set the fold. Instead, the means applied to the walls eliminates any adhesion between the outer walls of the package, or at least reduces that adhesion to such a low strength that it does not interfere with placing the two compartments in the package in communication with each other, as described later. Such tack is so light that the basic separation strength between the outer walls is determined by the strength of the fold or folds rather than by any light tacking between them.

From FIG. 6 it will also be noted that patch **25** is long enough in the direction of the longer dimension of the package to extend beyond the region of the double fold. Of course, as shown in FIG. 2, the patch is of lesser width transversely of the package than the distance between the marginal seals **14** and **16**. As will be evident, it is this transverse width of the patch that determines the size of the ultimate opening between the compartments available for transfer of product from one compartment to the other.

When it is desired to open the fold in order to effect intermixing or intermingling of the products in the two compartments, this is done by spreading apart the end portions of the package containing the two compartments. The package then assumes the position shown in FIG. 7 in which the two compartments are arranged each in prolongation of the other. Then by grasping the ends of the package and pulling them apart in the opposite directions of arrows **28**, the folded portions of the package are straightened out. The forces represented by arrows **28** are tension forces and are applied to the package in such a manner as to utilize its greatest strength, that is its tensile strength, in opposition to these forces. Thus, there is a minimum danger of tearing or otherwise injuring the package in such a way as to result in premature discharge of its contents.

It will be appreciated from reference to FIG. 7 that the tension forces represented by arrows **28** spread apart the walls at the fold progressively and consequently these forces are concentrated at any given instant over a very narrow portion of the fold. As a result, the fold, although mechanically strong enough to resist being opened by internally generated forces, is easily straightened out by the application of relatively small tension forces applied to the opposite ends of the package. A greater depth of the fold has the effect of giving a greater leverage to the forces tending to pull apart the sides of the fold, thus making it easier, rather than more difficult, if the fold is made deeper.

When the package is straightened out, it then appears again substantially as in FIG. 3 and the failure of patch **25** to adhere to outer wall **10** leaves a passageway between the two compartments of the package having a width substantially equal to the width of patch **25** through which the two products in the two different compartments of the package can be moved by squeezing or kneading the compartments. In this way, the products can be thoroughly intermixed while within the package. Discharge of the contents is easily accomplished by cutting off the corner of the package inwardly of the marginal sealed area to form a discharge opening.

In the event that there is any light tacking or adhesion of the wall **10** to the face of patch **25**, this can easily be broken by pressure applied to it by the liquid within one compartment by squeezing or applying external pressure to that compartment. This tacking is of a very low order of strength, much less than the strength produced at the marginal sealed areas, and much less than would be required to maintain a seal between walls **10** and **11** adequate to prevent premature intermingling of the products in the two compartments.

From the foregoing description it will be apparent that various changes may be made in the detailed construction and arrangement of the elements of the preferred embodiment of the invention already described. For example, the package can be made from a single web, instead of two separate webs. A single web is commonly used in form-and-fill production machines to produce envelope packages of this type and this web is folded along a longitudinally extending central axis to bring the two halves of the web into opposed position similar to the walls **10** and **11** formed by the two webs as described. The result is that the walls **10** and **11** are integral with

each other along one edge of the package, thus eliminating the need for a marginal heat seal at **14**.

Also, other types of materials may be used instead of the synthetic plastic film described above. For example, the walls may be made of paper impregnated with a synthetic resin to render the paper waterproof, such resin having thermoplastic properties such that it will soften and subsequently harden during the heating and cooling cycles applied to the folded region of the package. The marginal seals are then formed by an adhesive applied locally.

Also, it is not essential to adhere strictly to the sequence of operations set forth above. Such operations would be normally followed in the case of hand manufacture of individual packages or in the production of packages of this type on a so-called horizontal machine in which the two webs move in a horizontal direction through the machine from the web rolls forming the source of material for the outer walls. If the package is produced in a vertical machine in which the web moves downwardly, it then would be advantageous to join the webs together along three sides of one compartment, fill the compartment, then form either a single or a double fold as previously described, thus closing the fourth side of that compartment. Subsequent to forming the fold, the second compartment can be formed, filled and sealed. The ultimate package has the same construction as described, the only difference being in the sequence of the operations producing the package.

FIG. 8 illustrates a partially completed package made by a variation in the steps of sealing the package. In this package the seals **14** and **16** have been placed along the full length of the two longer sides of the package, leaving the two shorter sides or ends **32** open for filling the package. After folding and then filling through these open ends **32**, the seals **15** are placed to close the package.

Another possible modification of the present package is the application to the outside face of one of the outer walls, in this case wall **11**, of an adhesive in the vicinity of the fold. More especially, an adhesive can be applied to the outer face of wall **11** over the area in which the walls come in contact with each other in the formation of the double fold, indicated particularly at **30** in FIG. 6. Such an adhesive might be typically a thermo-setting lacquer which has the effect of bonding together portions of the outer wall to maintain more securely the configuration of the second fold **22**. This adds to the mechanical strength of the fold and decreases the possibility that it may be opened up prematurely either by internal forces within the package or by external forces which might be the result of rough handling, shipping, or other contact with the package.

From the foregoing description it will be seen that various changes in the construction and arrangement of the component parts of the package constituting the present invention may occur to persons skilled in the art but without departing from the spirit and scope of the present invention. Accordingly, it is to be understood that the foregoing description is considered to be illustrative of, rather than limitative upon, the invention disclosed herein.

We claim:

1. A multiple compartment package of thin, flexible, sheet material, comprising:
- a pair of overlying outer walls joined together to define between them a product-holding space;
- means dividing the product-holding space into two compartments each outside the other;
- said means including a self-sustaining fold in both walls extending transversely of the package across the product space holding the outer walls in mutual contact at their inner faces in the region of the fold to prevent product transfer between the compartments;
- and a product in each of the compartments;
- said fold being capable of being straightened by tension forces applied to the fold by pulling away from each other opposite ends of the package whereby internal communication between the compartments is established.

2. A multiple compartment package according to claim **1** in which the outer walls are of thermo-plastic material and the fold is formed under conditions of applied heat and pressure.

3. A multiple compartment package according to claim **2** in which the sheet material of both outer walls is heat sealable on the inner faces;
- and the package also includes means preventing the walls from heat sealing together over at least a portion of the length of the fold.

4. A multiple compartment package as in claim **3** in which the last-mentioned means is a piece of flexible sheet material adherently bonded to one outer wall and not heat sealable on the face in contact with the other outer wall.

5. A multiple compartment package according to claim **1** in which the outer walls are of thermoplastic material and the fold is thermally formed and set.

6. A multiple compartment package according to claim **1** which also includes adhesive means applied to the outer face of an outer wall in the vicinity of the fold to maintain the fold in position.

7. A multiple compartment package of thin, flexible, sheet material, comprising:
- a pair of overlying outer walls joined together to define between them a product-holding space;
- means dividing the product-holding space into two compartments each outside the other;
- said means including a pair of closely spaced, self-sustaining folds in both walls extending transversely of the package across the product space holding the outer walls in contact at their inner faces in the region of the folds to prevent product transfer between compartments;
- and a product in each of the compartments;
- said folds being capable of being straightened by tension forces applied to the fold by pulling away from each other the ends of the package whereby internal communication between the compartments is established.

8. A multiple compartment package according to claim **7** in which the outer walls are of thermoplastic material and the folds are formed under conditions of applied heat and pressure.

9. A multiple compartment package according to claim **7** in which the sheet material of the outer walls is heat sealable on the inner face;
- and the package also includes means preventing the walls from heat sealing together over at least a portion of the length of the folds.

10. A multiple compartment package as in claim **9** in which the last-mentioned means is a piece of flexible sheet material adherently bonded to one outer wall and not heat sealable on the face in contact with the other outer wall.

11. A multiple compartment package as in claim **7** in which the last-mentioned means is an area on the inner face of one outer wall treated to render the area substantially non-sealable.

12. A multiple compartment package as in claim **7** which also includes adhesive means applied to the walls of the package within the vicinity of the fold to assist in maintaining the fold in position.

13. A multiple compartment package as in claim **12** in which the adhesive is applied to the outer face of an outer wall adjacent the fold to assist in maintaining the fold.

14. A multiple compartment package as in claim **12** in which the outer walls are of sheet material heat sealable on the inner faces and the adhesive means is a portion of the heat sealable area.

15. A package of thin, flexible, thermoplastic sheet material, comprising:

a pair of overlying outer walls heat sealable on their inner faces and joined together to define between them an interior product-holding space open at one side thereof;

a product in said space;

means closing said open side to retain the product in said space, said means including a self-sustaining fold in both walls extending across the product space holding the outer walls in mutual contact at their inner faces in the region of the fold,

said fold being thermally formed and set but capable of being straightened by transverse tension forces applied to the fold at opposite sides thereof to open said side of said space;

and a piece of flexible sheet material bonded at one face to one outer wall and not heat sealable on the opposite face in contact with the outer wall substantially to prevent the outer walls from heat sealing together in the area of said piece.

16. A package as in claim **15** that also includes adhesive means applied to the walls of the package in the vicinity of the fold to assist in maintaining the fold in position.

17. A package as in claim **15** in which the adhesive is applied to the outer face of an outer wall adjacent the fold.

18. A package of thin, flexible, thermoplastic sheet material, comprising:

a pair of overlying outer walls heat sealable on their inner faces and joined together to define between them an interior product-holding space open at one side thereof;

a product in said space;

means closing said open side to retain the product in said space, said means including a pair of closely

spaced, self-sustaining folds in both walls extending across the product space holding the outer walls in mutual contact at their inner faces in the region of the folds,

said folds being thermally formed and set but capable of being straightened by transverse tension forces applied to the folds at opposite sides thereof to open said side of said space;

and a piece of flexible sheet material bonded at one face to one outer wall and not heat sealable on the opposite face in contact with the outer wall substantially to prevent the outer walls from heat sealing together in the area of said piece.

19. A package as in claim **18** that also includes adhesive means applied to the walls of the package in the vicinity of the folds to assist in maintaining the folds in position.

20. A package as in claim **19** in which the adhesive is applied to the outer face of an outer wall adjacent the folds.

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