

[54] **THERMOFORMED SNAP CLOSURES**

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24/208 A

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[58] Field of Search.. **24/208 A, 168 B, 208 R, 213,**
24/214; 229/2.5, 45; 220/31 S; 150/.5

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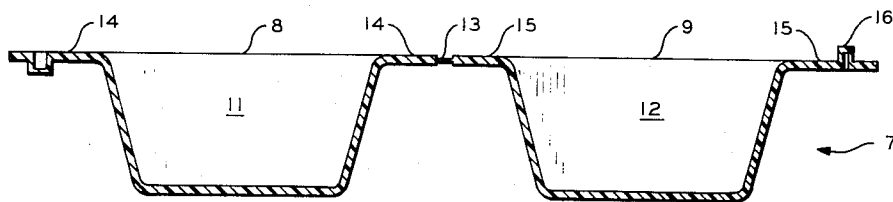
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[57]

ABSTRACT

An at least substantially cylindrical columnar projection thermoformed in a first sheet of a thermoformable polymeric material and an at least substantially cylindrical columnar depression thermoformed in a second sheet are employed as a snap fastener. The exterior dimensions of the columnar projection and the interior dimensions of the columnar depression permit the insertion of the columnar depression with significant frictional engagement therebetween.

8 Claims, 4 Drawing Figures



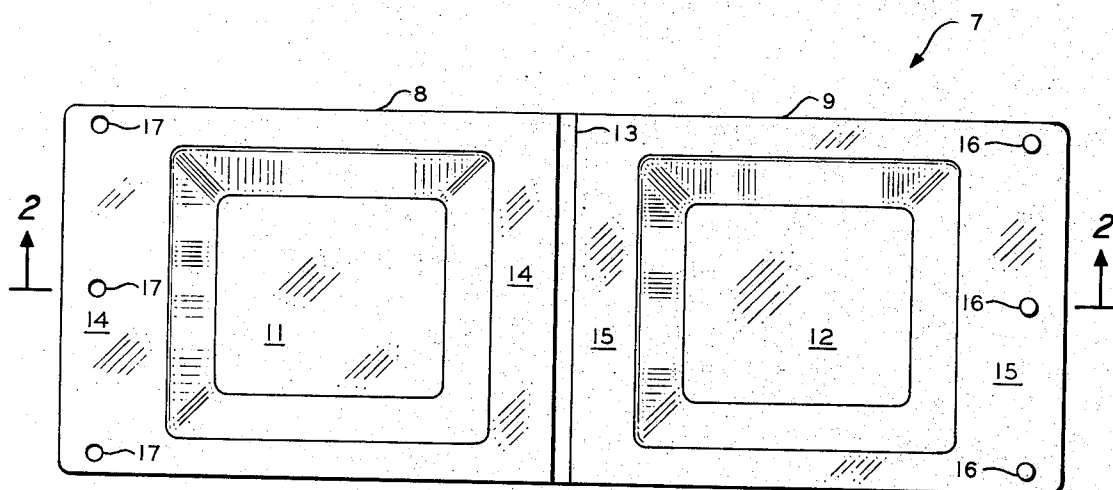


FIG. 1

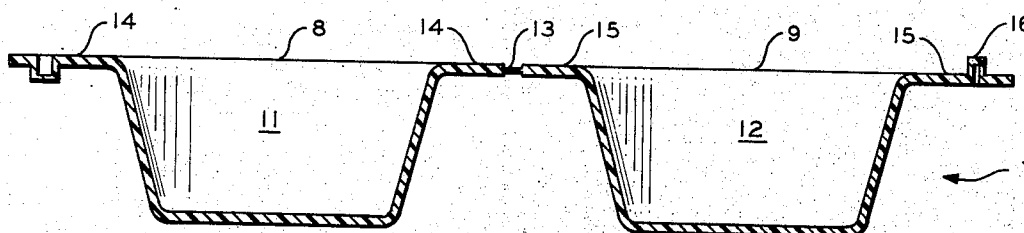


FIG. 2

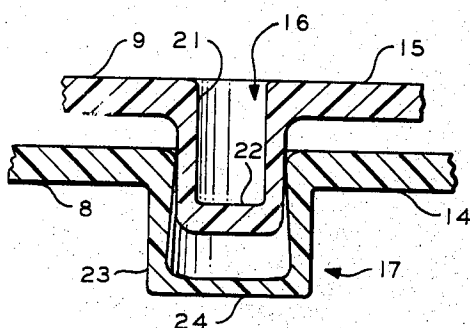


FIG. 3

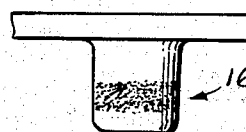


FIG. 4

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THERMOFORMED SNAP CLOSURES

The invention herein described was made in the course of or under Contract DAAA-15-70-C-0237 with Edgewood Arsenal, Department of Defense.

This invention relates to snap closures. In one aspect the invention relates to an integral snap closure for a package formed of one or more sheets of a synthetic organic thermoformable thermoplastic polymeric material, the component parts of the snap closure having been thermoformed in said sheets.

Snap fasteners have become a popular means for releasably securing two articles together. However, they have involved the expense of forming the separate components of the fastener, usually of metal, and then securing each component to its respective article. Such expense is generally excessive for disposable or one-use packages where cost is a major factor, such as inexpensive packages formed from sheets of thermoplastic polymeric material. Difficulties have also been encountered in the use of such snap fasteners on articles formed of sheets of thermoplastic polymeric material in that the stresses caused by the rigid fastener components frequently caused ruptures in the sheet material. Thus, the need for a very low cost snap fastener which can satisfactorily be employed with sheets of thermoplastic polymeric material has been apparent.

Accordingly, it is an object of the present invention to provide a new and improved snap closure structure. Another object is to provide a snap closure structure at minimum expense. Another object of the invention is to provide a snap closure structure which is suitable for use with packages formed of sheets of thermoplastic polymeric material. Yet another object of the invention is to provide a snap fastener, the elements of which are integral with the article to be fastened. A further object of the invention is to provide a new and improved package which is thermoformed from a sheet of thermoplastic polymeric material and which has snap closure elements thermoformed therein.

Other objects, aspects and advantages of the invention will be apparent from a study of the specification, the drawings and the appended claims to the invention.

In accordance with the present invention, the disadvantages of the prior art are avoided and the present objectives are achieved by thermoforming an at least substantially cylindrical columnar projection in a first portion of a sheet of thermoplastic polymeric material and thermoforming an at least substantially cylindrical columnar depression in a second portion of a sheet of thermoplastic polymeric material, the exterior dimensions of the columnar projection having a relationship with the corresponding interior dimensions of the columnar depression permitting the insertion of the columnar projection into the columnar depression with significant frictional engagement between the exterior surface of the columnar projection and the interior surface of the columnar depression, such frictional engagement being sufficient to lock the columnar projection and the columnar depression together for normal handling of the first and second sheet portions and insufficient to prevent withdrawal of the columnar projection from the columnar depression upon the application of a desired minimum separation force.

In the drawings FIG. 1 is a plan view of an open thermoformed package embodying the present invention; FIG. 2 is an elevational view in cross section taken

along line 2—2 of FIG. 1; FIG. 3 is an enlarged elevational view, in cross section, of one of the snap closures of the illustrated package with the package in the closed position; and FIG. 4 is an elevational view of the projection element of FIG. 3.

Referring now to the drawings in detail and to FIGS. 1 and 2 in particular, there is illustrated a package 7 which has been formed from a single sheet of a synthetic organic thermoformable thermoplastic polymeric material. The package 7 has two mating halves 8 and 9 joined by a fold line 13. Packaging cavities 11 and 12 are thermoformed in halves 8 and 9, respectively, on opposite sides of fold line 13. The fold line 13 can be made by thermoforming, stamping, or by controlled belding to form a crease along the desired line of fold. The cavities 11 and 12 can be of any desired thermoformable configuration. While two packaging cavities have been illustrated, a single packaging cavity or more than two packaging cavities can be employed as desired. The portion 14 of the sheet surrounding the cavity 11 and the portion 15 of the sheet surrounding cavity 12 serve as flanges to increase the rigidity of the package. The flange portions 14 and 15 can extend continuously around the cavities or discontinuous segments can be utilized, as desired. In accordance with the present invention at least one at least substantially cylindrical columnar projection 16 is thermoformed in the package 7 on one side of fold line 13 and a corresponding number of at least substantially cylindrical columnar depressions 17 are thermoformed in package 7 on the other side of fold line 13. Each projection 16 and its corresponding depression 17 are located at equal distances from fold line 13 so that the folding of package half 9 approximately 180° counterclockwise, as viewed in FIG. 2, about fold line 13 will result in each projection 16 entering its corresponding depression 17. While only projections 16 have been illustrated in package half 9, it should be obvious that a package half can be provided with both projections 16 and depressions 17 with corresponding depressions 17 and projection 16 being provided in the other package half.

Referring now to FIG. 3, one of the columnar projections 16 is shown in engagement with its corresponding columnar depression 17. Each columnar projection 16 comprises an at least substantially cylindrical side wall 21, and preferably, also includes a bottom wall 22 which is integral with side wall 21 continuously around the periphery thereof. The columnar projections can be thermoformed on a male mold, resulting in a thicker bottom wall 22 and thinner side wall 21 than that achieved with a female mold. The thicker bottom wall 22 increases the rigidity of the head of the columnar projection and provides greater resistance to permanent deformation of the columnar projection 16 upon repeated insertion into a corresponding columnar depression 17. The thinner side wall 21 permits a greater degree of conformance of the side wall 21 to the interior of depression 17. The utilization of a male mold to produce projection 16 also permits the exterior surface of projection 16 to retain the higher degree of roughness normally encountered due to the absence of a confining surface during the thermoforming operation. However, it is within the contemplation of the invention to utilize female molds to make projection 16. Female molds provide a greater degree of control of the exterior dimensions of the projections 16. Also, the cylindrical surface of the female mold can be treated, as

by sandblasting, to increase the coefficient of friction of the exterior surface of side wall 21, while maintaining a smooth, glossy finish on the outer surface of bottom mold 22, as shown in FIG. 4, to thereby minimize the resistance to the initial movement of a projection 16 into a corresponding depression 17 while maximizing the frictional resistance to the subsequent withdrawal of the projection 16 from the depression 17.

Each columnar depression 17 has an at least substantially cylindrical side wall 23 and is also preferably provided with an integral bottom wall 24. The exterior dimensions of the columnar projection 16 and the interior dimensions of the corresponding columnar depression 17 have a relationship permitting the insertion of the columnar projection 16 into the columnar depression 17 with significant frictional engagement between the exterior surface of the side wall 21 of the columnar projection and the interior surface of the side wall 23 of the columnar depression. Such frictional engagement should be sufficient to lock the columnar projection 16 and the corresponding columnar depression 17 together for normal handling of the package, but insufficient to prevent withdrawal of the columnar projection 16 from the corresponding columnar depression 17 upon the application of a desired minimum separation force. In a presently preferred embodiment the side wall 23 is tapered at an angle to the vertical of about 5° so that the inner diameter at the bottom of depression 17 is slightly larger than the diameter of the opening at the top of depression 17. This permits projection 16 to be inserted into and withdrawn from depression 17 with significant stress being applied to bottom wall 22 only as it passes through the neck opening at the top of the depression 17. In general, each of the height of the columnar projection 16 and the depth of the columnar depression 17 will be at least three times, preferably at least five times, the thickness of the sheet being thermoformed. It is also presently preferred that at least a circumferentially continuous portion of the side wall 21 of projection 16 engage the adjacent circumferentially continuous portion of side wall 23 of columnar depression 17 so that an at least substantially air tight chamber is formed upon the insertion of the columnar projection 16 a desired distance into the corresponding columnar depression 17. The buildup of the pressure of the air trapped in this chamber resists the further insertion of the columnar projection 16 into the columnar depression 17, thereby avoiding the application of excessive stresses at the base of either the columnar projection 16 or the columnar depression 17. Furthermore, the reduction in the pressure of the air trapped in the chamber caused by a partial withdrawal of the columnar projection 16 resists the further withdrawal of the columnar projection 16 from the columnar depression.

The columnar depression 17 can be thermoformed in a female mold, resulting in greater rigidity of the neck of the depression and a thicker side wall than would be achieved with a male mold. However, it is within the contemplation of the invention to utilize a male mold. The use of the male mold can provide a greater degree of control of the inner dimensions of columnar depression 17. In addition, a portion of the side wall surface of the male mold can be treated to increase the roughness of the inner wall of the columnar depression 17, preferably in a band located slightly below the neck opening of columnar depression 17.

The phrase "at least substantially cylindrical" includes columnar structures having oval transverse cross sections and rectangular transverse cross sections wherein the corners are significantly rounded and preferably the sides being bowed outwardly, as well as the illustrated columnar structures having circular transverse cross sections. While the invention has been illustrated with the columnar projection 16 extending outwardly from one planar surface of the thermoformed sheet and the columnar depressions extending outwardly from the opposite planar surface of the single sheet, other structures can be employed. For example, a strap having a thermoformed projection at each end can be employed to secure together two thermoformed articles, each having a thermoformed columnar depression.

Reasonable variations and modifications are possible within the scope of the foregoing disclosure, the drawings and the appended claims to the invention.

What is claimed is:

1. A thermoformed container comprising first and second sheet portions of a synthetic organic thermoformable thermoplastic polymeric material, at least one of said first and second sheet portions having a thermoformed packaging cavity therein, said first sheet portion having an at least substantially cylindrical thermoformed columnar projection therein, said second sheet portion having an at least substantially cylindrical thermoformed columnar depression therein, the exterior dimensions of said columnar projection having a relationship with the corresponding interior dimensions of said columnar depression permitting the insertion of said columnar projection into said columnar depression with significant frictional engagement between the exterior surface of said columnar projection and the interior surface of said columnar depression, such frictional engagement being sufficient to lock said columnar projection and said columnar depression together for normal handling of said first and second sheet portions and insufficient to prevent withdrawal of said columnar projection from said columnar depression upon the application of a desired minimum separation force; said columnar projection having a top continuous with the side wall thereof, and said columnar depression having a bottom continuous with the side wall thereof so that an at least substantially air tight chamber is formed upon the insertion of said columnar projection a desired distance into said columnar depression, whereby the buildup of the pressure of the air trapped in said chamber resists the further insertion of said columnar projection into said columnar depression and the reduction of the pressure of the air trapped in said chamber resists the withdrawal of said columnar projection from said columnar depression.

2. A container in accordance with claim 1 wherein said first and second sheet portions are portions of a single sheet.

3. A container in accordance with claim 2 wherein said columnar projection and said columnar depression are located in said single sheet equal distances on opposite sides from a fold line in said single sheet, said columnar projection extending outwardly from a first planar surface of said single sheet, and said columnar depression extending outwardly from the opposite planar surface of said single sheet.

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4. A container in accordance with claim 1 wherein each of said first and second sheet portions has at least one thermoformed cavity therein.

5. A container in accordance with claim 1 wherein each of the height of said columnar projection and the depth of said columnar depression is at least five times the thickness of each of said sheet portions.

6. A container in accordance with claim 5 wherein said columnar projection is a male mold thermoformed projection and wherein said columnar depression is a

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female mold thermoformed depression.

7. A container in accordance with claim 1 wherein the inner diameter of said columnar depression increases from the mouth thereof to the bottom thereof.

8. A container in accordance with claim 1 wherein at least one of the inner side wall surface of said columnar depression and the outer side wall surface of said columnar projection has a roughened surface to increase the coefficient of friction thereof.

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