United States Patent

Colgan et al.

[15] **3,641,659**

[45] **Feb. 15, 1972**

[54] MANUFACTURE OF VENTED CLOSURES

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[21] Appl. No.: **816,459**

Related U.S. Application Data

[62] Division of Ser. No. 483,526, Aug. 30, 1965, Pat. No. 3,455,481.

[52] **U.S. Cl.**.....**29/451**, 29/453, 29/525, 29/208 I, 29/235

[51] **Int. Cl.**.....**B23p 11/02**

[58] **Field of Search**.....29/453, 235, 450, 451, 208 F; 229/1.5 B, 43, DIG. 14; 220/44; 113/80 D

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[57] **ABSTRACT**

This disclosure relates to a method of and apparatus for manufacturing vented closures by first forming a disklike body having an end panel and a recess defined by a peripheral wall and an apertured end wall, temporarily enlarging an entrant opening of the recess, inserting a hydrophobic element into the recess through the temporarily enlarged entrant opening, compressing the hydrophobic element, and returning the entrant opening to a size which prevents the removal of the hydrophobic element from the recess through the entrant opening.

7 Claims, 10 Drawing Figures

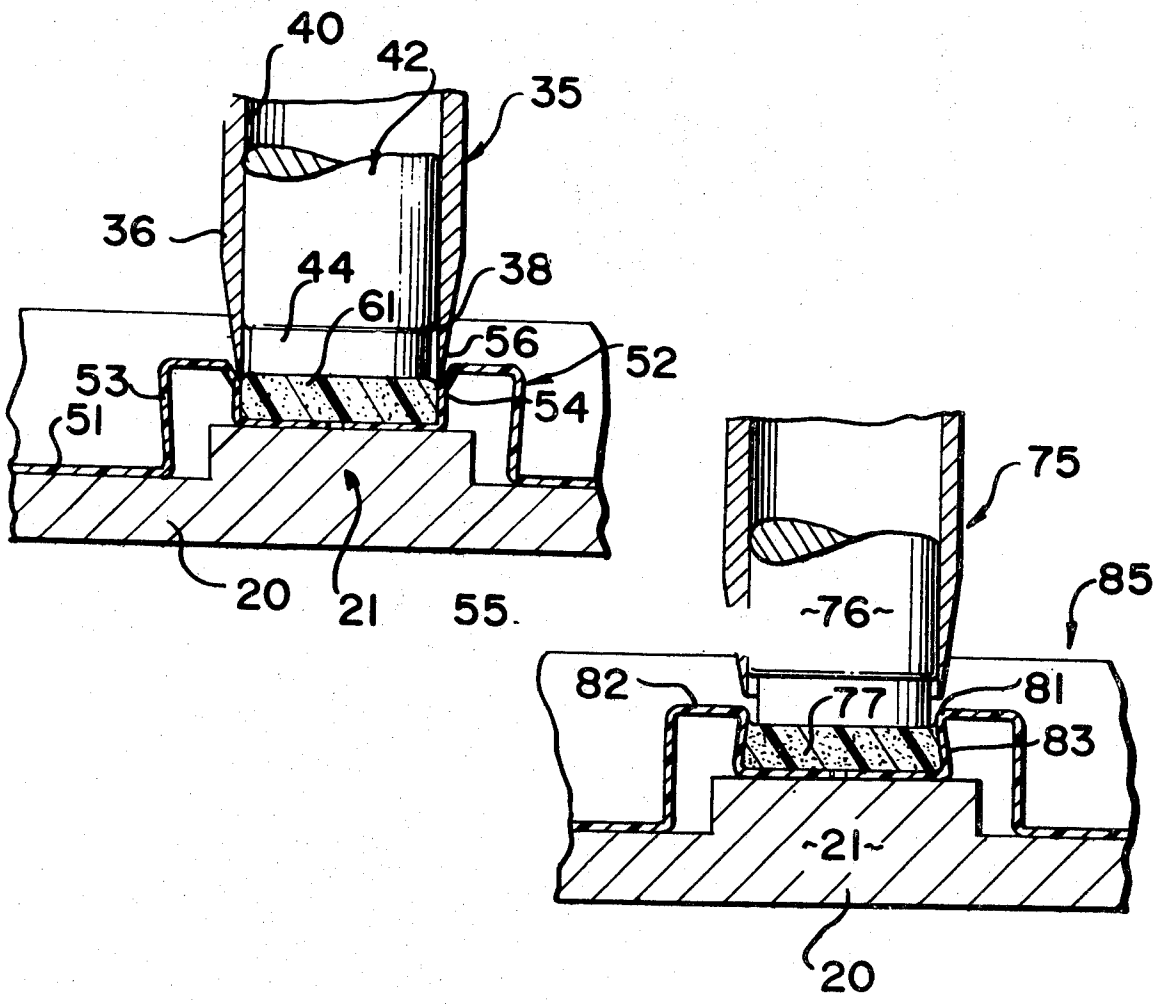

FIG. 1

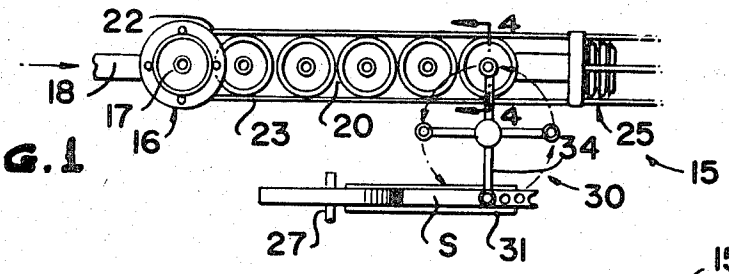

FIG. 2

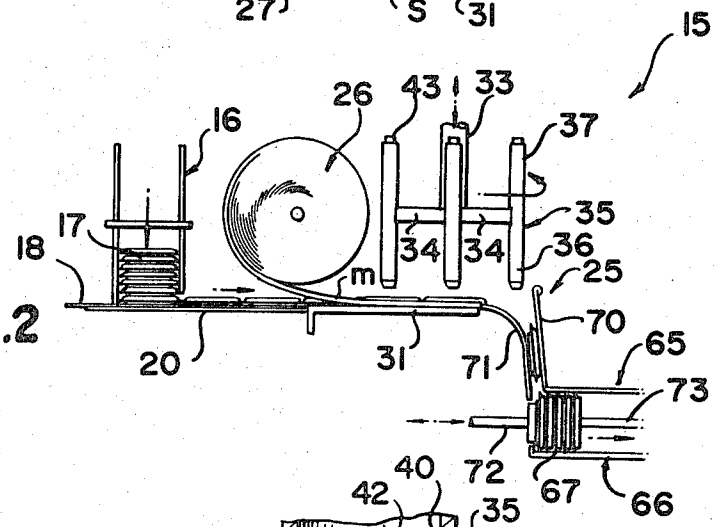

FIG. 3

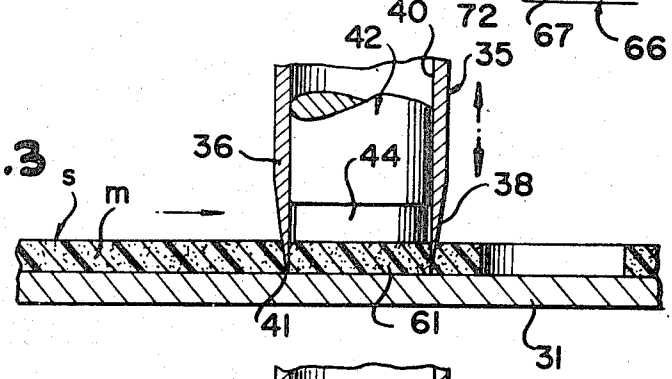

FIG. 4

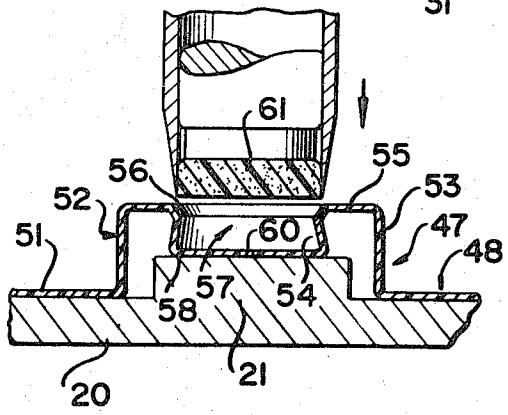

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FIG. 5

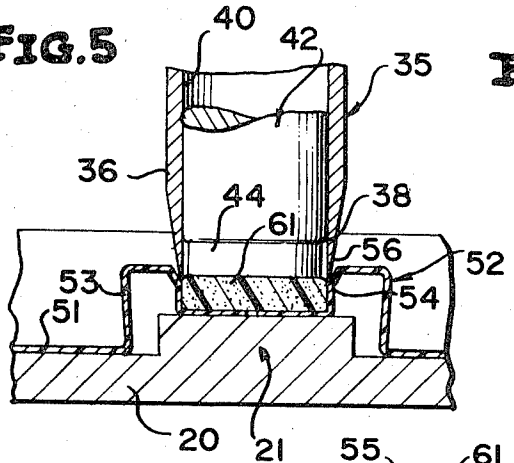


FIG. 6

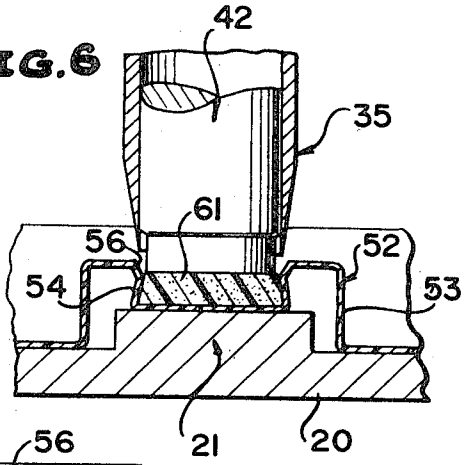


FIG. 7

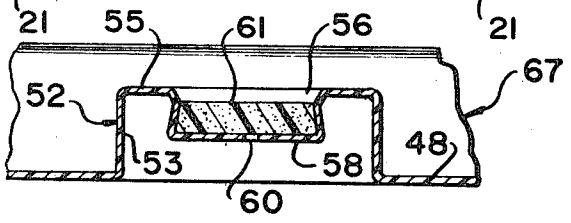


FIG. 8

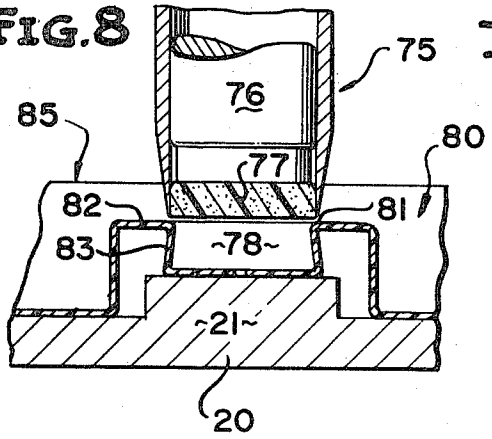


FIG. 9

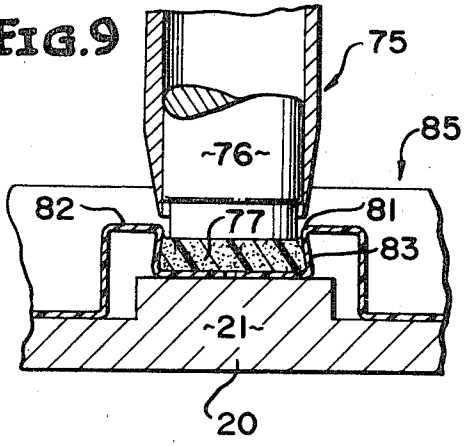
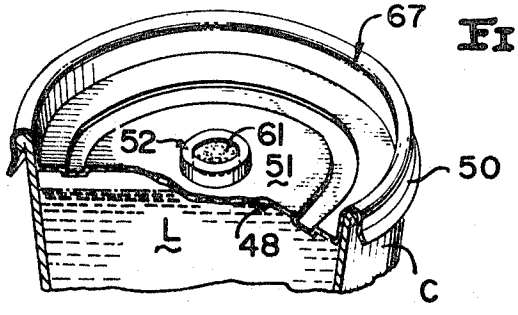


FIG. 10



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MANUFACTURE OF VENTED CLOSURES

This application is a divisional application of our copending commonly assigned application Ser. No. 483,526, filed Aug. 30, 1965, and now U.S. Pat. No. 3,455,481.

When a paper cup or other container is filled with a hot beverage, such as coffee, tea or the like, and capped with a lid or closure of paper or plastic or combinations thereof, the lid must be provided with some means through which excess vapor can escape to atmosphere. It is conventional to provide one or more small holes in such closures or lids at center portions thereof for this purpose. Such venting means serves the intended function but, at the same time, drops of the liquid contents can pass through the vent openings imparting an unattractive and unesthetic appearance to the exterior of the closures.

A primary object of this invention is to provide a novel method of forming a closure of the type described including the steps of forming a disklike body having an end panel and a recess defined by a peripheral wall and an apertured end wall, temporarily enlarging an entrant opening of the recess, inserting a hydrophobic element into the recess through the temporarily enlarged entrant opening, and returning the entrant opening to a size which prevents the removal of the hydrophobic element from the recess.

A further object of this invention is to provide a novel method of manufacturing a closure by performing the steps of forming a disklike body having an end panel and a recess defined by a flexible frustoconical wall and an apertured end wall, temporarily enlarging an entrant opening of the recess by flexing the frustoconical wall radially outwardly, inserting a hydrophobic element into the recess through the temporarily enlarged entrant opening, and releasing the flexed peripheral wall causing the same to rebound under the influence of internal forces to a size which prevents the removal of the hydrophobic element from the recess.

A further object of this invention is to provide a novel apparatus for forming a closure including means defining a predetermined path of travel for disklike bodies each having an end panel and a recess defined by a flexible frustoconical wall and an apertured end wall, means for advancing the disklike bodies along the predetermined path, a tubular element adjacent the predetermined path, means forming a portion of the tubular element for flexing the frustoconical wall of each of the disklike bodies whereby a portion of each recess is temporarily enlarged, and means for inserting a hydrophobic element into each recess from the tubular element while the recess is temporarily enlarged.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings:

IN THE DRAWINGS

FIG. 1 is a schematic fragmentary top plan view of a novel apparatus of this invention, and illustrates a turret-type mechanism for cutting circular elements from a web of hydrophobic material and inserting each element into a recess of each of a plurality of closures.

FIG. 2 is a fragmentary schematic side elevational view of the apparatus of FIG. 1, and more clearly illustrates the turret-type mechanism and means for stacking each of the manufactured closures.

FIG. 3 is an enlarged fragmentary sectional view taken through a tubular element of the turret-type mechanism, and illustrates the tubular element cutting a circular element from the hydrophobic material.

FIG. 4 is an enlarged fragmentary sectional view taken generally along line 4—4 of FIG. 1, and illustrates the tubular element positioned above and in axial alignment with a recess of one of the closures.

FIG. 5 is an enlarged fragmentary sectional view similar to FIG. 4, and illustrates the tubular element in a lowermost position at which the recess of the closure is enlarged, and a plunger forcefully urging the hydrophobic element into the recess.

FIG. 6 is an enlarged fragmentary sectional view taken generally along line 4—4 of FIG. 1, and illustrates the retracted position of the tubular element prior to the retraction of the plunger.

FIG. 7 is an enlarged fragmentary sectional view of the completed closure, and illustrates a generally frustoconical wall of the recess mechanically interlockingly securing the hydrophobic element in the recess.

FIG. 8 is an enlarged fragmentary sectional view taken generally along line 4—4 of FIG. 1, and illustrates a slightly modified closure in a position below one of the tubular elements housing a hydrophobic element.

FIG. 9 is a fragmentary sectional view similar to FIG. 8, and illustrates the reciprocated position of a plunger of the tubular element and the hydrophobic element force-fit in a recess of the closure.

FIG. 10 is a fragmentary top perspective view with parts removed for clarity of a container housing a liquid and illustrates one of the closures positioned on the container to prevent liquid seepage while permitting vapor to escape through a vent opening underlying a hydrophobic element of the closure.

A novel apparatus constructed in accordance with this invention is illustrated in FIGS. 1 and 2 of the drawings, and is generally referred to by the reference numeral 15. The apparatus 15 includes a hopper 16 housing a stack of identical closures 17. Lowermost ones of the closures 17 are bottom-fed from the hopper 16 by a feed bar 18 which is reciprocated by conventional means (not shown) to progressively advance the closures along a predetermined path of travel from left-to-right, as viewed in FIGS. 1 and 2 of the drawings.

The closures are supported by a plate or support 20 (FIGS. 1 and 4) having an upstanding portion 21 (FIG. 4) which functions in a manner to be described more fully hereafter. A pair of spaced, upstanding, parallel guides or rails 22, 23 guide the closures during the advancement thereof toward a discharge end 25 of the apparatus 15.

A roll 26 of hydrophobic material M in the form of a relatively narrow strip S is supported by a shaft 27 which is conventionally journaled in the framework (not shown) of the apparatus 15. Conventional means (not shown), such as pull rolls, are provided for moving the strip S from left-to-right toward a turret-type mechanism 30.

The material M is preferably polyethylene which is manufactured by fusing extremely small but discrete particles of polyethylene under controlled time, temperature and pressure conditions. The particles are heated just enough to fuse adjoining particle edges together while leaving an open lattice between adjoining particles. The open lattice defines a plurality of minute openings which prevent liquid passage but freely permit the passage of gas or vapor through the material M, as will appear more fully hereafter.

The strip S is supported by a plate 31 adjacent the mechanism 30. The plate 31 forms a portion of the framework (not shown) of the apparatus 15, and is supported substantially parallel to the support or plate 20. Means (not shown) can be provided for guiding the strip S during the movement thereof from left-to-right toward the mechanism 30. Such guide means may be, for example, upstanding portions of the plate 31 which freely contact and guide the opposite longitudinal edges (unnumbered) of the strip S.

The turret mechanism 30 includes a shaft 33 which is intermittently rotated and reciprocated in the directions indicated by the headed arrows in FIGS. 1 and 2 of the drawings by conventional means (not shown). The rotational and reciprocal movements of the mechanism 30 are synchronized by conventional synchronizing or timing means (not shown). Four identical radial arms 34 are carried by the shaft 33. A tubular element 35 is supported at an outermost end (unnumbered) of each of the arms 34. Each of the tubular elements 35 is identi-

cal, and includes a lower end portion **36** and an upper end portion **37** (FIG. 2).

As is best illustrated in FIG. **3** of the drawings the lower end portion **36** of each tubular element **35** has a generally frustoconical outer surface **38** which converges with an inner cylindrical surface **40** to define a circular cutting or severing edge **41**.

An identical piston **42** is telescopically housed in each of the tubular elements **35**. Each piston or plunger **42** has an upper end portion **43** normally projecting upwardly beyond the upper end portion **37** of an associated one of the tubular elements **35**. A reduced lower end portion **44** of each piston **42** is normally housed entirely within the end portion **36** of an associated one of the tubular elements **35**, as is clearly shown in FIG. **3** of the drawings. The pistons **42** are each selectively reciprocated by means (not shown) during the operation of the apparatus **15** which will be best understood by first describing the construction of one of the identical closures **17**.

As is best illustrated in FIG. **4** of the drawings, a closure **47** which is identical to the closures **17** comprises a disklike body **48** (FIG. **11**) having a downwardly opening curl **50** at its periphery for securing the disklike body to a cup or similar container C in which is packaged a hot liquid media, such as tea or coffee. An end panel **51** of the disklike body **48** includes an integral upstanding annular bead **52** defined by an outermost wall **53**, an inner wall **54** and an annular top wall **55**. The inner wall **54** is joined to the annular wall **55** by an integral wall portion **56** defining an entrance opening (unnumbered) of a recess **57**. The recess **57** is defined by the inner wall **54** and an end or terminal wall **58** having a vent opening or aperture **60**. The wall portion **56** and the inner wall **54** are each frustoconical in configuration thus imparting a generally frustoconical configuration to the recess **57**.

As the closures **17** are advanced along the support **20** the terminal wall of each is in sliding contact with the portion **21** of the support **20**, as is best illustrated in FIG. **4** of the drawings. Upon downward reciprocation of the turret-type mechanism **30** one of the tubular elements **35** cuts a circular disk or element **61** (FIG. **3**) from the material M. At the same time a diametrically opposite one of the tubular elements inserts a previously cut disk into the recess of one of the closures **17**, as will be described hereafter.

The shaft **33** of the turret-type mechanism **35** is reciprocated upwardly and successively indexed or rotated until the tubular element **35** carrying the hydrophobic disk **61** is in overlying relationship to, for example, the closure **47** as shown in FIG. **4** of the drawings. The axes of the tubular element **35**, the plunger **42**, the hydrophobic element **61** and the recess **57** are in alignment, and the shaft **33** is again moved downwardly to the position illustrated in FIG. **5** of the drawings. As the tubular element **35** moves between the position illustrated in FIG. **4** to the position shown in FIG. **5**, the cutting edge **41** of the tubular element **35** contacts the frustoconical wall portion **56** and progressively flexes the wall portion **56** and the inner wall **54** radially outwardly to the position illustrated in FIG. **5** of the drawings. This same outward flexing of the wall portion **56** and the frustoconical wall **54** flexes the outermost wall **53** outwardly to temporarily deform the bead **52** to the configuration illustrated in FIG. **5**. In this position the entrance to the recess **57** is enlarged to permit the free passage of the hydrophobic disk **61** into the recess **57** under the influence of the downward movement of the plunger **42** to the position shown in FIG. **5** of the drawing. The plunger **42** compresses the disk **61** causing a peripheral portion (unnumbered) of the latter element to forcibly grippingly engage the inner wall **54** of the annular bead **52**.

After the hydrophobic disk **61** has been completely inserted in the recess **57** of the annular bead **52** (FIG. **5**) the tubular element **35** is reciprocated upwardly to the position illustrated in FIG. **6** without movement of the plunger **42**. During the upward retracting movement of the tubular element **35**, the inner frustoconical wall **54** progressively rebounds under the influence of internal forces to the position illustrated in FIG. **6** of the drawings. In this position the frustoconical wall **54** securely clampingly grips and mechanically interlocks the hydrophobic disk **61** in the recess **54** in the absence of separate bonding means of any type, such as an adhesive or other type bonding means. The plunger **42** is thereafter fully retracted to the position illustrated in FIG. **3** of the drawings and the completed closure (FIG. **7**) is subsequently discharged into a stacking mechanism **65** at the discharge end **25** of the apparatus **15**.

The stacking mechanism **65** includes a housing **66** into which the completely formed vented closures, generally referred to by the reference numeral **67** are guided by opposite spaced guide plates **70, 71**. A pair of oppositely acting pistons **72, 73** are operated by means (not shown) which progressively move the closures **67** to the right as viewed in FIG. **2**. The piston **73** merely steadies and maintains the closures **67** in the on-edge position shown in FIG. **2** during the retraction of the piston **72** during which a closure is free to drop between the piston **72** and the leftmost of the plurality of closures **67**.

FIGS. **8** and **9** of the drawings illustrate a tubular element **75** and a plunger **76** which are identical in structure to the respective elements **35, 42** of the apparatus **15**. However, the method of inserting a hydrophobic disk **77** into a frustoconical recess **78** of a closure **80** is slightly different than that heretofore described with respect to FIGS. **4–6** of the drawings. The closure **80** also differs somewhat from the closure **47** in that the frustoconical wall portion **56** is eliminated and in lieu thereof an annular radius portion **81** joins an end wall **82** of the closure **80** to a frustoconical inner wall **83** partially defining the recess **78**.

After the tubular element **75** has been indexed to the position illustrated in FIG. **8** with the axes of the element **75**, the plunger **76**, the hydrophobic element **77** and the recess **78** in axial alignment, the plunger **76** is moved downwardly without movement of the tubular element **75**. The disk **77** is generally circular in configuration and the diameter thereof is slightly larger than an entrance opening of the recess **78** defined by the radius portion or shoulder **81**. As the plunger descends the periphery (unnumbered) of the hydrophobic element **77** deforms slightly and the inner frustoconical wall **83** is also flexed slightly to enlarge the entrance opening and effect complete introduction of the element **77** into the recess **78**. The plunger **76** compresses the hydrophobic element **77** upon continued downward movement to the position illustrated in FIG. **9** until the periphery of the element is in frictional mechanical clamping interlocking engagement with the frustoconical wall.

Upon the upward retraction of the plunger **76** the frustoconical wall **83** rebounds radially inwardly and the completely formed vented closure, generally referred to by the reference numeral **85**, assumes a configuration corresponding substantially identically to the configuration of the vented closure **67** (FIG. **7**).

From the foregoing, it will be seen that novel and advantageous provisions have been made for carrying out the desired end. However, attention is again directed to the fact that additional variations may be made in this invention without departing from the spirit and scope thereof as defined in the appended claims.

We claim:

1. A method of forming vented closures comprising the steps of providing a plurality of closures each having a disklike body having an upwardly opening recess defined by a peripheral wall and an apertured end wall, providing hydrophobic sheet material, cutting a hydrophobic element from the hydrophobic sheet material at one station while simultaneously inserting an earlier cut hydrophobic element into a recess of one of said closures at another station, the cutting step being accomplished by a plurality of hollow cutting tools; and including the further step of transferring each cut hydrophobic element from the hydrophobic sheet at said one station to its associated closure recess at said another

station by housing each hydrophobic element in an associated cutting tool and transferring the cutting tool to and at least partially into an associated closure recess.

2. A method of forming vented closures comprising the steps of providing a plurality of closures each having a disklike body having an upwardly opening recess defined by a peripheral wall and an apertured end wall, providing hydrophobic sheet material, cutting a hydrophobic element from the hydrophobic sheet material while simultaneously inserting an earlier cut hydrophobic element into a recess of one of said closures, camming the peripheral wall of each closure open prior to inserting a hydrophobic element into the associated recess.

3. A method of forming vented closures comprising the steps of providing a plurality of closures each having a disklike body having an upwardly opening recess defined by a peripheral wall and an apertured end wall, providing hydrophobic sheet material, cutting a hydrophobic element from the hydrophobic sheet material while simultaneously inserting an earlier cut hydrophobic element into a recess of one of said closures, camming the peripheral wall of each closure open by at least partially inserting therein a portion of the cutting tool prior to inserting a hydrophobic element into the associated recess.

4. The method as defined in claim 1 including the step of advancing the plurality of closures and hydrophobic sheet material, and terminating the advancement thereof during the cutting and insertion steps.

5. The method as defined in claim 2 including the step of advancing the plurality of closures and hydrophobic sheet material, and terminating the advancement thereof during the cutting and insertion steps.

6. The method as defined in claim 3, including the step of advancing the plurality of closures and hydrophobic sheet material, and terminating the advancement thereof during the cutting and insertion steps.

7. A method of forming a vented closure comprising the steps of providing a closure having a disklike body having a recess defined by a peripheral wall and an apertured end wall, providing a sheet of hydrophobic material, cutting an element from the hydrophobic sheet with a hollow cutting tool whereby the hydrophobic element is retained in the hollow cutting tool, positioning the cutting tool and recess in contiguous generally axially aligned relationship, pushing the hydrophobic element out of the hollow cutting tool and into the closure recess, and camming the peripheral wall of each closure open by at least partially inserting therein a portion of the cutting tool prior to inserting the hydrophobic element into the associated recess.

* * * * *