United States Patent

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Continuation-in-part of application Ser. No. 750,230, Aug. 5, 1968, now abandoned.

[54] **SEPARABLE MOLDED ARTICLE**
22 Claims, 19 Drawing Figs.

[52] **U.S. Cl.** ..... **220/53,** 220/42 B, 215/46.5, 220/24 A
[51] **Int. Cl.** **B65d 17/24,** B65d 41/00
[50] **Field of Search** 220/53, 54, 24, 42; 25/46.5

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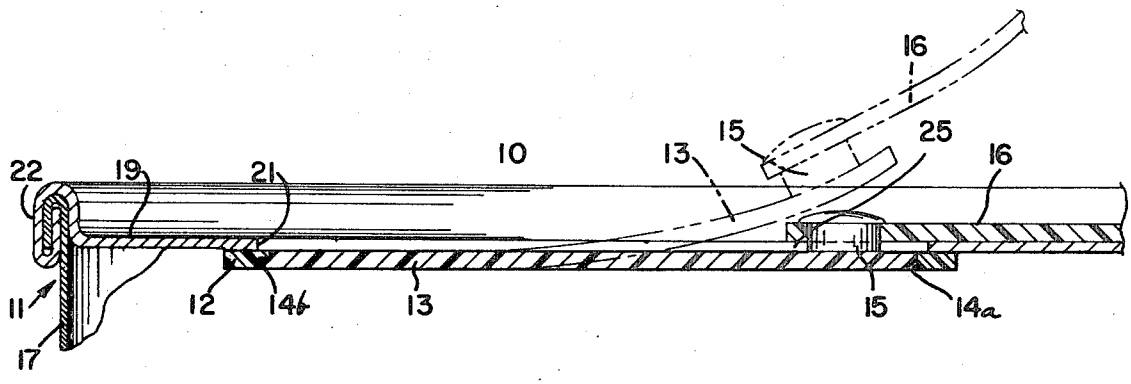
Primary Examiner—George T. Hall
Attorneys—Fred P. Kostka, Joseph E. Kerwin and William A. Dittman

ABSTRACT: An article of manufacture including a panel and a tear portion joined at an interface which forms a seal and a weakening line along which the tear is separable from the panel. The weakening line is formed by initially molding the panel or the strip portion to form one of the faces at the interface and using this preformed face as a mold surface to form the complementary sealing face of the other.



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SHEET 1 OF 5

FIG. 1

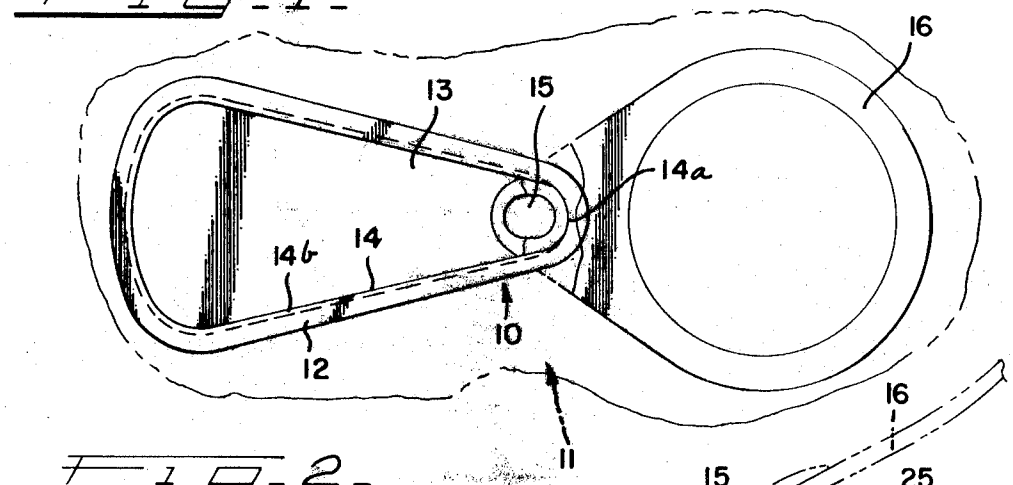


FIG. 2

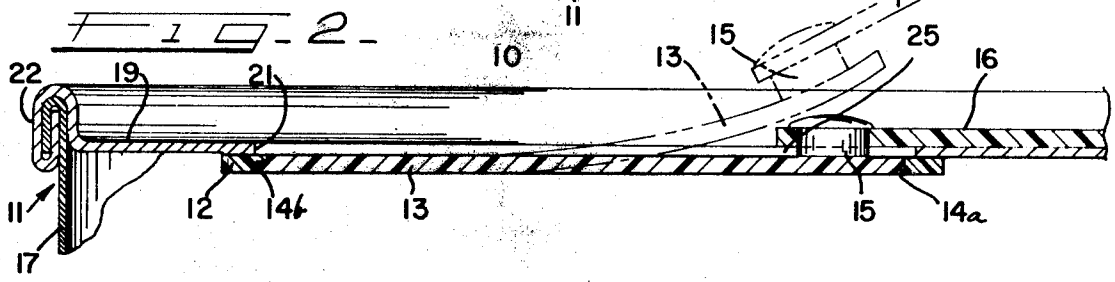
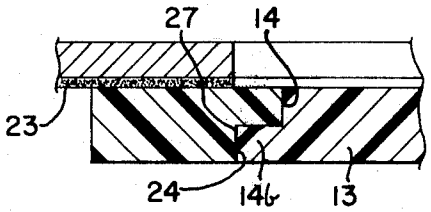


FIG. 3



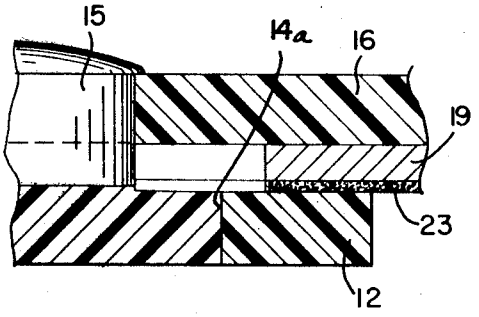


FIG. 5

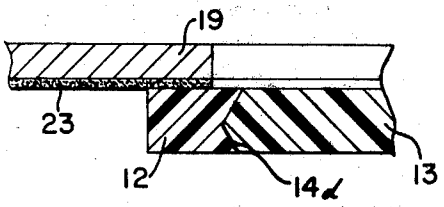


FIG. 4

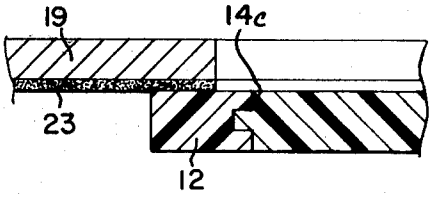
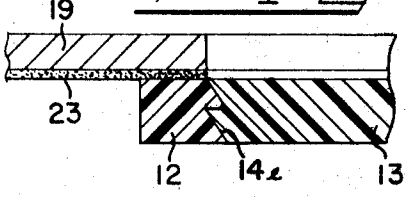


FIG. 6



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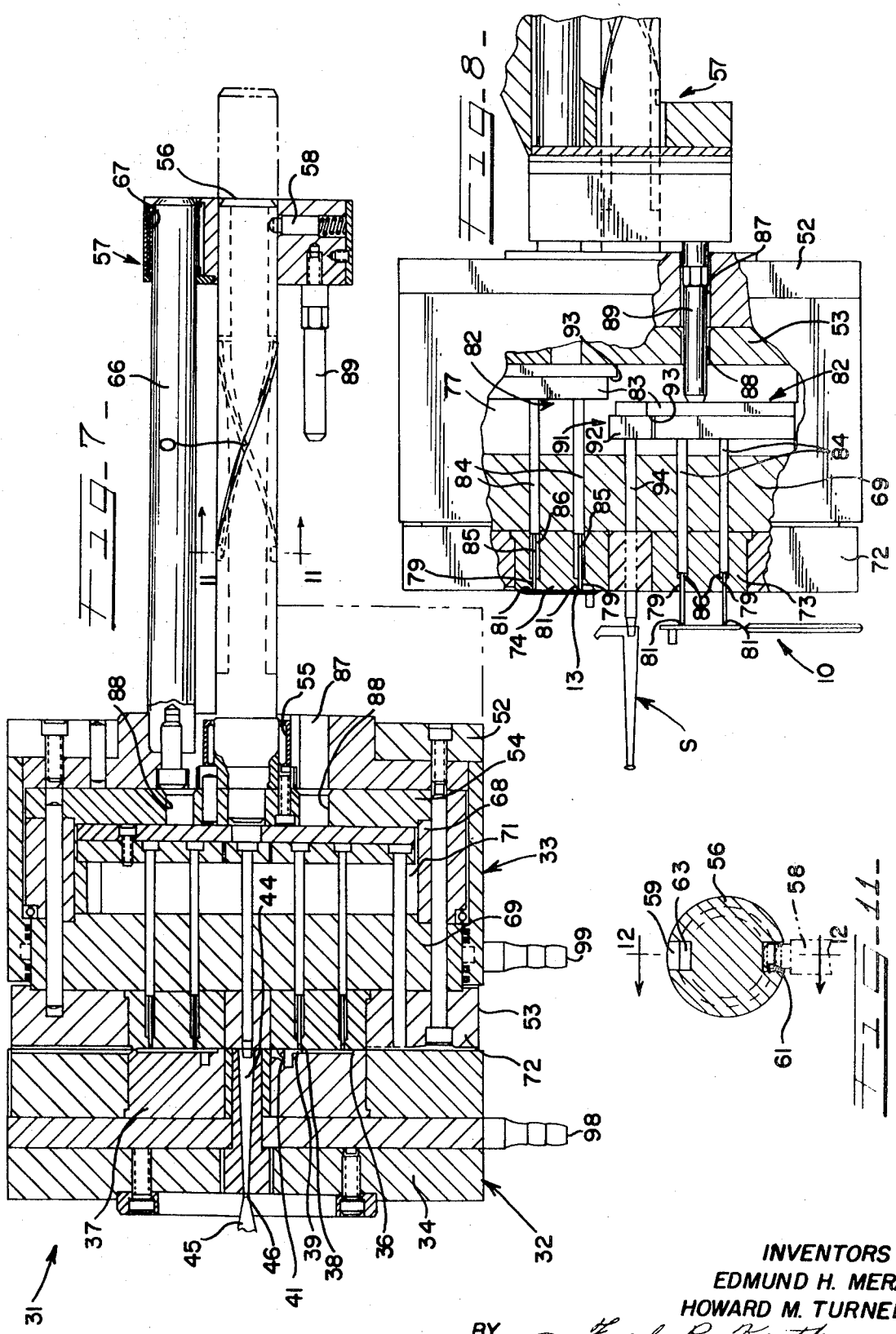

FIG. 7

FIG. 8

FIG. 11

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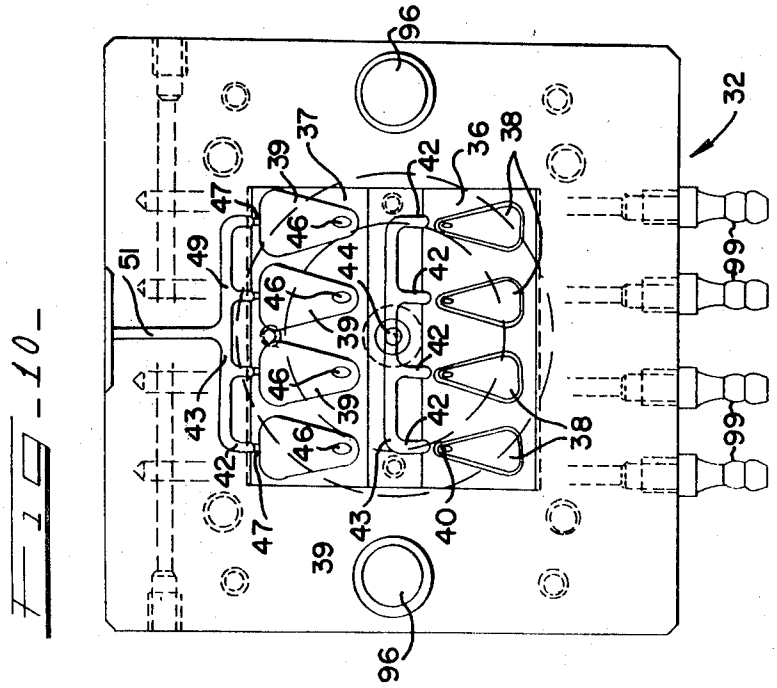

FIG. 10

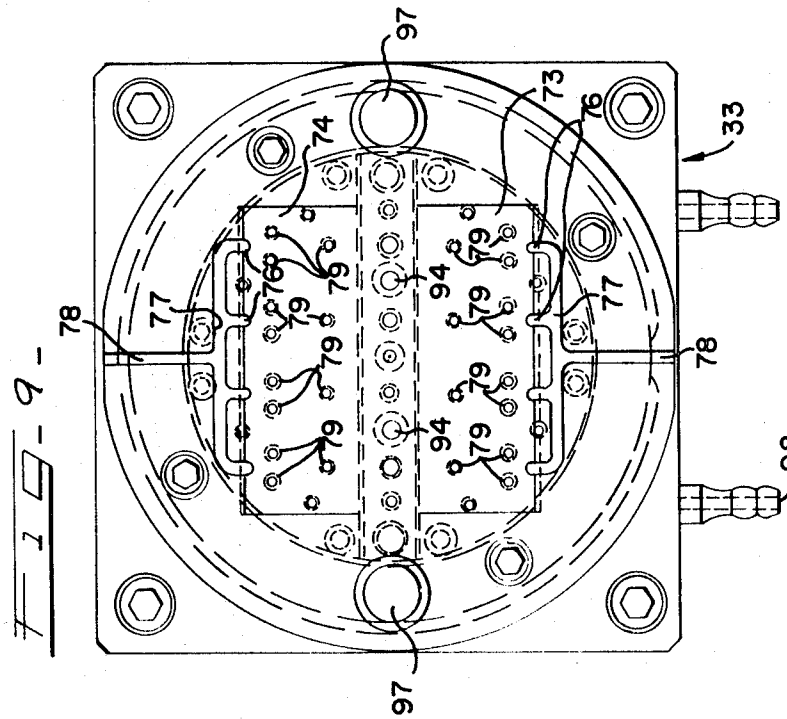

FIG. 9

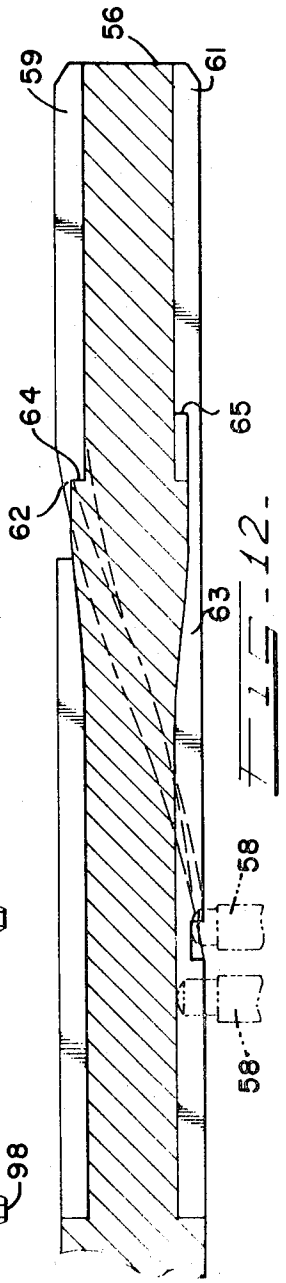

FIG. 12

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FIG. 13

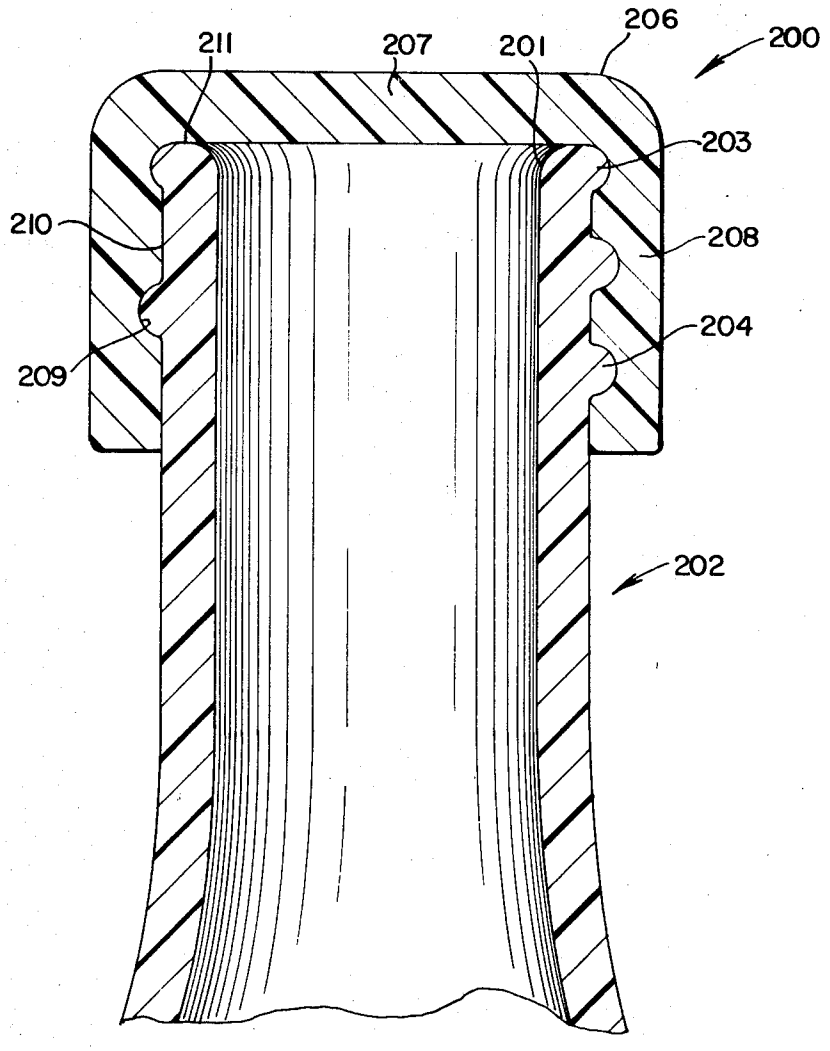

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FIG. 14

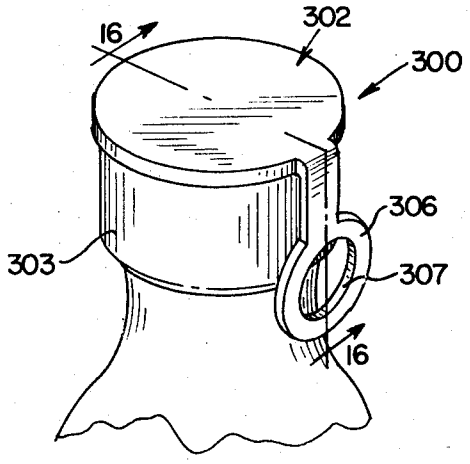


FIG. 15

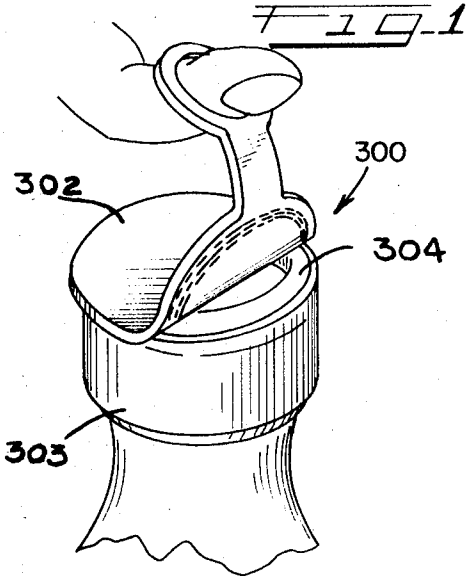


FIG. 16

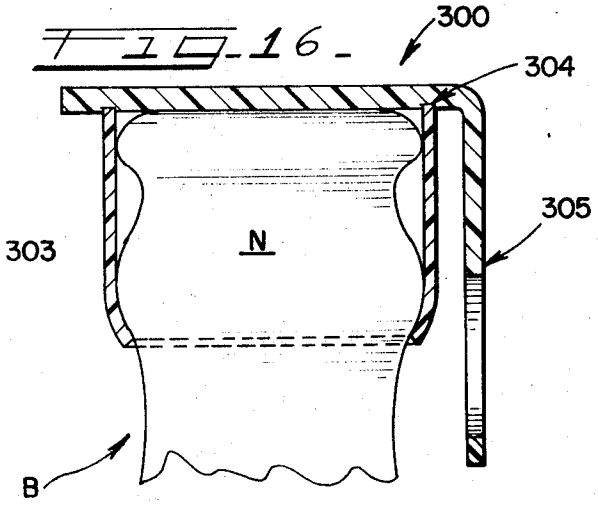


FIG. 17

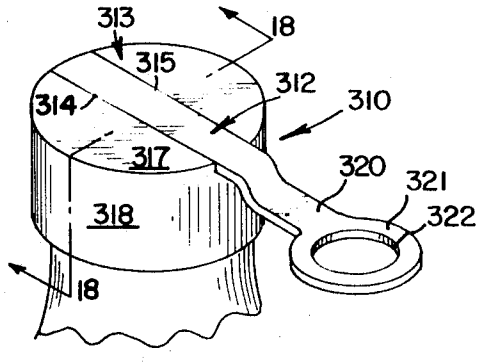


FIG. 18

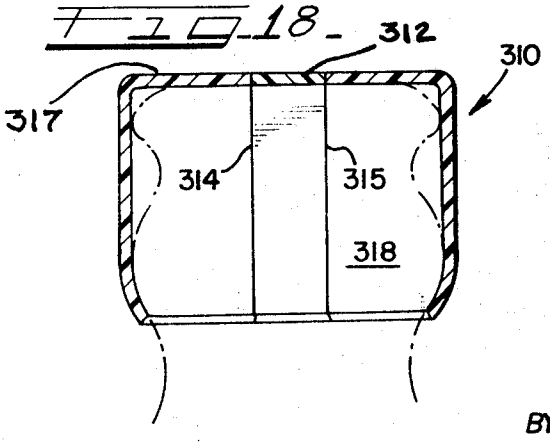
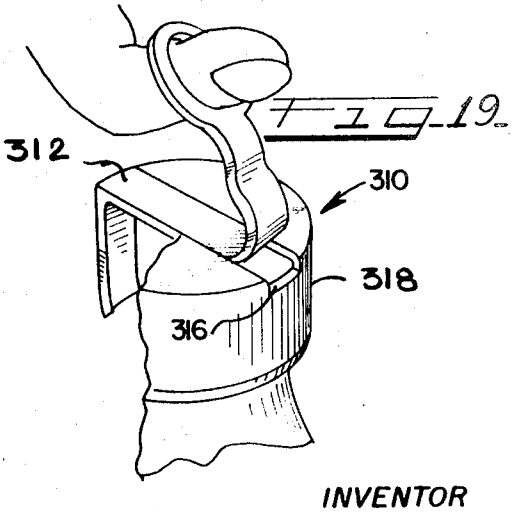


FIG. 19



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SEPARABLE MOLDED ARTICLE

This application is a continuation-in-part of U.S. Pat. application Ser. No. 750,230 filed Aug. 5, 1968.

The present invention relates to closures and, more particularly, to an easy opening closure for containers or the like.

It is a principal object of the present invention to provide a closure having a panel and separable tear portion joined along an interface which defines a weakening line created by molding one of the components about a prior formed face, so that the components are joined in sealing relationship at the interface and separable therealong upon the application of a separating force to one of the components.

It is a further object taken in conjunction with the foregoing principle object to a container with an easy opening closure formed with a panel and a tear portion which is separable from the panel to provide access to the contents of the container.

IN THE DRAWINGS:

FIG. 1 is a top plan view of a closure embodying the principles of the present invention and applied to a container end, which is shown in phantom lines, to more clearly illustrate the structure of the closure;

FIG. 2 is an enlarged fragmentary sectional view showing the closure applied to the container and illustrating in phantom lines the tear portion in a partially open position;

FIG. 3 is an enlarged fragmentary cross-sectional view more clearly illustrating the configuration of the interface defining the weakening line along which the tear portion is separable from the panel;

FIGS. 4–6 are enlarged fragmentary sectional views similar to FIG. 3 but illustrating different configurations of interfaces;

FIG. 7 is a cross-sectional view of the molding apparatus which may be used to manufacture the easy opening closure illustrated in FIGS. 1–3 and showing the apparatus in the closed molding position;

FIG. 8 is an end view of the indexing head of the apparatus shown in FIG. 7;

FIG. 9 is an end view of the stationary mold head of the apparatus illustrated in FIG. 7;

FIG. 10 is a side elevational view of the indexing head partially in cross section and shown in the open position thereof;

FIG. 11 is a cross-sectional view of the indexing shaft taken generally along the lines 11—11 of FIG. 7; and

FIG. 12 is a longitudinal cross-sectional view through the indexing shaft taken generally along the lines 12—12 of FIG. 11; and

FIG. 13 is a cross-sectional view of a further embodiment of a closure embodying the present invention;

FIG. 14 is a top perspective view of another novel easy opening closure constructed in accordance with the present invention, and illustrates a bottle cap having an end panel joined to a peripheral skirt along a weakening line, and a pull tab portion for removing the entire end panel from the peripheral skirt;

FIG. 15 is a top perspective view of the bottle cap of FIG. 14, and illustrates the manner in which the pull tab portion is manually grasped and lifted to remove the end panel from the peripheral skirt;

FIG. 16 is an enlarged fragmentary sectional view taken generally along the line 16—16 of FIG. 14, and more clearly illustrates the manner in which the end panel is joined to the peripheral skirt along the weakening line;

FIG. 17 is a top perspective view of another bottle cap constructed in accordance with the present invention, and illustrates a tear strip which is defined by portions of an end panel and a peripheral skirt of the cap;

FIG. 18 is an enlarged sectional view taken generally along line 18—18 of FIG. 17, and more clearly illustrates a pair of parallel weakening lines joining the tear strip to remaining portions of the cap;

FIG. 19 is a top perspective view of the cap with portions removed for clarity, and illustrates the manner in which a pull tab of the tear strip is grasped for removing the tear strip from a remaining portion of the cap.

Referring now to FIGS. 1–3, the closure embodying the principles of the present invention is shown in the form of an easy opening closure **10** attached to a container **11**.

The easy opening closure **10** comprises a panel **12** and a tear portion **13** which is separable from the panel **12** along interface **14** of the panel **12** and tear portion **13** to form an opening **25**. The tear portion **13** may be formed with post **15** to which there is connected a pull tab **16**. The pull tab **16** is grasped by the fingers for exerting a force to separate the tear portion **13** from the panel **12**. To minimize the force required to initiate the separation of the tear portion **13**, the interface **14** about the post **15** may be formed in the nature of a butt joint **14***a* which merges with the remainder of the interface **14** which as shown may be configurated as a scarf joint **14***b*.

The easy opening closure **19** is shown applied to a container **11** comprising generally a body **17** which may be made from any suitable material such as metal, plastic or the like. Attached to an open end of the body **17** is an end closure or cover **19** having a generally pear-shaped pour opening **21** formed therein. The cover **19** may be made from material the same as or different from the material of the container body **17**. As shown, the cover **19** is made from metal and is suitably attached to the body **17** as by a double seam **22**.

The easy opening closure **10** preferably secured to the underside of the end cover **19** so that the interface **14** is located inwardly of the edge of the pour opening **21** to reduce the danger of cutting along the metal or raw edge. At the same time the tear portion **13**, which may also be pear-shaped, is disposed over the pour opening **21** so that, upon separation from the panel **12**, the contents of the container **11** which may be a beverage or the like may be easily removed. The easy opening closure **10** may be made separate from the end closure **19** and subsequently adhered or attached thereto as by a suitable adhesive **23** or other bonding means.

In accordance with the present invention, the interface **14** is formed by preforming either the inner face or edge **24** defining the opening **25** in the panel **12** or the outer face or edge **27** of the tear portion **13** to provide a finished mold face on which the face of the other member is subsequently formed, as more fully to be explained hereinafter. The panel **12** and tear portion **13** may be made from a suitable moldable material as, for example, a thermoplastic such as polyethylene, polypropylene or the like, a thermosetting plastic such as a filled phenolic molding powder, or rubber.

The panel **12** and tear portion **13** may each be made from plastic materials selected from the same chemical class having the same or different physical properties or may be selected from different classes. For example, the panel **12** and tear portion **13** may both be made from polypropylene selected from the same class, but the polypropylene used for the panel **12** may differ from the polypropylene used for the tear portion **13** in respect of physical properties such as the melt flow, density or the like. Also, to illustrate the use of different chemical classes of material, either the panel **12** or tear portion **13** may be made from polypropylene while the other may be made from polyethylene. The particular material used will be determined to some extent by the container structure, container use, and in particular by the sealing characteristics desired at the interface **14**.

The seal at the interface **14** is formed so that the abutting faces or edges **24** and **27** of the panel **12** and tear portion **13**, respectively, form a seal which is capable of being separated therealong upon the application of a force thereon so that the interface **14** defines a weakening line.

The seal may be achieved by a tight fit of the tear portion **13** within the opening **25** so that the frictional forces at the interface **14** resist separation. To improve the sealing characteristics at the butt joint **14***a*, one or both of the abutting edges **24** and **27** may be roughened as by knurling or the like. The seal of the remainder of the interface **14** is in the nature of a scarf joint **14***b* which is disposed so as to resist the tendency of

the tear portion 13 to separate under the pressure forces exerted thereon by the container contents, such as carbonated beverages or the like, until a manually separating force is applied as more fully to be explained hereinafter.

Further embodiments for forming a seal at the interface 14 may be a tongue and groove joint 14*c* as illustrated in FIG. 4, an interface dovetail joint 14*d* as shown in FIG. 5 or a sawtooth joint 14*e* as shown in FIG. 6. The joints 14*b*, *c* and *d* are constructed so as to form an interlock at the interface and thereby permit the reinsertion of the tear portion 13 into the opening.

The panel 12 and tear portion 13 are preferably each formed by injection molding, although it should be readily apparent that other molding methods, as for example, compression molding, transfer molding, or impulse molding may also be used. It should also be mentioned that the panel 12 and tear portion 13 may each be formed by the same molding method or may be formed by different molding methods. Although the panel 12 having the opening 25 formed therein may be formed or molded first and used as a mold member to form the tear portion 13. In the preferred form of the invention the tear portion 13 is initially formed and the panel 12 molded thereabout as more fully to be explained hereinafter.

Referring now to FIG. 7 to 12 there is shown an apparatus 31 for injection molding of the closure 10. The injection molding apparatus 31 comprises generally a stationary head assembly 32 and an indexing head assembly 33. The indexing head assembly 33 is mounted for lengthwise movement relative to the stationary head assembly 32 from the closed position of FIG. 7 to an open position as shown in phantom.

The stationary head assembly 32 includes a molding head 34 having fastened therein a mold plate 36 for forming the tear portion 13 and a mold plate 37 for forming the panel 12 about the tear portion 13. The mold plates 36 and 37 as shown are each formed with a plurality of tear portion cavities 38 and panel cavities 39 for forming the tear portion 13 and the panel 12.

Each of the tear portion cavities 38 in the mold plate 36 is formed to shape the outer edge 27 of the tear portion 13 to form the scarf joint 14*b* and the butt joint 14*a* at the interface 14 of the completed closure 10. Projecting from and communicating with each of the cavities 38 is a cylindrical or post cavity 40 for forming the attachment post 15 to which the pull tab 16 is subsequently attached.

Gates 41 are provided at the upper end of the post cavities 40 for introducing molten plastic into the cavities 38 and 39. Communicating with the gates 41 are runner grooves 42 which are connected to a horizontal passage 43 which receives plastic from a passage 44 injected therein through an inlet opening 46 by an injection head 45.

The panel forming cavities 39 are larger than the tear portion cavities 38 and include a post opening 46 for accommodating the posts 15 therein, as more fully to be explained hereinafter. Gates 47 enter the cavities 38 at the wide end thereof and communicate with runner grooves 48. The runners 48 communicate with a horizontal passage 49 and a radial passage 51 extending to the edge of the head assembly 32 and through which the molten plastic is injected by an injection head (not shown).

The index head assembly 33 includes generally a housing 52 in which there is turnably journaled an index head 53. The index head 53 includes a rear annular plate 54 into which there is fixed one end of an index shaft 56. The index shaft 56 is journaled for rotation in a bearing 55 seated in the housing 52. The other end the shaft 56 is supported in a support assembly 57 for lengthwise sliding and turning movement during movement of the index head assembly 33 from the closed position shown in FIG. 7 to an open position shown in FIG. 8. Mounted on the support assembly 57 is a spring-biased pin 58 which is received in two diametrically opposed slots 59 or 61 formed in the index shaft 56. Connecting the slots 59 and 61 are helical grooves 62 and 63 into one of which the pin 58 rides during movement from the closed to open mold positions so that the index head 53 is rotated 180° within the housing 52. During movement from the open to closed position the pin 58 is prevented from entering either the groove 62 or 63 by shoulders 64 and 65 the appropriate one of which depresses the pin 58 so that it does not enter helical groove 62 or 63 but continues to move along the slot 59 or 61 as appropriate so that the index head 53 does not rotate within the stationary head and move lengthwise therewith.

Restraining the housing 52 against turning as the index head 53 turns is a guide shaft 66 which is fixed at one end to the housing 52 and at its other slidable within an opening 67 of the support assembly 57.

Fixed to the rear annular plate 54 of the index head 53 is a spacing sleeve 68 to the forward face of which there is fixed a disc 69 to define a chamber 71 with the annular plate 54. Suitably attached to the disc 69 is an index faceplate 72 having a pair of tear portion transfer plates 73 and 74 inserted therein to cooperate with the mold plates 36 and 37 on the stationary head assembly 32 for transferring the tear portions 13 formed in the mold plate 36 to the panel forming mold plate 37. The index faceplate 72 is provided with two sets of runner grooves 76, horizontal passages 77 and vertical passages 78, which cooperate with grooves 48, horizontal passage 49 and vertical passage 51 to form conduits through which the plastic flows when the stationary head assembly 32 and index faceplate 72 are in face-to-face relationship as shown in FIG. 7.

The transfer plates 73 and 74 are each formed with sets of retention feet opening 79 of generally dovetail configuration. The sets of opening 79 are located to be disposed within respective ones of the tear portion cavities 38 of the tear portion mold plate 36. In this manner the plastic flowing into the tear portion cavities 38 also enters the retention feet openings 79 to form retention feet 81 on one side of the tear portion 13. Thus, when the stationary and index head assemblies 32 and 33 are separated, the tear portion 13 is retained on the transfer mold plates 73 and 74.

For ejecting the retention feet 81 after the panel 12 has been formed thereon, there is provided a pair of ejecting assemblies 82—82 one for each of the transfer plates 73 and 74. The ejecting assemblies 82—82 each comprise a support plate 83 lengthwise slidable within the chamber 71 between the disc 69 and rear plate 54. Fixed to the support plate 83 are ejecting pins 84 having ejecting fingers 85 extending into opening 86 formed in the respective transfer plate 73 and 74, and communicating with the retention feet openings 79.

The ejecting assembly 82 is actuated to the ejecting position during lengthwise movement of the indexing head assembly 33 to open position. To this end, the index assembly stationary housing 52 is provided with an opening 87 and the indexing head rear plate 54 is formed with a pair of diametrically opposed openings 88—88, of which one is aligned with the housing opening 87 when the index head 53 is turned 180° during movement to the open position. In this position an actuating pin 89 carried by the shaft support assembly 57 extends through the aligned openings 87 and 88 and engages the slide plates 83 of one of the ejecting assemblies 82. The other ejecting assembly 82 remains stationary. Upon further movement of the index head assembly 33 toward the support assembly 57 the pin 89 is operative to slide the ejecting pins 84 and fingers 85 through the openings 86 and force the retention feet 81 on the tear portion 13 out of the retention opening 79. In this manner, the plurality of completed closures 10 are detached from the transfer plate 73 and 74 depending on which plate is aligned with the mold plate 36. As shown, the four closure units 10 upon ejection remain attached to the sprue and runners which are later detached.

A sprue and runner separating assembly 91 is disposed between each of the ejecting assemblies 82—82 and includes a mounting block 92 which is engageably with shoulders 93—93 on the ejecting pin support plates 83. Extending from the mounting block 92 is a pair of pins 94 which are slidable through the disc 69 and faceplate 72. As shown in FIG. 8, when one of the ejecting assemblies 82 is actuated to eject the

retention feet **81** of a completed group of closures **10** from the index head face plate **72**, the mounting block **92** is simultaneously moved so that the pins **94** project outwardly to break the sprue and runners from the previously formed tear portions **13** seated in the upper transfer plate **74**.

After the ejection of the closure **10**, the indexing head assembly **33** is returned to the closed position shown in FIG. **7**. During the return movement the indexing pin **58** rides in one of the linear slots **59** or **61** only so that the index head **53** remains stationary within the housing **52**. As the index head assembly **33** approaches the stationary head assembly **32** the sprue ejecting pins **94** engage the face thereof and are pushed inwardly. At the same time the sprue ejecting pin mounting block **92** in engagement with the shoulder **93** on the slide plate **83** carrying the retention feet ejecting pins **84** is also moved rearwardly so that, when the stationary head assembly **32** and indexing head assembly **33** are in face-to-face engagement, the slide plate **83** is in the fully retracted position shown in FIG. **7**.

Holding the stationary head assembly **32** and index head assembly **33** in alignment in the closed position during the molding operation are locating pins **96—96** fixed to the stationary head assembly **32** and received in complementary located openings **97—97** provided in the index head faceplate **72**. For controlling the molding temperatures in the stationary head assembly **32** and index head assembly **33** each are provided fluid passages **98** and **99** respectively which are connected to a suitable source of coolant (not shown).

Assuming that a set of previously formed tear portions **13** are retained in the upper transfer plate **74** and located within respective ones on the panel mold cavities **39** in the upper half of the stationary head assembly **32** and the apparatus is in the closed position shown in FIG. **7**, the apparatus is how in position to simultaneously form the panels **12** about the tear portions **13** and form tear portions **13** in the tear position mold cavities **38** in the mold plate **36**. This is accomplished by simultaneously injecting molten plastic into the passage **44** and **51**. The molten plastic introduced into the passage **44** is forced under pressure through the passage **44**, runners **42** and gates **41** into the tear portion mold cavities **38**. At the same time the molten plastic also flows into the retention feet opening **79** in the index head mold faceplate **73**. The inward flow into the retention feed openings **79** is limited by the ends of the ejecting fingers **85** located in the passages **86**.

The molten plastic injected into the passage **51** flows through the passage **49**, runners **48** and gates **47** into the panel mold cavities **39** having the previously formed tear portions **13** positioned therein. To achieve the desired seal at the interface **14** of the preformed outer edge of the tear portion **13** and panel **12**, the temperature and injection pressure of the molten plastic entering the panel mold cavities **39** are controlled to maintain the hat at the interface **14** at a level below that causing the prior formed edge of the tear portion **13** to lose its configuration. The heat is maintained at level sufficiently below that causing the formation of an unbreakable seal at the interface **14**. It has been found that the heat should be such that upon subsequent solidification of the panel **12** about the tear portion **13** the latter is securely seated in sealing relationship thereon and capable of being separated along the interface **14** upon the application of a manually applied force. For opening a container of the general type of which the closure of the present invention is applied, the manual force should preferably be less than about 15 pounds so that the force may be applied by the user's fingers. A more detailed description of the pressure and temperature conditions will be described hereinafter.

After the formation of the tear portions **13** and closures **10** in the respective mold cavities **38** and **39**, the indexing head assembly **33** moves the open position during which the indexing head is rotated 180_{o} within the housing **57**. The closures **10** and tear portions **13** are retained on the index head **53** by means of the retention feet **81** seated in the retention feet opening **79** until after the indexing head **53** has completed the 180° rotation.

During the remainder of the linear movement, the actuating pin **89** enters the aligned opening **87** and **88** and engages the ejecting pin slide plate **83**, so that the ejecting fingers **85** are operative to eject the completed closure units **10** from the transfer plate **73**. The forward movement of the slide plate **83** also moves the sprue removal pin **94** into engagement with the sprue and runners attached to the tear panels **12** so as to be separated therefrom.

Thereafter the index head **53** returns to the closed position to repeat the operation described above.

Closures **10** have been made in accordance with the foregoing described method in which the tear portion **13** and panel **12** were both made from the same material. The tear portion **13** was preformed to provide the interface structure **14** illustrated in FIGS. **2** and **3**. The panel **12** was molded thereabout as described heretofore with injection of the plastic to form the panel **12** about the tear portion **13** being carried out under conditions in which the injection pressure was maintained at about 800 lbs. per square inch and with a constant molding time (i.e., time during which the index head assembly **33** and stationary head assembly **32** remain closed) of about 4.0 seconds. A plurality of runs were performed using different melt temperatures as determined at the nozzle of the injection head and different mold temperatures to vary the seal formed at the interface **14**.

A pull tab **16** was attached to the posts **15** of each of the tear portion **13** to complete the closure **10**. Thereafter the closures **10** from each of the runs were tested against specified standards to determine the pop force required to initiate separation of the seal at the butt joint **14***a*, the pull force required to separate the scarf joint **14***b* to the wide end, and detachment force required to complete the separation of the tear portion **13** from the panel **12** at the wide end thereof. The standard pop force is set not to exceed 8 pounds and the standard pull and detachment forces are set not to exceed 15 pounds respectively. The test was performed on an Instron tensile stress unit which applied a constant strain rate of 2 inches per minute on the pull tab **16**.

Table I below tabulates the results obtained when the panel **12** and tear portion **13** are both made from a polypropylene homopolymer having a melt flow of 4.0 and a density of 0.905 and Table II when the panel **12** and tear portion **13** are both made from a polypropylene copolymer having a melt flow of 3.5 and a density of 1.898.

TABLE I

Nozzle Temp.*	Mold Temp.	Pop Value	Pull Value	Detach
350° F.	80° F.	1.6 lbs.	5.3 lbs.	5.3 lbs.
400° F.	80° F.	2.2 lbs.	8.5 lbs.	8.5 lbs.
*380° F.	80° F.	5.0 lbs.	7.5 lbs.	7.5 lbs.

*Butt joint 14a omitted and scarf joint 14b completely extending about interface 14.

TABLE II

380° F.	80° F.	1.8 lbs.	6.8 lbs.
400° F.	80° F.	1.5 lbs.	7.9 lbs.

Closures were also formed in accordance with the foregoing method in which the panel **12** was made from a plastic of a class different from the plastic of the tear portion **13**. The molten plastic for forming the closure **10** was injected at a con-

stant pressure of 800 pounds and the mold time was held constant at 4.0 seconds. The nozzle temperature and mold temperature were varied as described above. The closures were assembled and tested as described above. The results using a polyethylene having a melt flow of 0.7 and a density of 0.96 to form a panel **12** about a tear portion **13** made from a polypropylene having a melt flow of 3.5 and a density of 0.898 are tabulated below in Table III.

TABLE III

Nozzle Temp.		Pop Value	Pull Value	Detach
380° F.	80° F.	0.7 lbs.	2.0 lbs.	2.0 lbs.
420° F.	80° F.	0.9 lbs.	1.8 lbs.	1.8 lbs.

Referring now to FIG. **13**, there is shown a further embodiment of closure **200** made in accordance with the present invention. As shown, the closure **200** is shown associated with a pour opening **201** of a bottle **202**, although it is to be understood that the closure may also be formed about a wide mouth opening container such as a jar or the like. The pour opening **201** is formed with a retention bead **203** and may be provided with projections **204** defining a helical screw thread which merges with the bead **203**. The screw thread **204** facilitates the removal of the closure **200** therefrom.

The closure **200** is in the form of a cap or crown **206** having a top panel **207** and an integral depending flange **208**. The inner face **209** is joined to the outer face **210** of the bottle **202** adjacent the mouth at an interface **211** which defines a weakening line along which the cap **206** is separable.

The interface or weakening line **211** is formed by preforming either the inner face **209** of the cap flange or skirt **208** or the outer face **210** about the pour opening **201** so as to provide a finished mold face on which the face of the other member is subsequently molded. The cap **206** and bottle **202** may be made from suitable moldable material as for example, a thermoplastic such as polyethylene, polypropylene and the like, a thermosetting plastic such as a filled phenolic molding powder or rubber. The compositions of the plastics used to made the cap and bottle may be similar to those heretofore described in connection with the embodiments of FIGS. **1–6**.

The cap **206** and bottle **202** are formed by molding in sequence so that the face is preformed and may be used to form the complementary face of the other. Assuming that the cap **206** is formed first so that the inner surface thereof is preformed, the cap is then positioned into a mold in which the bottle is formed. The cap **206** is located in the bottle forming mold (not shown) so as to provide a mold surface for forming the exterior face **210** about the pour opening of the bottle.

The heat of the molding of the bottle is maintained, as described heretofore, so that upon subsequent solidification of the pour opening portion of the bottle **202** to the cap, the latter is sealed thereto and at the same time capable of being separated along the interface upon the application of manual twisting force. The heat to achieve the separable interface is obtained by controlling the temperature and injection pressure so that the inner face **209** of the cap **206** forming the mold for the pour opening portion of the bottle **202** does not loose its configuration. When the heat is controlled in this manner, the interface is separable and upon manual twisting each of the faces at the interface maintain their integrity.

Various different forms of crown caps or bottle caps may also be constructed in a manner which permits the partial or entire removal of the cap from an associated bottle. In this regard reference is now made to FIGS. **14** through **19** of the drawings which illustrate a cap generally designated by the reference numeral **300** which is secured to a neck N of the conventional bottle B.

The cap **300** is of a two-piece construction defined by a removal tear-out panel portion **302** and a remaining peripheral skirt portion **303**. The tear-out panel **302** and the remaining portion **303** are joined to each other along a weakening line **304** (FIG. **16**) which functions to facilitate the rupture and subsequent removal of the tear-out panel **302** in a manner which will be more apparent hereafter.

The tear-out panel portion **302** is generally circular and may be slightly larger than the exterior diameter of the peripheral skirt **303**, as is best illustrated in FIG. **16**. A pull tab **305** depends downwardly from the tear out panel portion **302** extends along the peripheral skirt **303** and terminates in a ringlike gripping portion **306** having a finger-receiving opening **307**.

The cap **300** is formed by either of two analogous methods which correspond to those heretofore described in connection with the embodiment of FIGS. **1–6**, wherein the peripheral skirt **303** or the tear-out panel **302** and its integral pull tab **305** is formed first and thereafter the other is molded thereabout.

Assuming that the tear-out portion **302** and its tear-tab **305** are initially formed from plastic material by a conventional molding process and that the pull tab is in the plane of the tear-out portion, the tear-out portion may be positioned in a split-mold which when closed has an annular cavity disposed with its axis concentric with the central axis of the tear-out portion **302**. Molten synthetic polymeric material, such as polyethylene, polypropylene, etc., is then injected into the closed mold into the annular cavity, and the mold is maintained under controlled temperature and pressure as heretofore described which causes the material in the cavity to mold about the prior molded surface of the tear-out panel portion **302** at the circular interface or weakening line **304**. Upon cooling the plastic material solidifies along a line or plane of weakness which is separable upon the application of a pulling force. Thus, when the cap **300** is secured to the bottle neck N as for example, by crimping, the lower end of the peripheral skirt **303** as shown and folding the tear-tab **305** downwardly, the latter is merely lifted and pulled as diagrammatically illustrated in FIG. **15** causing the tear-out panel **302** to rupture along the weakening line **304** effecting the eventual complete removal of the panel **302** from the peripheral skirt **303**. The contents packaged in the bottle B can now be dispensed, it being noted that the peripheral skirt **303** remains on the neck N of the bottle B in accordance with this embodiment of the invention.

Another method of forming the cap **300** is the reverse of that heretofore described, namely, first forming the peripheral skirt **303** and positioning the same in a mold having a cavity corresponding to the tear-out panel **302** and its associated pull tab **305**. Upon the introduction of synthetic polymeric material into this cavity the cap **300** is similarly formed with the weakening line **304** at the interface of the tearout panel **302** and the peripheral skirt **303**.

Under some circumstances, it may be desirable to separate the peripheral skirt **303** upon the bottle neck N upon the removal of the tear-out panel **302**. A closure in the form of a bottle cap for permitting the entire removal thereof from an associated bottle is shown in FIGS. **17** through **19** of the drawings, and is generally designated by the reference numeral **310**.

The cap **310** is similarly of a two-piece construction defined by a removable tear-out panel portion **312** in the form of a pull strip and a remaining portion **313**. The tear-out panel **312** and the remaining portion **313** are joined to each other along a pair of parallel weakening lines, which are generally designated by the reference numeral **314**, **315** and a bridging weakening line **316**. The weakening lines **314**, **315** extend from the weakening line **316** across an end panel **317** of the cap **310** and down a diametrically opposite side of a peripheral skirt **318**, as is best illustrated in FIG. **18**. A pull tab portion **320** of the tear-out panel **312** projects beyond the peripheral skirt **318** and terminates in a gripping ring **321** having a finger-receiving opening **322**.

The cap **310** is formed analogous to that heretofore described relative to the method of forming the cap **300**, except for the particular configuration of the mold in which the cap **310** is formed. Therefore, it is believed unnecessary for a complete understanding of this invention to describe the particular method of forming the cap **310**. However, it will be pointed out that by either of the two methods, the weakening lines **314, 315** and **316** are separable upon the application of an upwardly directed force to the tear-out panel **312** by gripping and pulling the same as shown in FIG. **19** results in the complete removal of the panel **312**. The remaining portion **313** of the cap **310** can now be readily grasped and easily removed as the material of the peripheral skirt **318** can be manually spread to remove the remaining portion **313** completely from the associated bottle.

While preferred forms and arrangement of parts have been shown in illustrating the invention, it is to be clearly understood that various changes in details and arrangement of parts may be made without departing from the spirit and scope of the invention as defined in the appended claimed subject matter.

What is claimed is:

1. An article of manufacture comprising a first member and a second member connected to said first member at an interface defining a weakening line along which said second member is separable from said first member upon the application of a manual force thereto, said weakening line being formed by the sequential molding of said first and second members using a prior molded face at the interface of one of said members to form the complementary face of the other of said members.

2. The invention as defined in claim **1** wherein said first member comprises a panel and said second member comprises a tear portion.

3. The invention as defined in claim **2** wherein said panel is formed with an opening defined by a face of said interface and said tear portion is disposed in said opening with the outer edge thereof defining the complementary face of said interface.

4. The invention as defined in claim **3** wherein said faces at said interface are shaped to provide an interlock.

5. The invention as defined in claim **4** wherein said interlock is formed to permit reinsertion of said tear portion into said opening after separation from said panel.

6. The invention as defined in claim **3** wherein said faces at said interface are in the form of a scarf joint.

7. The invention as defined in claim **3** wherein said faces at said interface are in the form of a butt joint.

8. The invention as defined in claim **3** wherein said faces at said interface are in the form of a tongue and groove joint.

9. The invention as defined in claim **3** wherein said faces at said interface are in the form of a dovetail joint.

10. The invention as defined in claim **2** wherein said panel and tear portion are both made from a plastic material.

11. The invention as defined in claim **10** wherein said plastic material from which said panel is made is the same chemical class as the tear portion but of different physical characteristics.

12. The invention as defined in claim **11** wherein said plastic material from which said panel is made from a plastic of a different chemical class than the tear portion.

13. The invention as defined in claim **10** wherein said panel portion and said tear portion are cohesively connected at said interface.

14. The invention as defined in claim **1** wherein said first member comprises a generally tubular body having an open end, and said second member comprises a closure superposed over the open end of said tubular body.

15. The invention as defined in claim **13** wherein said closure includes a downwardly depending skirt embracing said tubular body to form said interface defining said weakening line.

16. The invention as defined in claim **15** wherein said tubular body and said closure are both made from a plastic material.

17. In an easy opening container having an opening, a closure member attachable to said container for covering said opening, said closure member comprising a panel member having an opening, a tear portion molded in said panel opening with the edge of the tear portion and the edge defining said panel opening lying on an interface forming a seal and defining a weakening line along which the tear portion is separated from said panel, and finger grip means on said tear portion for applying a force for separating said tear portion from said panel.

18. The invention as defined in claim **13** wherein said edges at said interface are formed to interlock and provide for reinsertion of said tear portion into said opening.

19. The invention as defined in claim **13** wherein said panel and said tear portion are both made from plastic.

20. An closure for an open ended container, said closure comprising a panel adapted to overlie the end of said container, and a depending skirt adapted to embrace the exterior of said container about said opening, said closure including a tear portion formed in said panel and separable therefrom to provide an opening, said tear portion being joined to said panel along an interface defining a weakening line, said weakening line being formed by a sequential molding of said panel and said tear portion using a prior molded face at the interface of one of said tear portion or said panel to form the complementary face of the other.

21. The invention as defined in claim **20** wherein said weakening line extends into said skirt.

22. The invention as defined in claim **21** wherein said tear portion comprises a pair of spaced weakening extending from said panel and terminating at the free end of said skirt.