

FIELD OF THE INVENTION

The present invention pertains to improvements in packages for single-use, disposable folded towels. More particularly, the present invention pertains to flexible packages which provide for fully automatic unfolding of a two-directionally folded towel upon removal from the package without a separate unfolding step requiring additional consumer action. The present invention also pertains to flexible packages which provide for automatic unfolding in the withdrawing direction of a two-directionally folded towel upon removal from the package. Both single-towel and multi-towel packages incorporating these advantageous features are presented.

BACKGROUND OF THE INVENTION

In today's society, cleanliness is very important both from a health standpoint and an aesthetic standpoint. However, when one is away from home it is much more difficult to perform personal cleansing due to unavailability of traditional cleansing tools such as soap, cloths, and running water. Cleansing of sensitive areas of the body also requires special consideration, as ordinary towel products, cleansing agents, and other associated materials such as disinfectants may cause irritation and discomfort.

To address this problem, manufacturers of consumer products have developed disposable, paper-based towel products which are pre-moistened with a non-irritating cleansing agent. As used herein, the terms "single-use" and "disposable" are used interchangeably to refer to towels and packages which are to be used once and then discarded, rather than retained (and perhaps cleaned) for reuse. There are two basic types of containers for such pre-moistened towel products, namely multi-towel containers and single-towel disposable packages.

In a typical multi-towel container, a flexible or rigid moisture-impervious container is utilized. The pre-moistened towel products are either on a roll, with perforations defining the ends

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5 dispensing of individual towels, and are usually recloseable to
protect the remaining towels. The major drawback of most
multi-towel containers is that, because of the number of towels
contained, of necessity they have a significant amount of bulk, are
awkward to carry away from home, and render discretion in use
10 practically impossible.

Pocket-sized, single-towel disposable packages designed for
away-from-home use avoid the bulk and awkwardness of the multi-towel
containers, but are not without drawbacks. Most such packages do
not have a defined portion of the towel which is presented to the
15 consumer upon opening the package, and hence the consumer must
typically reach inside the package and fish about for the folded
towel to grasp and extract it. Due to the lack of a roll of towels
to feed from and/or other towels to interact with, in a typical
single-towel package the folded pre-moistened towel is typically
20 dispensed as a small, tightly folded moist pad consisting of the
towel as it remains folded in two directions, i.e., along major axes
of the towel. The consumer must then manually unfold this small pad
of material to have the entire extent of the towel available for
use. This is an undesirable and time-consuming process requiring
25 two hands to accomplish, and without which the towel is of little
practical use. The pre-moistened nature of the towel exaggerates
this problem. The amount of handling of the towel which this
unfolding requires also presents a significant likelihood of
contamination of the towel prior to actual use.

30 The present invention is directed to improving single- and
multi-towel packages to provide the advantageous accessibility and
unfolding features of multi-towel containers while retaining the
transportability and concealability of a single-towel disposable
package, and thus increase consumer satisfaction with this type of
35 product. A plurality of such single-towel packages, or multi-towel
variations of such packages, may thus provide comfort and
convenience as might be required for a day of traveling or a full

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5 The drawbacks of typical single-towel disposable packages may
be remedied by providing some means for presenting the towel for
grasping by the consumer, as well as some means to interact with the
folded towel upon removal from the package so as to cause it to
unfold. Of the possible ways of accomplishing this interaction,
10 most must be ruled out as too costly, too complex, or too bulky in
the context of such a pocket-sized, single-towel disposable package.

Packages according to the present invention provide the
advantageous accessibility and unfolding features of multi-towel
containers while retaining the transportability and concealability
15 of a single-towel package by providing a package design in which
elements of the package itself provide greater accessibility of
defined portions of the towel for grasping, and interact with the
folded towel to provide the desired unfolding action. The total
package remains compact, flexible, liquid-impervious, and simple in
20 its construction. Simplicity equates to low manufacturing costs and
reliability in consumer usage.

The present invention consists of three basic package
configurations which, in combination with the action of removing a
folded, pre-moistened towel, unfold the towel for use. Such
25 packages are sized, and the towels folded to a corresponding size,
so as to be appropriate for carrying in a pocket, travel bag, or
purse for use away from home.

In a first embodiment of the present invention, a package
slightly larger than the folded towel is utilized. On one side, the
30 package has an elongated opening with a major dimension slightly
smaller than the minor dimension (width) of the folded towel and a
minor dimension slightly larger than the thickness of the leading
edge of the folded towel. At the end of the towel adjacent to the
opening, the towel has a grasping portion which provides a grasping
35 point for the consumer. When the consumer exposes/opens this
opening, grasps the grasping portion, and withdraws the folded

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5 In a second embodiment according to the present invention, a package again slightly larger than the folded towel is utilized. At one end, the package tapers down to a pre-determined width which, when torn open by the consumer, provides an elongated opening having a major dimension slightly smaller than the minor dimension (width)
10 of the folded towel. At the end adjacent to the tapered end, the towel has a grasping portion which provides a grasping point for the consumer. When the consumer tears open the tapered end of the package, grasps the grasping portion, and withdraws the folded towel, it completely unfolds the towel, leaving the consumer holding
15 a fully unfolded, ready-to-use towel. The geometrical relationship between the opening formed by tearing open the tapered end and the folded towel is the key to the unfolding performance of this embodiment of the present invention.

In a third embodiment according to the present invention, a
20 package again slightly larger than the folded towel is utilized. At one edge, the package is designed to be torn open by the consumer to expose one end of the folded towel. Inside the package, extending completely across the width of the package from one side seam to the other, a flexible bar-like member formed of a thin, flexible
25 material is located up to approximately one-fourth to one-half of the way down from the leading edge of the folded towel. This bar-like member is interleaved with the folds of the towel such that, when the consumer tears open the package, grasps the leading edge of the towel, and withdraws the towel, it fully unfolds the
30 towel in the lateral direction. The consumer then merely has to unfold the towel in the longitudinal direction. The key to the unfolding performance of this embodiment of the present invention is the bar-like member forcing the towel to unfold and pass behind it on the way out through the open edge of the package. This
35 embodiment is particularly well-suited for adaptation as a multi-towel package.

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5 Figure 1 is a plan view of an unfolded towel according to a first embodiment of the present invention.

 Figures 2A through 2C are perspective views depicting the steps required to fold a towel such as depicted in Figure 1.

10 Figures 3A and 3B are plan views of a towel folded according to Figures 2A-2B, with Figure 3A depicting a front view and Figure 3B depicting a back view.

 Figures 3C and 3D are frontal plan views of alternative folded towel configurations suitable for use with packages according to the first embodiment of the present invention.

15 Figures 4A through 4D are plan views depicting the steps required to assemble an improved package according to a first embodiment of the present invention.

20 Figures 4E through 4H are plan views of alternative package configurations according to the first embodiment of the present invention.

 Figures 5A through 5D are perspective views depicting the steps required to open an improved package and remove the folded towel according to the first embodiment of the present invention.

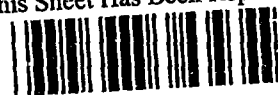
25 Figure 6 is a plan view of an unfolded towel according to a second embodiment of the present invention.

 Figures 7A through 7C depict the steps required to fold a towel such as depicted in Figure 6, with Figure 7A being an elevational view, Figure 7B being a plan view, and Figure 7C being a perspective view.

30 Figures 8A and 8B are plan views of a towel folded according to Figures 7A-7C, with Figure 8A depicting a front view and Figure 8B depicting a back view.

35 Figure 8C is a frontal plan view of an alternative folded towel configuration suitable for use with packages according to second and third embodiments of the present invention.

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5 configuration according to the second embodiment of the present invention.

Figures 10A through 10D are perspective views depicting the steps required to open an improved package and remove the folded towel according to the second embodiment of the present invention.

10 Figure 11 is a plan view of an unfolded towel according to a third embodiment of the present invention.

Figures 12A and 12B are perspective views depicting the steps required to fold a towel such as depicted in Figure 11.

15 Figures 13A and 13B are plan views of a towel folded according to Figures 12A and 12B, with Figure 13A depicting a front view and Figure 13B depicting a back view.

Figures 14A through 14C are plan views depicting the steps required to assemble an improved package according to a third embodiment of the present invention.

20 Figures 15A through 15E are perspective views depicting the steps required to open an improved package and remove the folded towel according to the third embodiment of the present invention.

25 Figures 16A and 16B are plan views depicting two of the steps required to assemble an improved package according to a multi-towel variation of the third embodiment of the present invention.

Figures 17A through 17C are perspective views depicting three of the steps required to open an improved package and remove the folded towels according to a multi-towel variation of the third embodiment of the present invention.

30 **DETAILED DESCRIPTION OF THE
PREFERRED EMBODIMENTS**

What follows is a description of three possible embodiments of improved packages according to the present invention. While each is accompanied by a description of a presently preferred manner of
35 folding a folded towel for use with each package, it is to be understood that there are many possible ways of folding towels for use with such improved packages, so long as certain common

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5 First, the term "flexible" is intended to encompass materials which are easily bent and conform to irregular surfaces as, for example, materials flexible enough to be carried in one's pocket or purse relatively unobtrusively and without discomfort, as well as materials which are flexible enough to perform the desired wiping or
10 cleansing tasks.

The term "thin" refers to materials having thicknesses which are substantially less than their length and/or width such as, for example, various sheet-like and cord-like materials. Such materials may typically have thickness on the order of about 1/16 inches (1.59
15 mm) or less, although somewhat thicker materials may be utilized if they have sufficient flexibility for use with packages according to the present invention, as discussed above.

The term "liquid-impervious" is intended to encompass materials which generally deny penetration of liquid material through them in either direction, such as into or out of a package formed of such a
20 material, the liquid being any common, non-toxic liquid which will not physically compromise the integrity of the package.

It should be noted that in all Drawing Figures the towel materials and package materials have a thickness represented by a single line for graphic clarity, although in reality of course the
25 towel materials and package materials have a finite and measurable thickness.

In the Drawing Figures, Figures 1 through 5D depict an improved package and folded towel according to a first embodiment of the
30 present invention.

Figure 1 illustrates a towel for use with a package according to a first embodiment of the present invention, which is depicted in its unfolded state. The numeral 105 denotes the towel generally, and the numerals 110, 111, 112, and 113 are used to identify the
35 four corners of the towel 105, which may be generally rectangular in shape in a preferred configuration. The towel 105 also has two side edges 120 and 123, a leading edge 130, and a trailing edge 134.

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lateral fold lines are thus mutually orthogonal. The towel 105 also preferably has three diagonal fold lines 140, 141, and 142 adjacent to leading edge 130.

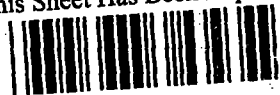
10 Figures 2A through 2C depict the folding process to fold the towel 105 depicted in Figure 1.

15 In Figure 2A, the towel 105 has been z-folded along fold lines 121 and 122 such that side edge 120 overlies fold line 122, and side edge 123 is behind fold line 121. This folding step has now also formed a rear corner 114, the use of which becomes apparent in Figure 2B. This folding operation has defined the folded width (FW) of the folded towel, measured parallel to the lateral fold lines, and has also defined a first folded thickness (FFT), which is the thickness of the overlying longitudinally folded portions of the towel.

20 In Figure 2B, the corner 110 has been folded diagonally downward and forward to form a free corner, and hence a grasping portion for extracting the folded towel from the improved package. In addition, rear corner 114 is shown being folded diagonally downward and rearward along fold lines 141 and 142 so as to isolate the portion of the leading edge 130 adjacent to the grasping portion formed by free corner 110. This ensures that the consumer will only grasp the front thickness of the folded sheet, and that only by free corner 110, rather than grasping the entire thickness of the folded sheet or one of the more rearward layers. Corner 110 will be the first portion of the towel to be withdrawn from the package, initiating the withdrawal of leading edge 130. Trailing edge 134 will be the last portion of the towel to be removed from the package.

30 In Figure 2C, the towel 105 folded according to Figures 2A and 2B has now been accordion-folded along lateral fold lines 131-133 such that fold line 131 overlies fold line 133. The portion of leading edge 130 which is adjacent to the free corner 110 extends

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5 thickness (SFT), which is the thickness of the overlying laterally folded portions of the towel.

10 Figures 3A and 3B depict front and rear views, respectively, of the towel 105 after it has been folded according to the process depicted in Figures 2A-2C and pressed flat so as to occupy minimal space. The folded towel 105 preferably exhibits a generally rectangular outline, save for the corner 110 folded downward via fold line 140. The distance between leading edge 130 and fold line 131 (measured parallel to the longitudinal fold lines 121 and 122) defines the folded length (FL), and the distance between side edge 15 120 and fold line 121 (measured parallel to the lateral fold lines 131-133) defines the folded width (FW). As the longitudinal fold lines and lateral fold lines are mutually orthogonal, the folded length and folded width are also mutually orthogonal.

20 The various elements of the folded towel 105 which are visible in the folded state are labeled in Figures 3A and 3B to show their final position following the folding operation. The relative positions of these elements of the folded towel have proven to be critical to proper unfolding of the towel as described below with regard to Figures 5A-5D.

25 While a presently preferred manner of folding the folded towel according to this first embodiment of the present invention has been set forth, there are many other ways to fold a towel so as to obtain satisfactory performance with this improved package. For example, the folding methods described with respect to Figures 7A-7C and 30 Figures 12A-12B could be utilized, or any other similar method which incorporates a greater or lesser number of folds. In addition, the grasping portion could be formed as a projection 115 on the leading edge of the folded towel, such as shown in Figure 3C, and folded downward over the front surface of the folded towel so as to align 35 with the opening.

There are three critical aspects of the towel folding operation according to this first embodiment of the present invention. First,

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5 to grasp and withdraw the folded towel by its leading edge.
Finally, the towel must be folded longitudinally first, and then
laterally, with the longitudinal and lateral folds being generally
orthogonal to one another, so as to permit the lateral folds to
unfold first, and then the longitudinal folds, as described below
10 with respect to Figures 5A-5D.

Figures 4A through 4D illustrate the steps required to assemble
a complete package according to this first embodiment of the present
invention.

15 In Figure 4A, the folded towel 105 has been placed on top of a
back sheet 150, which comprises a sheet of thin, flexible, and
preferably liquid-impervious material. Back sheet 150 is sized so
as to be marginally larger than the folded width and somewhat larger
than the folded length of the folded towel 105.

20 In Figure 4B, a front sheet 151 has been placed over the folded
towel 105 and back sheet 150. Front sheet 151 also comprises a
sheet of thin, flexible, and preferably liquid-impervious material,
and front sheet 151 has a size and shape which generally correspond
to the size and shape of the back sheet 150, but having a shorter
length than back sheet 150. Front sheet 151 further includes an
25 opening 152, which is represented by the dotted line.

In Figure 4C, front sheet 151 and back sheet 150 have been
sealed together around the periphery of front sheet 151, as shown at
153, to contain the folded towel. Opening 152 must be in overlying
spaced relation to and in registry with free corner 110, such that
30 when closure 154 is removed the consumer has access to and can grasp
free corner 110 to withdraw and unfold the folded towel 105.

Figure 4D depicts the completed package, after the portion of
back sheet 150 which protrudes beyond front sheet 151 has been
folded downward over opening 152 and bonded to front sheet 151
35 around the periphery of opening 152 (as shown by stippled region
160) so as to constitute a closure 154. The folded towel 105 is now

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5 first embodiment of the present invention.

In Figure 5A, the consumer has grasped the completed package at one side just below opening 152 with one hand. The consumer then grasps the end of closure 154 nearest to the first hand with his or her other hand and, by pulling the closure upward and across the package as shown in Figur 5B, peels the closure so as to expose opening 152. As shown in Figure 5B, this step leaves the opening exposed and provides access to the folded towel 105, with the free corner 110 in registry with opening 152.

15 The consumer in Figure 5C has now shifted one hand so as to grasp the lower edge 156 of the package with one hand and has grasped the free corner 110 with the other hand so as to begin extracting the folded towel from the package.

As this extraction process proceeds, more and more of the towel is withdrawn from the package and simultaneously unfolded such that the exposed portion of the towel is in a substantially unfolded state. The unfolding process culminates in the complete extraction of the towel from the package, as shown in Figure 5D. The consumer is now holding a fully and completely unfolded towel, such that the towel is now ready for the desired use. The empty package may now be disposed of in an appropriate fashion.

25 A unique interaction between the folded towel and the periphery of the opening is the source of the unfolding feature of this embodiment of the present invention. The opening is preferably smaller in both directions than the folded width and folded thickness of the towel. This ensures that the towel cannot simply slide out of the package while remaining in its folded state. The periphery of the opening exerts a force on the towel in a direction which opposes the force exerted by the consumer in withdrawing the towel and serves to accomplish the unfolding of the lateral folds of the towel. Because the opening is also generally smaller than the folded width of the towel, the edges of the opening push inward on the outermost folds and edges of the folded towel as the towel

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5 what dictates the size and shape of the opening, as well as the
manner in which the towel is folded. As stated previously, the
number of folds in each direction is not critical, so long as the
towel ultimately reaches a generally rectangular shape with the
longitudinal folds folded first and the lateral folds folded last.
10 As the towel passes through the opening, the lateral folds unfold
first and the longitudinal folds unfold last, due to the nature of
the forces applied by the opening on the towel.

The forces applied, particularly the inward forces applied to
unfold and separate the longitudinal folds, must be sufficient to
15 overcome the adhesion force between adjacent towel surfaces. This
adhesion force is caused by the use of cleansing agents or other
liquids to moisten the towel. The opening must therefore be sized
to account for not only the dimensions of the folded towel, but also
the "stickiness" of the towel in terms of the adhesion force between
20 adjacent layers. A more detailed discussion of the adhesion force
appears below.

Although the shape of this opening may range from a narrow slit
to an oval to nearly circular depending upon the final dimensions of
the folded towel, two dimensions of the opening will remain constant
25 for a particular folded towel. For the purposes of this invention
the term "circumference" refers to the length of the periphery of
the opening, "maximum width" refers to the maximum extent of the
opening in the direction parallel to the sides of the package (which
represents the minor dimension of the elongated opening), and
30 "maximum length" refers to the maximum extent of the opening in the
direction parallel to the dispensing edge of the package (which
represents the major dimension of the elongated opening), all
regardless of the actual shape of the opening.

In order to achieve the proper unfolding of the folded towel,
35 the opening dimensions must be related to the dimensions and
adhesion properties of the folded towel. For towels and packages
according to this first embodiment of the present invention, this

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5 experimentally determined parameters which account for the adhesion properties and unfolding characteristics of the folded towel in its folded condition.

10 In a package configuration according to this embodiment of the present invention, a trial and error experimental process has revealed that the parameter A is preferably between about 0.8 and about 1.3, more preferably between about 0.9 and about 1.2, and most preferably about 1.0. Likewise, the parameter B is preferably between about 1.0 and about 3.0, more preferably between about 1.0 and about 1.2, and most preferably about 1.1. It should be noted
15 that even though the openings may typically have a maximum width which is larger than the second folded thickness of the folded towel, and may perhaps also have a maximum length which is larger than the folded width of the towel, due to the fact that the towel is being extracted from the package by pulling in a direction which
20 lies in the plane of the package, both sides of the folded towel do contact and interact with the edges of the opening defining the maximum width.

As the adhesion force required to separate adjoining layers of the towel (discussed in greater detail below) increases, the
25 parameters A and B tend toward the lower end of these ranges so as to result in increased force exerted inwardly on the towel. As the towel becomes stiffer and/or has a higher basis weight, and hence harder to compress inward in a direction parallel to the folded width (FW), and/or as the number of longitudinal folds increases,
30 the parameters A and B tend toward the higher end of these ranges. Surface textures which increase resistance to sliding of towel layers with respect to each other also lead to parameters A and B which tend toward the higher end of these ranges. These relationships hold generally constant for a wide range of folded
35 towel dimensions, although for towels which have unusually large or small folded dimensions, these ranges may need to be adjusted up or down to achieve acceptable unfolding performance.

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5 the towel while the remainder of the towel remains folded within the
package. Second, the package itself may tear, particularly in the
vicinity of the opening, allowing the towel to emerge from the
package while still in its folded state, or only partially unfolded.
Of course, neither of these occurrences are desirable, and with
10 proper assessment of the adhesion forces present the package can be
designed appropriately.

Thus, once a towel material, cleansing agent, and folded towel
dimensions are selected, these relationships can be utilized to
properly size and configure an opening which will provide the
15 unfolding feature of the present invention.

As shown in Figure 4B, a presently preferred opening
configuration is one in which the opening 152 has an elongated,
generally oval shape. According to this first embodiment,
regardless of the exact size or shape of the opening, the location
20 of the opening will be generally toward one end of the front sheet,
which preferably has an overall shape of a generally rectangular
nature.

This location facilitates the extrication of the folded towel
from the package by enabling the consumer to grasp the edge of the
25 package farthest from the opening with one hand and exert a pulling
force on the towel with the other hand. As shown in Figure 5C, this
pulling force is exerted generally in the plane of the package,
rather than perpendicular to the plane of the package. The location
nearer to one edge, the dispensing edge 155, maintains the planar
30 orientation/relationship of the package and towel during the
unfolding process, and increases the relative amount of package
containing the towel while minimizing the empty portion of the
package between the opening and the "drawing" end of the package.

The opening, therefore, is preferably located up to about
35 one-half, more preferably up to about one-third, and most preferably
up to about one-quarter of the length of the package from the
dispensing edge 155. As illustrated in Figures 4A and 5B, this

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5 of the package remaining unoccupied, the leading edge of the towel
is preferably folded downward over the front side of the folded
towel (and the free corner 110 folded oppositely to that shown in
Figure 2B) as shown in Figure 3D such that the grasping portion 110
10 of the folded towel is also more centrally located and is in
registry with the opening.

In an embodiment of the aforementioned type, the consumer must
withdraw the folded towel by pulling the towel through the opening
generally perpendicularly to the plane of the package to achieve
unfolding of the towel. This necessitates restraining the package
15 by holding two opposite edges or corners of the package while
withdrawing the towel.

Various means of forming opening 152 and closure 154 are
possible, all of which permit performance of the necessary
interaction between the folded towel and the opening. For example,
20 as depicted in Figure 4B, opening 152 can comprise an orifice cut
out of front sheet 151, such that the front sheet material within
the dotted lines is removed entirely. The closure 154 is then
formed by bonding the flap depicted in Figure 4C over opening 152 so
as to seal the package. When closure 154 is peeled away as depicted
25 in Figure 5B, the opening 152 is exposed for use.

Alternatively, the opening could be formed by fully perforating
or partially perforating (only through the outermost layer of front
sheet 151, so as to maintain package integrity), slitting, or
scoring (such as by use of a laser or sharp edge) the front sheet so
30 as to outline the opening, then bonding the closure over the
outlined opening in the manner described above, and further
including bonding the closure to the portion of the front sheet
bounded by the outlined opening. When the closure is peeled away,
the portion of the front sheet within the perforation, slitting, or
35 scoring outline remains attached to the closure and is torn free
from the remainder of the front sheet, thus exposing the opening for
use.

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5 periphery of the opening so as to constitute a closure 154, such as depicted in Figure 4F. The opening is formed as above described, and when the closure 154 is removed from the front sheet 151, the opening is exposed for use.

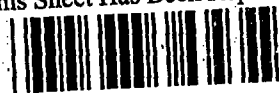
10 Many other ways of forming the closure are possible, and all are deemed to be within the scope of the present invention.

15 In all circumstances where the forming of the opening constitutes a breach (or a potential breach) of the liquid-impervious nature of the front sheet, the closure must provide a liquid-tight and air-tight seal over the opening so as to prevent possible contamination and/or drying out of the folded towel prior to use. This can be accomplished by the use of adhesives applied to the underside of the closure, the surface of the front sheet around the opening, or both, and extending uninterrupted entirely around the periphery of the opening. Alternatively, a 20 two-sided adhesive tape, preferably a high tack/low tack tape such as tape number 9415PC, manufactured by the 3M Corporation, could be utilized, again extending uninterrupted entirely around the periphery of the opening with the high tack side preferably facing the front surface of the package. Another alternative would be to 25 use some sort of thermal bonding of the closure to the front sheet, such as described below with respect to sealing the front and back sheets together. The use of the two-sided high tack/low tack tape is a presently preferred method of affixing the closures of packages according to this embodiment of the present invention.

30 While with regard to single-towel packages reclosability and resealability of the closure are not critical, if the package were adapted to provide multi-towel capabilities the closure would preferably be resealable in order to protect the remaining unused towels from contamination and drying out.

35 As shown in Figures 4B-4F and 5A-5B, removable closures utilized in this first embodiment preferably incorporate some sort of protruding tab which is not firmly bonded to the outer surface of

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5 projection.

As shown in Figures 5C and 5D, it is important that when withdrawing the towel 105 from the package the consumer grasps the package in the sealed region 153 as close to the lower edge 156 as possible. If the consumer grasps the package above the sealed area 153, there is the possibility that he or she may in fact squeeze the package in the open interior region containing the folded towel, and thereby pinch the folded towel between the front and back sheets, and thus make withdrawal of the towel more difficult.

Depending upon the width of sealed area 153 at the lower edge 156, it may be desirable to provide a larger sealed region for grasping, such as shown in Figures 4G and 4H. This larger sealed region ensures that the towel will be located farther from the lower edge of the package, and may take the form of a single, generally central extension 170, as shown in Figure 4G, or a generally wider sealed area 180 extending entirely across the package, as shown in Figure 4H. The overall package length may need to be adjusted accordingly to maintain sufficient interior volume for the folded towel.

Figures 6 through 10D depict an improved package and folded towel according to a second embodiment of the present invention, which is a presently preferred embodiment.

Figure 6 illustrates a towel for use with a package according to a second embodiment of the present invention, which is depicted in its unfolded state. The numeral 205 denotes the towel generally, and the numerals 210, 211, 212, and 213 are used to identify the four corners of the towel 205, which may be generally rectangular in shape in a preferred configuration.

In Figure 6, the fold lines of towel 205 are illustrated through the use of dotted lines. In a preferred configuration, the towel has four longitudinal fold lines 220, 221, 222, and 223 parallel to an imaginary line connecting corners 210 and 212, and three lateral fold lines 230, 231, and 232 which are perpendicular

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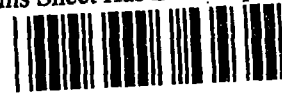
5 Figure 6 is a plan view looking downward on the unfolded towel 205 as it lies on a horizontal surface; hence, Figure 7A is an elevational view looking horizontally at the towel from the direction of corner 212. In Figure 7A, the folding of the towel 205 along the longitudinal fold lines 220-223 has been initiated.

10 In Figure 7B, which returns to the same viewpoint as Figure 6, the longitudinal folding process has been completed. Fold line 221 now overlies fold line 223, and fold line 220 now overlies fold line 222. Corner 210 has now become a free corner to form a grasping portion for the consumer to grasp to initiate the unfolding and
15 withdrawal process, and as such will be the first portion of the towel to be withdrawn from the package. Corner 212 has now become a trailing corner, and will be the last portion of the towel to be removed from the package. Corners 211 and 213 have now been folded out of the way via fold lines 220 and 223, respectively, such that
20 in the longitudinal direction the outer margins of the folded towel consist of only folded edges. This folding operation has defined the folded width (FW) of the folded towel, measured parallel to the lateral fold lines, and has also defined a first folded thickness (FFT), which is the thickness of the overlying folded portions of
25 the towel.

In Figure 7C, the towel 205 folded according to Figures 7A and 7B has now been accordion-folded along lateral fold lines 230-232, such that fold line 230 now overlies fold line 232. Free corner 210 extends beyond fold line 231 to ensure that the consumer will only
30 grasp the free corner 210 rather than the entire thickness of the folded towel. This ensures the proper unfolding of the towel. This folding operation has defined the folded length (FL) of the folded towel, measured parallel to the longitudinal fold lines, and has also defined a second folded thickness (SFT), which is the thickness
35 of the overlying laterally folded portions of the towel.

Figures 8A and 8B depict front and rear views, respectively, of the towel 205 after it has been folded according to the process

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5 defines the folded length (FL), and the distance between fold lines 221 and 222 (measured parallel to the lateral fold lines 230-232) defines the folded width (FW). As the longitudinal fold lines and lateral fold lines are mutually orthogonal, the folded length and folded width are also mutually orthogonal.

10 The various elements of the folded towel 205 which are visible in the folded state are labeled in Figures 8A and 8B to show their final position following the folding operation. The relative positions of these elements of the folded towel have proven to be critical to proper unfolding of the towel as described below.

15 While a presently preferred manner of folding the folded towel according to this second embodiment of the present invention has been set forth, there are many other ways to fold a towel so as to obtain satisfactory performance with this improved package. For example, the folding methods described with respect to Figures 2A-2C and Figures 12A-12B could be utilized, or any other similar method 20 which incorporates a greater or lesser number of folds. In addition, the grasping portion could be formed as a projection 214 on the leading edge of the folded towel, such as shown in Figure 8C, particularly if the towel is folded parallel to its edges as 25 illustrated in Figures 2A-2C and 12A-12B rather than diagonally as illustrated in Figures 7A-7C.

There are three critical aspects of the towel folding operation according to this second embodiment of the present invention. First, the towel in its finally folded state must have a generally 30 rectangular overall shape. Second, a grasping portion must be located near the dispensing edge 255, as shown in Figure 9A, so as to present a defined portion of the towel for the consumer to grasp and withdraw the folded towel by its leading edge. Finally, the towel must be folded longitudinally first, and then laterally, with 35 the longitudinal and lateral folds being generally orthogonal to one another, so as to permit the lateral folds to unfold first, and then

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5 present invention.

10 In Figure 9A, the folded towel 205 has been placed on top of a back sheet 250, which comprises a sheet of thin, flexible, and preferably liquid-impervious material. Back sheet 250 is sized so as to be marginally larger than the folded width and folded length of the folded towel 205, and is preferably shaped so as to have the edge 255 nearest to the free corner 210 shorter than the opposing edge 256.

15 In Figure 9B, a front sheet 251 has been placed over the folded towel 205 and back sheet 250. Front sheet 251 also comprises a sheet of thin, flexible, and preferably liquid-impervious material, and front sheet 251 has a size and shape which generally correspond to the size and shape of the back sheet 250.

20 Figure 9C depicts the completed package, after front sheet 251 and back sheet 250 have been sealed together around their peripheries as shown at 252. Near the dispensing edge 255, two notches 253 and 254 are preferably formed which extend part way through the seal 252 so as to form a means for initiating a tear line across the front and back sheets, as will be described below. The folded towel 205 is now completely contained inside an airtight and moisture-tight package, where it will remain clean and ready for use.

Figures 10A through 10D depict the process of opening the completed package and extracting the folded towel according to the second embodiment of the present invention.

30 In Figure 10A, the consumer has grasped the completed package at one side just below one of the notches, in this case 253. The consumer grasps the package with his or her other hand just above the notch 253, and by pulling his or her hands in opposite directions perpendicular to the plane of the package initiates a tear line 257 across the end of the package near dispensing edge 255 as shown in Figure 10B. As the grain of the package material used for front sheet 251 and back sheet 250 (if the package material has

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5 exposed and protruding beyond the tear line 257 so that it may be readily grasped, as described below.

10 Tear line 257 actually comprises a torn edge on front sheet 251 and a torn edge on back sheet 250, the two torn edges being joined to one another by the inner edges of the sealed portion 252 adjacent to the notches 253 and 254. The two torn edges free of the sealed portion 252 define the periphery of an opening which has a circumference equal to the sum of the lengths of the two torn edges, which are preferably nearly equal.

15 As shown in Figure 10C, the consumer may completely tear off the upper portion of the package and discard it in an appropriate fashion, or may alternatively leave it partially attached, so long as the attachment does not extend inward beyond the inner edge of the sealed area 252 and thus diminish the size of the opening defined by tear line 257 and bounded at each end by the inner margin of sealed area 252. The consumer in Figure 10C has now shifted one hand so as to grasp the lower edge 256 of the package with one hand and has grasped the free corner 210 with the other hand so as to begin extracting the folded towel from the package.

25 As this extraction process proceeds, more and more of the towel is withdrawn from the package and simultaneously unfolded such that the exposed portion of the towel is in a substantially unfolded state. The unfolding process culminates in the complete extraction of the towel from the package, as shown in Figure 10D. The consumer is now holding a fully and completely unfolded towel, such that the towel is now ready for the desired use. The empty package and the torn-off portion may now be disposed of in an appropriate fashion.

35 A unique interaction between the folded towel and the periphery of the opening is the source of the unfolding feature of this embodiment of the present invention. The opening preferably has a length smaller than the folded width of the towel, and which is also smaller than the bottom edge of the package. During the withdrawal of the towel, the opening becomes even shorter in length as the

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5 ensure that the towel cannot simply slide out of the package while remaining in its folded state.

10 The periphery of the opening exerts a force on the towel in a direction which opposes the force exerted by the consumer in withdrawing the towel and serves to accomplish the unfolding of the lateral folds of the towel. Because the opening is also generally smaller than the folded width of the towel, the "ends" of the opening push inward on the outermost folds and edges of the folded towel as the towel passes through the opening, thus serving to cause the overlying surfaces of the towel between the longitudinal folds to separate and effectuate the unfolding of the longitudinal folds of the towel.

15 This interaction between the folded towel and the opening is what dictates the size and shape of the opening, as well as the manner in which the towel is folded. As stated previously, the number of folds in each direction is not critical, so long as the towel ultimately reaches a generally rectangular shape with the longitudinal folds folded first and the lateral folds folded last. As the towel passes through the opening, the lateral folds unfold first and the longitudinal folds unfold last, due to the nature of the forces applied by the opening on the towel.

20 The forces applied, particularly the inward forces applied to unfold and separate the longitudinal folds, must be sufficient to overcome the adhesion force between adjacent towel surfaces. This adhesion force is caused by the use of cleansing agents or other liquids to moisten the towel. The opening must therefore be sized to account for not only the dimensions of the folded towel, but also the "stickiness" of the towel in terms of the adhesion force between adjacent layers. A more detailed discussion of the adhesion force appears below.

35 Although the shape of this opening may range from a narrow slit to an oval to nearly circular during the course of the withdrawal of the folded towel, the circumference of the opening will remain

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5 the opening (before beginning to withdraw the towel) in the
direction parallel to the dispensing edge of the package (which
represents the major dimension of the opening), and "maximum width"
refers to the maximum extent of the opening in the direction
perpendicular to the plane of the package (which represents the
10 minor dimension of the elongated opening) as the opening is reshaped
by the towel passing through it, all regardless of the actual shape
of the opening.

In order to achieve the proper unfolding of the folded towel,
the maximum length must be related to the dimensions and adhesion
15 properties of the folded towel. For towels and packages according
to this second embodiment of the present invention, this
relationship assumes the form $ML = C \times FW$, where ML is the maximum
length of the opening, FW is the folded width of the folded towel,
and C is an experimentally determined parameter which accounts for
20 the adhesion properties and unfolding characteristics of the folded
towel in its folded condition.

In a package configuration according to this embodiment of the
present invention, the maximum length of the opening is typically
always less than the folded width of the folded towel, and the
25 maximum width of the opening as it is reshaped during towel
withdrawal is dictated by the performance of the towel during the
withdrawal process, i.e., will seek its own size in response to the
extraction of the towel. A trial and error experimental process has
revealed that the parameter C is preferably less than about 1.0,
30 more preferably between about 0.5 and about 0.9, and most preferably
about 0.6. As packages made according to this embodiment of the
present invention are more sensitive to towel characteristics than
the other embodiments, the opening size will need to be adjusted for
each particular towel type for best results.

35 As the adhesion force required to separate adjoining layers of
the towel (discussed in greater detail below) increases, the
parameter C tends toward the lower end of these ranges so as to

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Surface textures which increase resistance to sliding of towel layers with respect to each other also lead to a parameters C which tends toward the higher end of these ranges. These relationships hold generally constant for a wide range of folded towel dimensions, although for towels which have unusually large or small folded dimensions, these ranges may need to be adjusted up or down to achieve acceptable unfolding performance.

If the opening is sized too small for towel of given dimensions and adhesion characteristics, or if the towel surfaces adhere too strongly, one of two things is likely to occur. First, the towel may tear, leaving the consumer holding only a portion of the towel while the remainder of the towel remains folded within the package. Second, the package itself may tear, particularly in the vicinity of the opening, allowing the towel to emerge from the package while still in its folded state, or only partially unfolded. Of course, neither of these occurrences are desirable, and with proper assessment of the adhesion forces present the package can be designed appropriately.

Thus, once a towel material, cleansing agent, and folded towel dimensions are selected, this relationship can be utilized to properly size and configure an opening which will provide the unfolding feature of the present invention.

As shown in Figure 9C, a presently preferred package configuration is one in which the preferably generally rectangular package tapers such that the dispensing edge is smaller than the lower edge and the remainder of the package. The critical length, the "maximum length" defined above, corresponds to the free length of the two torn edges, which are bounded at each end by the inward boundary of the bond between the front and back sides of the package.

This tapering facilitates the extrication of the folded towel from the package by providing a smooth transition from the wide

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5 The consumer grasps the end of the package farthest from the opening
with one hand and exert a pulling force on the towel with the other
hand. As shown in Figure 10C, this pulling force is exerted
generally in the plane of the package, rather than perpendicular to
the plane of the package. The location of the opening generally
10 centrally at one of the shorter edges of the package maintains the
planar orientation/relationship of the package and towel during the
unfolding process.

This tapering to facilitate extrication can also be
accomplished by forming tapering bonded regions joining the front
15 sheet and back sheet, as depicted in Figure 9D and identified by the
numeral 260. In this manner, the overall package shape can be
rectangular or other similar shape, while the tapered bonded regions
260 properly size the opening resulting when the dispensing edge 255
is opened and provide the desirable smooth transition for the folded
20 towel. Thus, regardless of whether or not the dispensing edge as a
whole is shorter than the bottom edge, a properly sized opening
which is preferably shorter than the bottom edge may be obtained
upon the opening of the dispensing edge.

Many other ways of forming and properly sizing the dispensing
25 edge are possible, and all are deemed to be within the scope of the
present invention.

As shown in Figures 10C and 10D, it is important that when
withdrawing the towel 205 from the package the consumer grasps the
package in the sealed region 252 as close to the lower edge 256 as
30 possible. If the consumer grasps the package above the sealed area
252, there is the possibility that he or she may in fact squeeze the
package in the open interior region containing the folded towel, and
thereby pinch the folded towel between the front and back sheets,
and thus make withdrawal of the towel more difficult.

35 As with packages according to the first embodiment of the
present invention, depending upon the width of sealed area 252 at
the lower edge 256, it may be desirable to provide a larger sealed

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generally which extend from the leading edge 330 to the trailing edge 334. The overall package length may need to be adjusted accordingly to maintain sufficient interior volume for the folded towel.

10 Figures 11 through 15E depict an improved package and folded towel according to a third embodiment of the present invention.

Figure 11 illustrates a towel for use with a package according to a third embodiment of the present invention, which is depicted in its unfolded state. The numeral 305 denotes the towel generally, and the numerals 310, 311, 312, and 313 are used to identify the 15 four corners of the towel 305, which may be generally rectangular in shape in a preferred configuration. The towel 305 also has two side edges 320 and 323, a leading edge 330, and a trailing edge 334.

In Figure 11, the fold lines of towel 305 are illustrated through the use of dotted lines. In a preferred configuration, the 20 towel has two longitudinal fold lines 321 and 322 parallel to the side edges, and three lateral fold lines 331, 332, and 333 parallel to the leading and trailing edges. The longitudinal fold lines and lateral fold lines are thus mutually orthogonal.

Figures 12A and 12B depict the folding process to fold the 25 towel 305 depicted in Figure 11.

In Figure 12A, the towel 305 has been z-folded along fold lines 321 and 322 such that side edge 320 overlies fold line 322, and side edge 323 is behind fold line 321. This folding step is precisely analogous to the folding step depicted in Figure 2A with respect to 30 the first embodiment of the present invention. This folding operation has defined the folded width (FW) of the folded towel, measured parallel to the lateral fold lines, and has also defined a first folded thickness (FFT), which is the thickness of the overlying folded portions of the towel.

35 In Figure 12B, the towel 305 folded according to Figure 12A has now been accordion-folded along lateral fold lines 331-333 such that fold line 331 overlies fold line 333. Leading edge 330 extends

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5 the last portion of the towel to be removed from the package. This folding operation has defined the folded length (FL) of the folded towel, measured parallel to the longitudinal fold lines, and has also defined a second folded thickness (SFT), which is the thickness of the overlying laterally folded portions of the towel.

10 Figures 13A and 13B depict front and rear views, respectively, of the towel 305 after it has been folded according to the process depicted in Figures 12A and 12B and pressed flat so as to occupy minimal space. The folded towel 305 preferably exhibits a generally rectangular outline. The distance between leading edge 330 and fold
15 line 331 (measured parallel to the longitudinal fold lines 321 and 322) defines the folded length (FL), and the distance between side edge 320 and fold line 321 (measured parallel to the lateral fold lines 331-333) defines the folded width (FW). As the longitudinal fold lines and lateral fold lines are mutually orthogonal, the
20 folded length and folded width are also mutually orthogonal.

The various elements of the folded towel 305 which are visible in the folded state are labeled in Figures 13A and 13B to show their final position following the folding operation. The relative positions of these elements of the folded towel have proven to be
25 critical to proper unfolding of the towel as described below.

While a presently preferred manner of folding the folded towel according to this third embodiment of the present invention has been set forth, there are many other ways to fold a towel so as to obtain satisfactory performance with this improved package. For example,
30 the folding methods described with respect to Figures 2A-2C and Figures 7A-7C could be utilized, or any other similar method which incorporates a greater or lesser number of folds. In addition, the grasping portion could be formed as a projection on the leading edge of the folded towel, such as that identified with the numeral 214 in
35 Figure 8C, or in this configuration may merely constitute the leading edge of the towel, so long as it is near the dispensing edge 356 for the consumer to grasp, as shown in Figure 14A.

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5 the dispensing edge 356, as shown in Figure 14A, so as to present a
defined portion of the towel for the consumer to grasp and withdraw
the folded towel by its leading edge. Finally, the towel must be
folded longitudinally first, and then laterally, with the
longitudinal and lateral folds being generally orthogonal to one
10 another, so as to permit the lateral folds to unfold first, as
described below with respect to Figures 15A-15E.

Figures 14A through 14C illustrate the steps required to
assemble a complete package according to this third embodiment of
the present invention.

15 In Figure 14A, the folded towel 305 has been placed on top of a
back sheet 350, which comprises a sheet of thin, flexible, and
preferably liquid-impervious material. Back sheet 350 is sized so
as to be marginally larger than the folded width and folded length
of the folded towel 305. A flexible bar 351, comprising a strip of
20 flexible and preferably thin material, has been placed through the
folded towel 305 such that it isolates the portion of the folded
towel bounded by leading edge 330 and lateral fold line 331 from the
portion of the folded towel bounded by lateral fold lines 331 and
332, as well as the rest of the folded towel. Flexible bar 351 is
25 thus parallel to the lateral fold lines 331-333, and is sized so as
to match the width of back sheet 350. The importance of flexible
bar 351 will be discussed below.

In Figure 14B, a front sheet 352 has been placed over the
folded towel 305 and back sheet 350. Front sheet 352 also comprises
30 a sheet of thin, flexible, and preferably liquid-impervious
material, and front sheet 352 has a size and shape which generally
correspond to the size and shape of the back sheet 350.

Figure 14C depicts the completed package, after front sheet 352
and back sheet 350 have been sealed together as shown at 353. This
35 seal 353 also firmly attaches the flexible bar 351 at each end to
the respective margins of the package. Near the dispensing edge
356, two notches 354 and 355 are preferably formed which extend part

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Figures 15A through 15E depict the process of opening the completed package and extracting the folded towel according to the third embodiment of the present invention.

10 In Figure 15A, the consumer has grasped the completed package at one side just below one of the notches, in this case 354. The consumer grasps the package with his or her other hand just above the notch 354, and by pulling his or her hands in opposite directions perpendicular to the plane of the package initiates a tear line 358 across the end of the package near dispensing edge 356 as shown in Figure 15B. As the grain of the package material used for front sheet 352 and back sheet 350 preferably runs parallel to edge 356, the material tears across each sheet in a generally straight line from one notch 354 to the other notch 355. As also shown in Figure 15B, this tearing operation leaves leading edge 330 exposed and protruding beyond the tear line 358 so that it may be readily grasped, as described below.

20 Tear line 358 actually comprises a torn edge on front sheet 352 and a torn edge on back sheet 350, the two torn edges being joined to one another by the inner edges of the sealed portion 353 adjacent to the notches 354 and 355. The two torn edges free of the sealed portion 353 define the periphery of an opening which has a circumference equal to the sum of the lengths of the two torn edges, which are preferably nearly equal.

30 Although the shape of this opening may change from a narrow slit to an oval to nearly circular during the course of extracting the folded towel, depending upon the quantity of towel material passing through the opening at any instant in time, the circumference of the opening remains constant throughout the withdrawal process. As such, for the purposes of this invention the term "circumference" refers to the length of the periphery of the opening, regardless of its shape at any point in time. The circumference of the opening according to this embodiment of the

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the upper portion of the package and discard it in an appropriate fashion, or may alternatively leave it partially attached, so long as the attachment does not extend inward beyond the inner edge of the sealed area 353 and thus diminish the size of the opening defined by tear line 358 and bounded at each end by the inner margin of sealed area 353. The consumer in Figure 15C has now shifted one hand so as to grasp the lower edge 357 of the package with one hand and has grasped the leading edge with the other hand so as to begin extracting the folded towel from the package.

Figure 15D illustrates the role of the flexible bar 351 in the unfolding process, with the front sheet 352 removed for clarity. As the towel is pulled from the package, the towel material is forced to pass between the flexible bar 351 and the front sheet 352, such that only one thickness of the towel at a time can pass between them. Due to the initial relationship between the folds of the towel 305 and the flexible bar 351, this ensures that all of the lateral folds 331-333 will be pulled taught and unfolded as the respective portions of the towel are aligned for passage between the flexible bar 351 and front sheet 352. As this extraction process proceeds, more and more of the towel is withdrawn from the package and simultaneously unfolded such that the exposed portion of the towel is completely unfolded in the longitudinal direction, i.e., the exposed portion of the towel is free of lateral folds 331-333.

The unfolding process culminates in the complete extraction of the towel from the package, as shown in Figure 15E. The consumer is now holding the towel by the leading edge 330, the towel having been completely unfolded in the longitudinal direction. The towel is now in the same folded state as depicted in Figure 12A, i.e., the longitudinal folds are still folded. All the consumer needs to do in order to utilize the towel is to shake or otherwise move the towel such that the longitudinal folds fall unfolded, or manually separate the adjacent towel surfaces. The towel is then ready for

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5 present invention. As stated above, the flexible bar is interleaved
between the lateral folds of the towel so as to isolate the portion
between the leading edge and the first lateral fold. Because the
bar will exert a force on the towel in a direction opposing the
force exerted by the consumer in withdrawing the towel, and because
10 the bar is captured between two layers of the towel joined by this
first fold, the towel cannot simply slide out of the package while
remaining in its folded state. The flexible bar thus forces the
towel to unfold laterally and pass between the front side of the
package and the bar on its way out of the package.

15 This interaction between the folded towel and the opening is
what dictates the size and shape of the opening, as well as the
manner in which the towel is folded. As stated previously, the
number of folds in each direction is not critical, so long as the
towel ultimately reaches a generally rectangular shape with the
20 longitudinal folds folded first and the lateral folds folded last.
As the towel passes between the flexible bar the front side of the
package on its way out through the dispensing edge, the lateral
folds unfold due to the nature of the forces applied by the flexible
bar on the towel.

25 The forces applied must be sufficient to overcome the adhesion
force between adjacent towel surfaces. This adhesion force is
caused by the use of cleansing agents or other liquids to moisten
the towel. The flexible bar must therefore be sized to account for
not only the dimensions of the folded towel, but also the
30 "stickiness" of the towel in terms of the adhesion force between
adjacent layers, because as the adhesion force becomes greater, the
more likely the flexible bar is to deform and perhaps fail. A more
detailed discussion of the adhesion force appears below. As the
towel becomes stiffer and/or has a higher basis weight, and hence
35 harder to compress inward in a direction parallel to the folded
width (FW), and/or as the number of longitudinal folds increases,
the more likely the flexible bar is to deform and perhaps fail.

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5 dimensions and adhesion characteristics, or if the towel surfaces
adhere too strongly, one of two things is likely to occur. First,
the flexible bar may fail, allowing the towel to emerge from the
package while still in its folded state, or only partially laterally
10 unfolded. Second, the package itself may tear, particularly in the
vicinity of the attachment of the flexible bar, allowing the towel
to again emerge still at least partially laterally folded. Of
course, neither of these occurrences are desirable, and with proper
assessment of the adhesion forces present the package can be
designed appropriately.

15 The flexible bar 351 according to this embodiment of the
present invention is preferably of sufficient width (measured
perpendicular to dispensing edge 356) as to have only minimal
deformation during withdrawal of the folded towel. The width
required depends on the length of the bar required to traverse the
20 overall width of the package, the material utilized, and the
rigidity of its attachment to the edges of the package. The
criticality of the width is that it must be sufficient to withstand
the forces exerted on it by the withdrawing of the folded towel
without bowing significantly toward the dispensing edge and also so
25 as to permit enough of its ends to be sealed and affixed to the
package edges to prevent its being torn free. Conversely, using a
bar which is too wide results in wasted material. For a typical
package which may be approximately 3 inches (76.2 mm) wide, this
width is preferably between about 1/4 and about 2 inches (6.4-50.8
30 mm), more preferably between about 3/8 and about 1 inch (9.5-25.4
mm), and most preferably about 1/2 inch (12.7 mm). The material
utilized for the flexible bar preferably has characteristics similar
to the overall package material in terms of thickness and
flexibility, and if the bar material has a grain direction
35 associated with it, the grain preferably runs parallel to the length
of the flexible bar.

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5 leading edge 330 toward the first lateral fold. This orientation
has been found to provide for the best unfolding performance because
it allows more of the folded portion of the towel to remain unbound
by the flexible bar in the lower portion of the package during the
10 unfolding operation. It is critical, however, that the flexible bar
be located sufficiently far from the leading edge 330 that the other
folds of the folded towel are isolated from the portion of the
folded towel between the leading edge 330 and the first lateral
fold, in this case fold line 331.

15 As shown in Figures 15C and 15E, it is important that when
withdrawing the towel 305 from the package the consumer grasps the
package in the sealed region 353 as close to the lower edge 357 as
possible. If the consumer grasps the package above the sealed area
353, there is the possibility that he or she may in fact squeeze the
20 package in the open interior region containing the folded towel, and
thereby pinch the folded towel between the front and back sheets,
and thus make withdrawal of the towel more difficult.

As with packages according to the first and second embodiments
of the present invention, depending upon the width of sealed area
353 at the lower edge 357, it may be desirable to provide a larger
25 sealed region for grasping, such as shown in Figures 4G and 4H.
This larger sealed region ensures that the towel will be located
farther from the lower edge of the package, and may take the form of
a single, generally central extension 170, as shown in Figure 4G, or
a generally wider sealed area 180 extending entirely across the
30 package, as shown in Figure 4H. The overall package length may need
to be adjusted accordingly to maintain sufficient interior volume
for the folded towel.

It is within the scope of the present invention that improved
single-towel packages according to each of the foregoing embodiments
35 may be modified and adapted to function as multi-towel packages
while still maintaining the advantageous accessibility and unfolding
features of a single-towel package. The third embodiment of Figures

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5 With a multi-towel package, some means of resealing the package
to protect the remaining towels is often desirable (in the event all
are not used at the same time). Thus, the tear-to-open dispensing
edge of the single-towel version of the third embodiment could be
replaced by some form of resealable closure. Figures 16A and 16B
10 would replace the sealing and notching step depicted in Figure 14C
(steps depicted in Figures 14A and 14B would remain essentially the
same), and correspond generally to the formation of the flap closure
of Figures 4C and 4D. The difference in Figure 16A is that the edge
of front sheet 452 nearest the dispensing edge 456 is left unsealed
15 to form an open end 458, which functions precisely the same as the
tear line 358 of Figures 15B-15E. Front sheet 452 and back sheet
450 are joined around three sides at 453, sealing a flexible bar 451
(see Figure 17B) between them. As shown in Figure 16B, the unsealed
portion of the back sheet 450 is then folded over the open end 458
20 to form a closure 454.

 The stippled region 460 indicates a region of bonding between
the flap closure 454 and the front sheet 452, extending entirely
across the package below the open end 458 so as to form an air-tight
and liquid-tight seal. This seal may be formed by any of the
25 above-described methods, so long as it results in a reclosable and
resealable seal, but the use of the two-sided tape discussed above
with respect to the first embodiment is presently preferred. The
dispensing edge is thus preferably releasably sealed by a resealable
closure (the flap), which may be opened by a consumer to expose the
30 open end 458 for access to the towels.

 If it were desired to form a package wherein all towels would
be utilized on a single occasion, or if the recloseable feature were
not desired for a specific application, other means of closing the
open end could be utilized. For example, the dispensing edge
35 configuration of the second and third embodiments discussed above
could be utilized to form a tear-to-open package. For permitting
more consumer discretion in the pattern of usage, however, some sort

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5 has been opened as depicted in Figures 5A and 5B. The lower edge of
the package 457 (which may be enlarged, as previously described) is
grasped by the consumer, and the leading edge 430 of the first towel
is grasped and withdrawn through the open end 458 as previously
described. The leading edge 530 of the next towel is then presented
10 since it is attached to the trailing edge of the first towel, and
the consumer then momentarily pinches the lower portion of this next
towel between the front and back sheets (or otherwise restrains this
sheet) so that the pulling force exerted on the extracted towel will
cause the towel to tear free of the towel remaining within the
15 package. After this next towel is withdrawn, the leading edge 630
of the next towel is presented, and this process is repeated until
the supply of towels is exhausted. The flap closure may be resealed
to protect the remaining towels, until such time as the last towel
is withdrawn and the package disposed of in a suitable manner.

20 Although the towels may be folded in any suitable manner,
including the folding operations previously described, it is
presently preferred that the towels have fewer lateral folds,
preferably only about one, such that the towels only traverse the
length of the package twice and the leading and trailing edges are
25 near the dispensing edge, as shown in Figure 17B. The towels are
detachably joined in any suitable manner such as, for example, by
straight, curvilinear, or angled perforated lines, such that the
trailing edge of a leading towel is joined to the leading edge of a
trailing towel. While any number of towels may be utilized in such
30 a package, the presently preferred number of towels is three to keep
package size to a minimum. A stacked towel arrangement is
presently preferred, although other towel arrangements may be
equally suitable for use, such as side-by-side, etc..

35 In operation, the first towel passes behind the flexible bar
and longitudinally unfolds on its way out of the package, as with
the single-towel version of the third embodiment. Figure 17C
corresponds to Figure 15E in that the towel as shown is in the same

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5 towel surfaces. The towel is then ready for the desired use.

Once the first towel is entirely out of the package, and the leading edge of the next towel appears at the open end, the consumer tears off the first towel as previously described. The towels and package are then as shown in Figure 17C, and the package can then be
10 resealed if desired. When a subsequent towel is desired, the package can then be reopened and the leading edge of the next towel can be grasped and the towel withdrawn (as above described), and it likewise will pass behind the flexible bar and unfold longitudinally. Of course, more than one towel can be withdrawn at
15 a time, if desired, and the towels will all follow one another behind the flexible bar and longitudinally unfold as they exit the package.

The overall shape and size of the flexible packages in each of the three embodiments of the present invention discussed above are
20 not critical in terms of performing the unfolding operation, so long as certain common attributes are retained. For example, regardless of their exact shape the package must necessarily be somewhat larger than the final folded dimensions of the folded towel in order to entirely surround and contain the folded towel. If the package is
25 too much larger than the folded towel, however, the package will be more bulky for the consumer to carry, and furthermore the package will be more easily distorted during the unfolding and withdrawal process. Therefore, both from a material usage standpoint and a performance standpoint, as depicted in the Drawing Figures the
30 flexible packages of the present invention are preferably only marginally larger in all directions than the folded towels they contain, and their overall shape generally corresponds to the shape of the folded towel. Typical overall package dimensions from about
35 2 inches by about 3 inches (51 x 76 mm) to about 3 inches by about 4 inches (76 x 102 mm) have performed satisfactorily.

In addition, for those embodiments which incorporate a tearing operation to form a dispensing opening, the package must be designed

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5 is presently preferred that all packages according to the present
invention have a somewhat elongated, generally rectangular overall
shape with somewhat rounded corners. Such a shape is easy for the
consumer to carry, such as in a pocket or purse, and aids in the
proper orientation of the package during the withdrawal and
10 unfolding process. Other shapes may be utilized, however, such as
oblong or oval shapes, square shapes, or any other desired shape.

With regard to each of the foregoing embodiments, it may be
desirable to provide multi-package sets of single- or multi-towel
packages suitable for more extended away-from-home use. Such sets
15 may comprise individual packages joined at their side, top, or
bottom edges to form a frangible web by some easily detachable
means, such as, for example, perforated or partially slitted or
scored lines. Such joints could be formed by only partially
severing the packages during the sealing and cutting operations, or
20 by forming such joints by some sort of bonding operation after the
individual packages have been separated. The multi-package sets
would thus lend themselves to accordion-folding, etc., to still
facilitate easy transportation and concealment in a pocket or purse.
Individual packages could then be removed individually as desired
25 for use, and subsequent disposal, without affecting the sealed
integrity of the remaining packages in the set.

With respect to each of the three embodiments discussed above,
the unfolding advantages obtained according to the present invention
may be achieved by the use of a substantially moisture-free (dry)
30 towel, i.e., without any liquid cleansing agents or other liquids to
moisten the towel. However, the towels preferably contain some
quantity of a suitable cleansing agent, such as a mixture of water,
polyethylene glycol, ethanol, and a perfume, and perhaps lanolin and
a bacteriostat. For other uses, particularly medical uses, it may
35 be desirable to moisten the towel with a disinfecting solution, such
as alcohol. Such cleansing agents improve the effectiveness of the
towel in use, but in general cause the layers of the towel to cling

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5 this clinging tendency through selective applications of force to
certain regions of the folded towel during the withdrawal process.
While the towels may be entirely "dry", and unfold satisfactorily in
such packages, or moistened with a liquid which does not impart as
much "stickiness" or "clinginess" to the towel, the improved
10 packages according to the present invention perform the unfolding
process satisfactorily up to an upper limit of cleansing agent
content and/or stickiness. While the quantity of the agent may vary
according to the composition of the agent, and hence its
"stickiness", the adhesion force quantifies a critical parameter.
15 Other factors which affect the resistance of the towel to unfolding
include the surface finish and texture of the towel, the resistance
to sliding between adjacent towel layers, and the relative moisture
content of the towel.

20 With all of the above factors combined, if too much force is
required to separate the layers and unfold the folds, one of two
things may be expected to occur. First, the towel itself may emerge
from the package still in its folded state, or only partially
unfolded, due either to the towel "roping" together while passing
through an opening rather than unfolding, or due to a failure of an
25 element of the package itself. Second, the towel may tear, leaving
the consumer holding only a portion of the towel while the remainder
of the towel remains folded within the package. Of course, neither
of these occurrences are desirable, and with proper assessment of
the adhesion forces present the package can be designed
30 appropriately.

35 The towel itself can be formed of any commonly-used tissue-type
paper material, or any other similar thin and flexible sheet-like
material deemed suitable for use in such a package, including, for
example, woven and non-woven fabric-type materials. Such materials
include single- and two-ply sheets of tissue paper, having
sufficient strength to avoid tearing during the withdrawing
operation, especially when in a moistened condition. The basis

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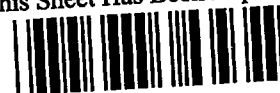


5 the size of the towel to the desired folded dimensions. Two-ply
paper towels with basis weights (per ply) of about 0.0087 lb/ft²
(0.0043 g/cm²) and single-ply paper towels with basis weights of
10 about 0.0082 lb/ft² (0.0040 g/cm²) have performed well, and towel
dimensions of from about 3 inches by about 5 inches (76 x 127 mm) to
about 6 inches by about 10 inches (152 x 254 mm) have been used
successfully.

Towels suitable for use with packages according to any
particular embodiment of the present invention may be folded with
15 the fold lines parallel to the respective edges of the towel (such
as depicted in Figures 1 and 11, for example), or non-parallel to
the respective edges of the towel (such as depicted in Figure 6, for
example), so long as the longitudinal and lateral folds are
generally orthogonal to one another, as described above.

The thin, flexible, and substantially liquid-impervious
20 material utilized for the package can be any suitable single or
multiple layer sheet material. Commonly used materials include
metallic foils, plastic films, or treated paper products. Suitable
materials include high density polyethylene, polyethylene-based
25 copolymers, polyesters (PET, PETG), polypropylene, nylon, and a
paper/foil/low density polyethylene laminate utilized with the paper
side toward the outside of the package, and a
nylon/polyethylene/aluminum foil/linear low density polyethylene
laminate utilized with the nylon side toward the outside of the
package. One presently preferred material for packages according to
30 the third embodiment of the present invention is the
nylon/polyethylene/aluminum foil/linear low density polyethylene
laminate, while for the first and second embodiments the presently
preferred material is the paper/foil/low density polyethylene
laminate. The material utilized must have sufficient strength and
35 rigidity to maintain its shape and avoid tearing during the
unfolding process.

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5 with a folded towel moistened with a cleansing agent or other
liquid. The flexible bar may even be fabricated from a thin,
flexible line or cord material, such as a synthetic (nylon)
monofilament line, although to provide maximum attachment area
within the edge seals a sheet-like material is presently preferred.

10 For package configurations which utilize a tearing process to
open the package and create a dispensing opening, if the package
material has a grain direction associated with it, the grain
direction preferably runs parallel to the direction of the tear so
as to facilitate a generally straight tear line across the package.

15 If there is no tearing operation associated with the opening of a
particular package configuration, the grain direction is not
critical. If the material utilized for the flexible bar of the
third embodiment has a grain direction, the grain direction
preferably runs across the package along the length of the flexible
bar so as to afford maximum strength and resistance to tearing of
20 the bar.

The edges of the front and back sheets of packages according to
all embodiments of the present invention are preferably joined in a
manner which provides a substantially liquid-tight and air-tight
25 seal. This seal, in combination with the substantially
liquid-impervious sheet material and closure (if applicable),
defines a substantially air-tight and liquid-tight package for
containing the folded towel. This in turn protects the folded towel
from contamination and also prevents any cleansing agent from
30 evaporating or leaking out of the package, thus keeping the towel in
a condition suitable for use.

This seal may be formed by a variety of acceptable methods,
including crimping, clamping, taping, bonding with various
adhesives, and thermal bonding. The presently preferred method of
35 sealing the periphery of the front and back sheets is thermal
bonding. The term "thermal bonding", sometimes called "heat
sealing", may include a number of methods of generating and applying

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5 Possible methods which are well known include heated jaw sealing, hot air sealing, hot wire sealing, ultrasonic sealing, and impulse sealing, with the impulse sealing process being presently preferred.

The width of the seals, i.e., how far inward they extend from the periphery of the front and back sheets, however they are formed,
10 is not critical so long as sufficient seal width is provided to maintain a durable seal. Seals which are too narrow may be prone to rupture during transport of the package prior to use, particularly in a purse or pocket environment.

For ease of manufacture, it is preferable to form the heat
15 seals, cut the front and back sheets from larger sheets, and form the tear-initiating notches (if applicable) all at the same time, although such steps can be accomplished separately. Where such notches are formed so as to extend part way through the heat seals, it is critical that the innermost portion of the heat seal remain
20 intact so as not to lose the liquid-tight and air-tight integrity of the package.

With respect to the third embodiment of the present invention, wherein the flexible bar is joined to the side edges of the package by the seals, it is critical that the seals firmly retain the ends
25 of the flexible bar to withstand the forces exerted upon the bar during the withdrawal process. As such, it is preferable to have the ends of the flexible bar extend entirely through the seals and terminate approximately at the outer periphery of the front and back sheets so as to afford maximum contact area within the seal. If
30 heat sealing is the method of sealing selected, the flexible material utilized for the flexible bar must be appropriate for the sealing operation, i.e., capable of fusing to the inner surfaces of both the front and back sheets.

There are several possible ways to facilitate the tearing open
35 of the dispensing edges of packages formed according to the second and third embodiments of the present invention. The front and back sheets could be partially scored, slitted, or perforated along the

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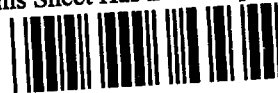
5 of facilitating opening of the packages of the second and third
embodiments is to provide opposing notches in the side edges of the
packages near the dispensing edge, as depicted in the Drawing
Figures. The notches provide a region of stress concentration which
ensures that the tearing of the front and back sheets will begin at
10 the point of the notch and propagate across the package.
Orientation of the grain of the package material (if it has a grain
direction) parallel to the line of the desired tearing helps to
ensure that the propagation of the tear lines will be generally
straight across the package from one notch to the other.

15 It will be apparent to one skilled in the art that many
variations of the present invention are possible. For example, the
packages may differ in size, thickness, and/or shape from those
disclosed above. Different materials may also be utilized, as well
as different manufacturing techniques. Furthermore, depending on
20 the physical properties of the materials used to form the packages
and folded towels, and their methods of manufacture, in order to
obtain best results it may be necessary to vary the dimensions and
proportions from those discussed above. All such modifications and
variations are within the scope and intent of the appended Claims.

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- (a) at least one folded sheet, said sheet being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said second folded thickness being greater than said first folded thickness, said sheet further having a grasping portion for grasping by a consumer, said grasping portion overlying a front surface of said sheet and preferably comprising a free corner folded diagonally downward over said front surface of said sheet;
- (b) a package formed of a thin, flexible, and preferably liquid-impermeable material, said package entirely surrounding and containing said sheet, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a top edge opposing said bottom edge, each of said edges joining said front side and said back side, said package having an elongated opening, preferably generally oval in shape, on said front side, said elongated opening defining a minor dimension parallel to said folded length and a major dimension parallel to said folded width, said front surface of said sheet and said front side of said package being in overlying spaced relation to one another, said elongated opening being releasably sealed by a closure and adapted to be opened by a consumer for access to said sheet, said elongated opening further being disposed on said front side such that said grasping portion of said sheet is registered in underlying spaced relationship to said opening; and
- (c) said minor dimension of said elongated opening having a maximum width which is between 1.0 and 3.0 times, preferably between 1.0 and 1.2 times, said second folded thickness, said major dimension having a maximum length which is between 0.8 and 1.3 times, preferably between 0.9 and 1.2 times, said folded width;

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of said sheet to substantially unfold.

2. The flexible package of Claim 1, further characterized in that said closure comprises a flap folded downward over said elongated opening.
3. A flexible package for dispensing a folded sheet, characterized in that said package comprises:
 - (a) at least one folded sheet, said sheet being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said second folded thickness being greater than said first folded thickness, said sheet further having a grasping portion for grasping by a consumer, said grasping portion extending lengthwise beyond a remainder of said sheet and preferably comprising a free corner of said sheet;
 - (b) a package formed of a thin, flexible, and preferably liquid-impervious material, said package entirely surrounding and containing said sheet, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a dispensing edge opposing said bottom edge, each of said edges joining said front side and said back side, said dispensing edge being adapted to be opened by a consumer for access to said sheet, said dispensing edge and said grasping portion of said sheet being adjacent to one another; and
 - (c) said dispensing edge being designed such that when said dispensing edge is opened by said consumer, an elongated opening having a length which is shorter than said bottom edge is formed, said elongated opening defining a minor dimension parallel to said first folded thickness and a major dimension

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whereby when said consumer opens said dispensing edge and forms said opening, said grasping portion is presented for grasping, and whereby grasping said grasping portion and withdrawing said sheet from said package through said dispensing edge automatically causes said longitudinal folds and said lateral folds of said sheet to substantially unfold.

4. The flexible package of Claim 3, further characterized in that said side edges are provided with opposed notches near said dispensing edge to facilitate opening by said consumer, and in that said dispensing edge has a shorter length than said bottom edge.
5. A flexible package for dispensing a folded sheet, characterized in that said package comprises:
 - (a) at least one folded sheet, said sheet being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said second folded thickness being greater than said first folded thickness, said sheet further having a grasping portion for grasping by a consumer, said grasping portion extending lengthwise beyond a remainder of said sheet;
 - (b) a package formed of a thin, flexible, and preferably liquid-impervious material, said package entirely surrounding and containing said sheet, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a dispensing edge opposing said bottom edge, each of said edges joining said front side and said back side, said dispensing edge being adapted to be opened by a consumer for access to said sheet, said dispensing edge and said grasping portion of said sheet being

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said back side, said flexible bar being interleaved between said lateral folds of said sheet such that a portion of said sheet between said grasping portion and a first lateral fold is on an opposite side of said flexible bar from said remainder of said sheet, said flexible bar having a width which is smaller than said folded length, said flexible bar further having a length sufficient to fully extend from one of said side edges to the other of said side edges, said flexible bar being located up to one-half, preferably up to one-fourth, of said folded length from said grasping portion toward said first lateral fold, and said flexible bar being firmly affixed to said side edges;

whereby when said consumer opens said dispensing edge said grasping portion of said sheet is presented for grasping, and whereby upon grasping said grasping portion and withdrawing said sheet from said package through said dispensing edge, said flexible bar automatically causes said lateral folds of said sheet to substantially unfold.

6. The flexible package of Claim 5, further characterized in that said side edges are provided with opposed notches near said dispensing edge to facilitate opening by said consumer.
7. A flexible package for dispensing folded sheets, characterized in that said package comprises:
 - (a) a first folded sheet, said first sheet being first folded longitudinally to define a predetermined folded width and then folded laterally to define a predetermined folded length, such that said first sheet has longitudinal folds generally parallel to its length and at least one lateral fold generally parallel to its width, said longitudinal folds and said lateral fold being generally orthogonal to one another, said first sheet further having a grasping portion for grasping by a consumer and a trailing edge, said grasping portion extending lengthwise beyond a remainder of said first sheet;

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folds generally parallel to its length and at least one lateral fold generally parallel to its width, said longitudinal folds and said lateral fold being generally orthogonal to one another, said additional sheet further having a grasping portion for grasping by a consumer and a trailing edge, said grasping portion of said additional sheet being detachably joined to said trailing edge of said first sheet;

- (c) a package formed of a thin, flexible, and preferably liquid-impervious material, said package entirely surrounding and containing said sheets, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a dispensing edge opposing said bottom edge, each of said edges joining said front side and said back side, said dispensing edge being adapted to be opened by a consumer to form an open end for access to said sheets, said dispensing edge and said grasping portion of said first sheet being adjacent to one another; and
- (d) said package further comprising a flexible bar formed of a flexible material, said flexible bar being disposed inside said package between said front side and said back side, said flexible bar being interleaved between portions of said first sheet such that a portion of said first sheet between said grasping portion and said lateral fold is on an opposite side of said flexible bar from said remainder of said first sheet and said additional sheet, said flexible bar having a width which is smaller than said folded lengths of said sheets, said flexible bar further having a length sufficient to fully extend from one of said side edges to the other of said side edges, said flexible bar being located up to one-half, preferably up to one-fourth, of said folded length from said grasping portion of said first sheet toward said lateral fold, and said flexible bar being firmly affixed to said side edges;

whereby when said consumer opens said closure said grasping portion of said first sheet is presented for grasping, and whereby upon grasping said grasping portion of said first sheet and withdrawing said first sheet from said package

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8. The flexible package of Claim 7, further characterized in that said dispensing edge is releasably sealed by a resealable closure, said closure preferably comprising a resealable flap folded downward over said open end.
9. A flexible package according to any one of Claims 5 to 8, further characterized in that said flexible bar is formed of a thin, flexible sheet material or a thin, flexible cord material.
10. A flexible package according to any one of Claims 1 to 9, further characterized in that said sheet is moistened with a cleansing agent.

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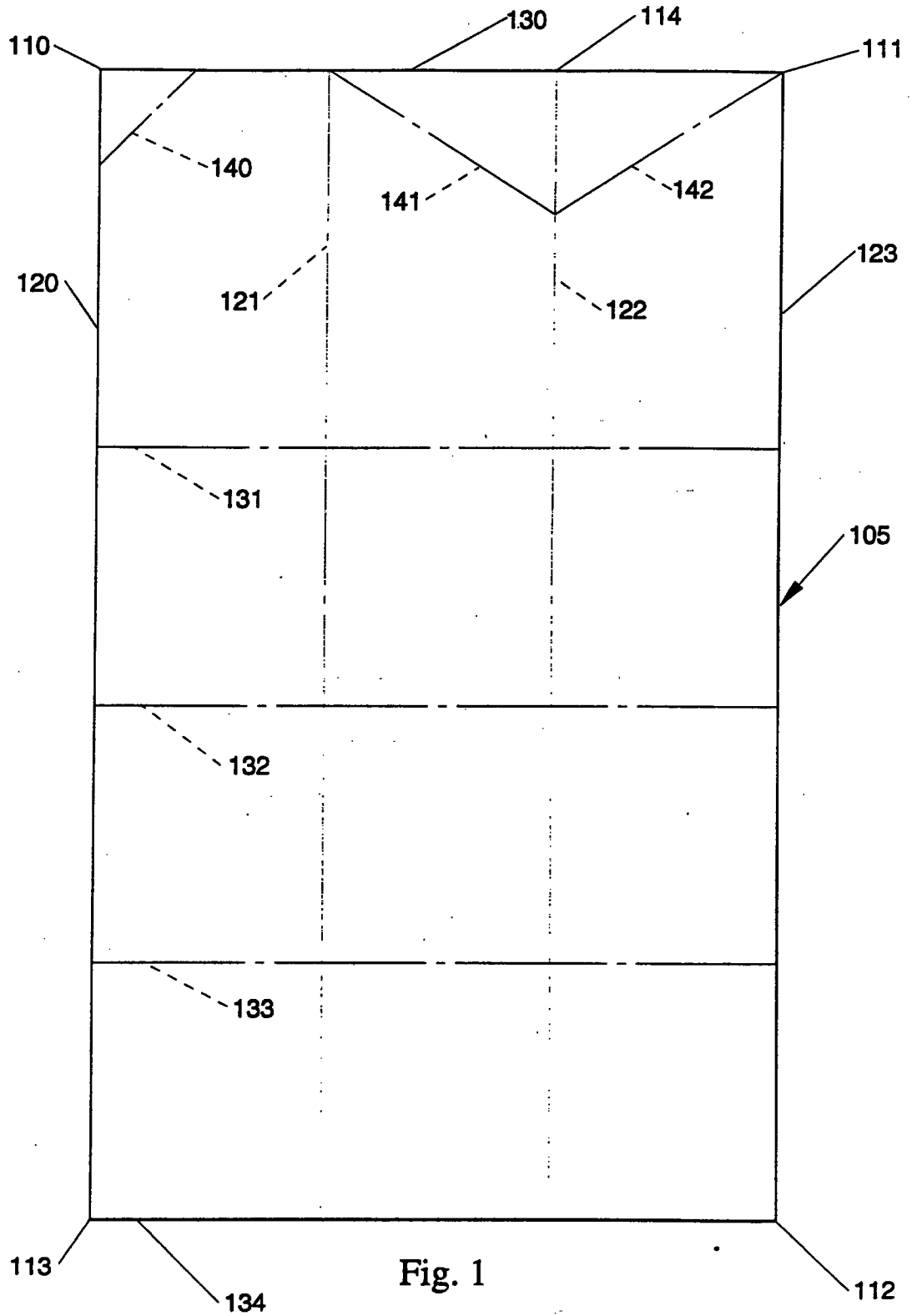


Fig. 1

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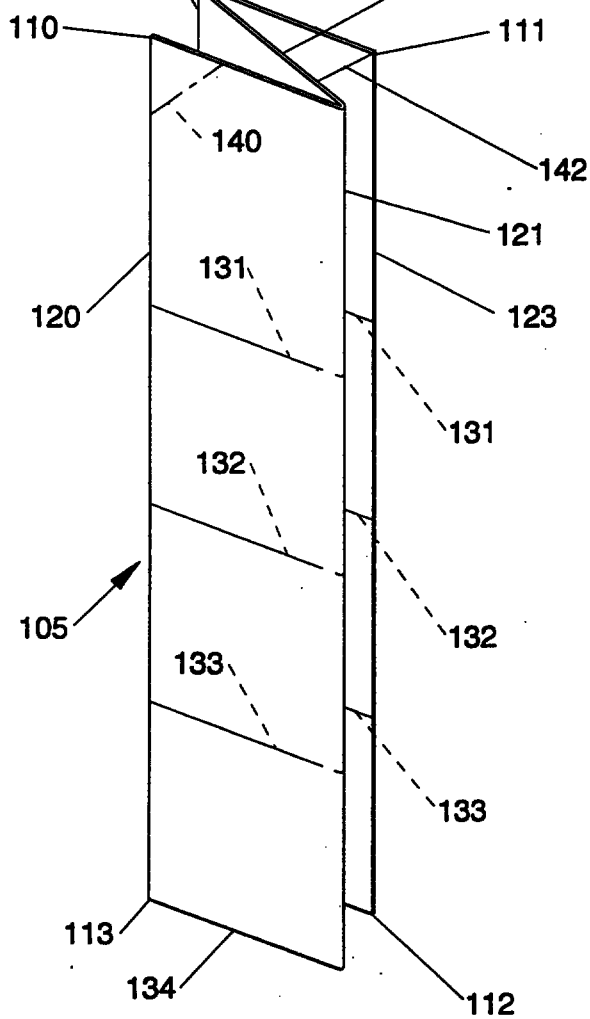


Fig. 2A

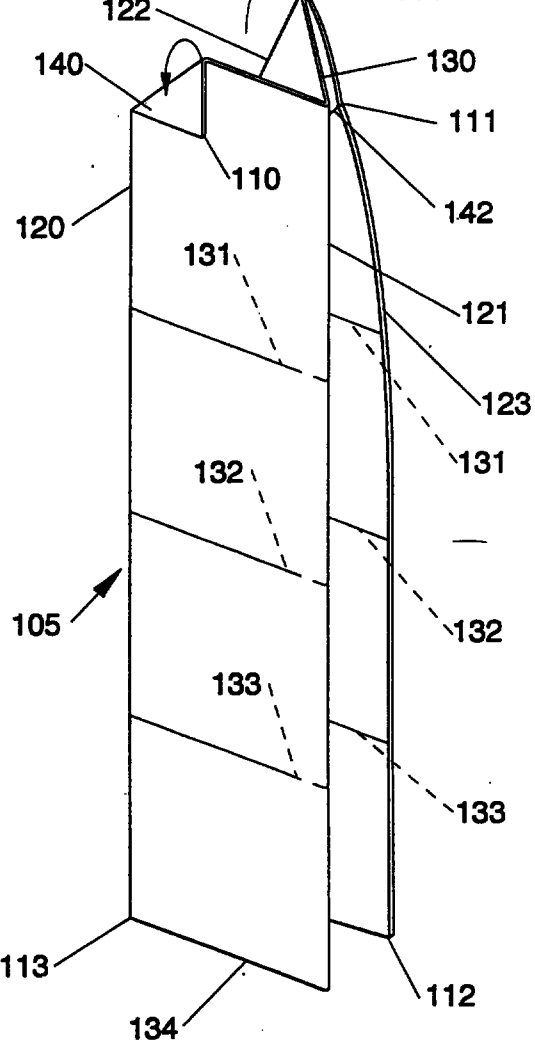


Fig. 2B

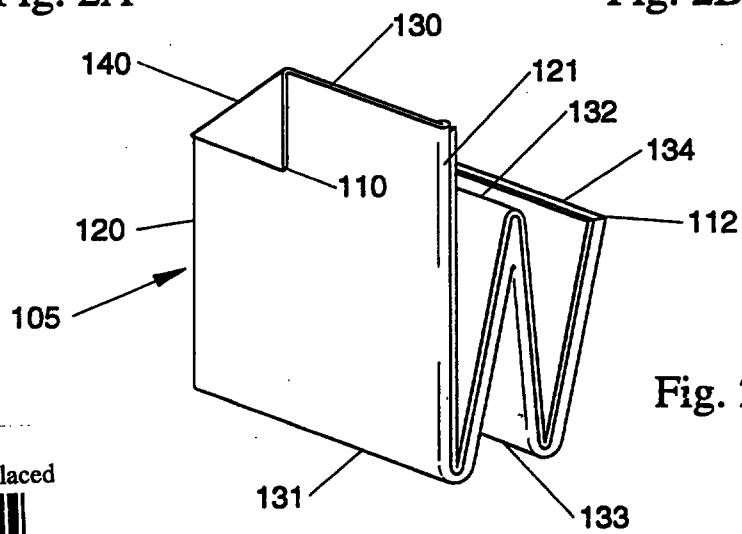


Fig. 2C

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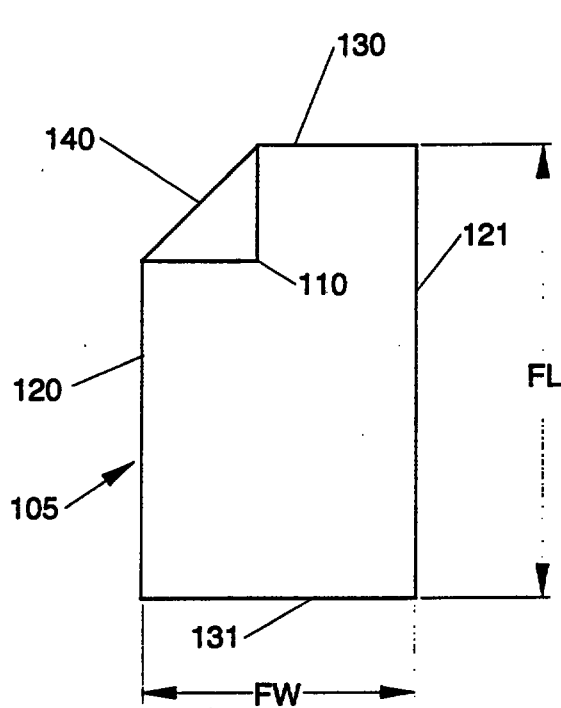


Fig. 3A

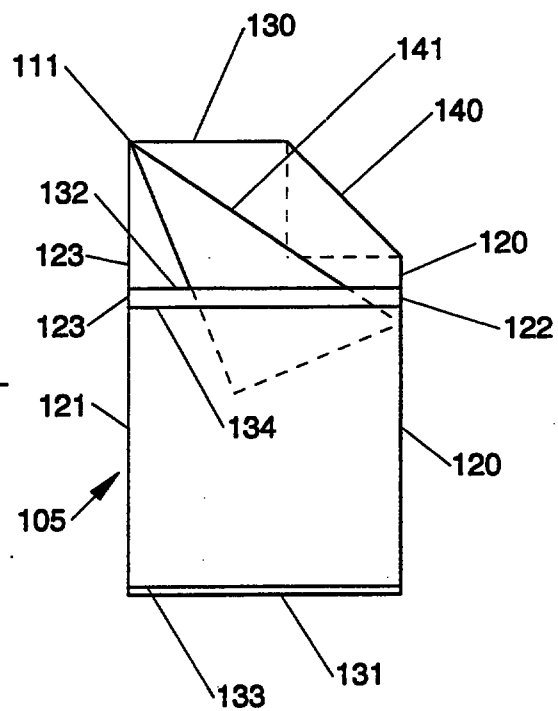


Fig. 3B

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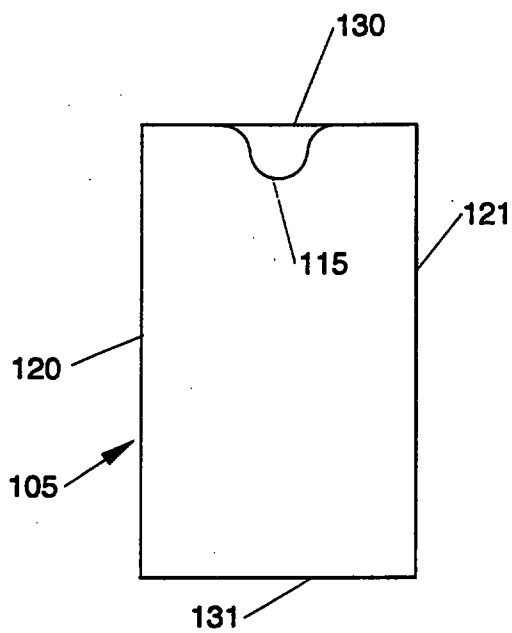


Fig. 3C

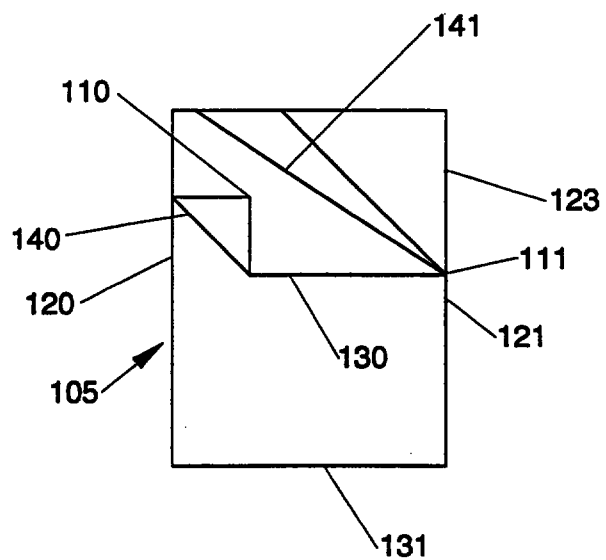


Fig. 3D

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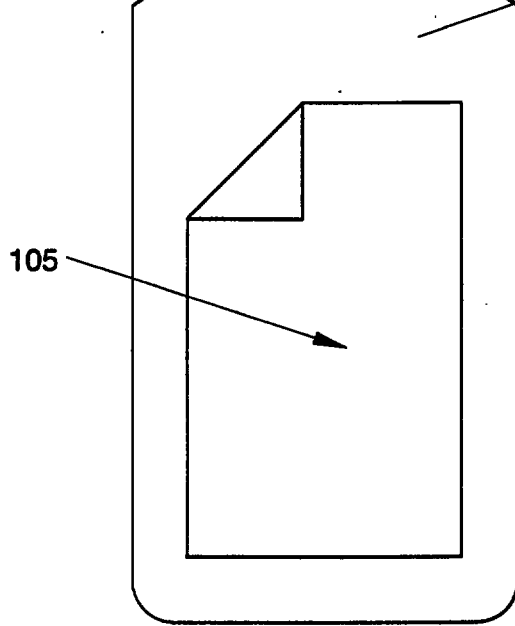


Fig. 4A

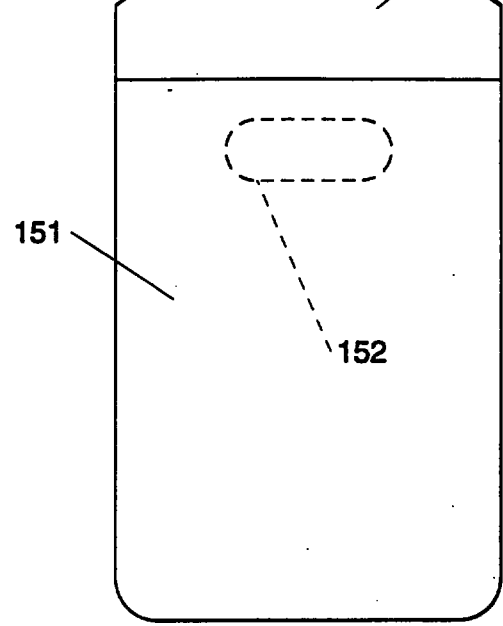


Fig. 4B

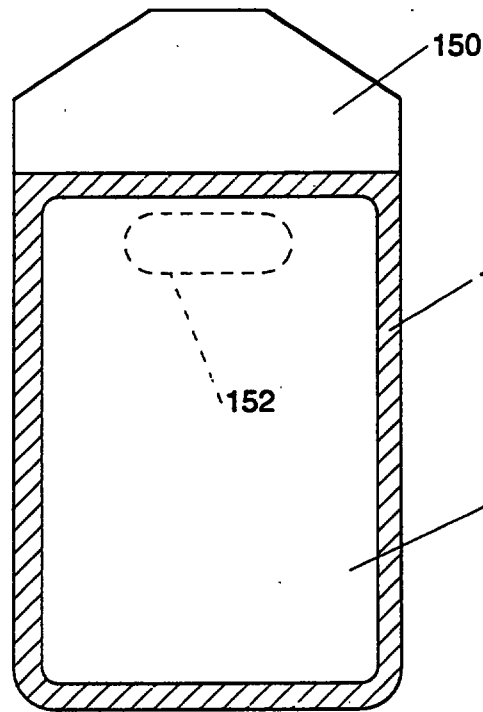


Fig. 4C

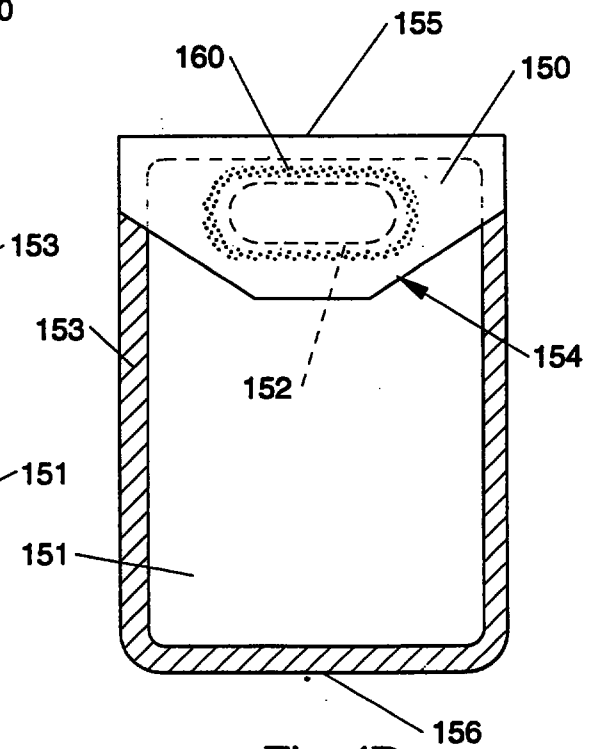


Fig. 4D

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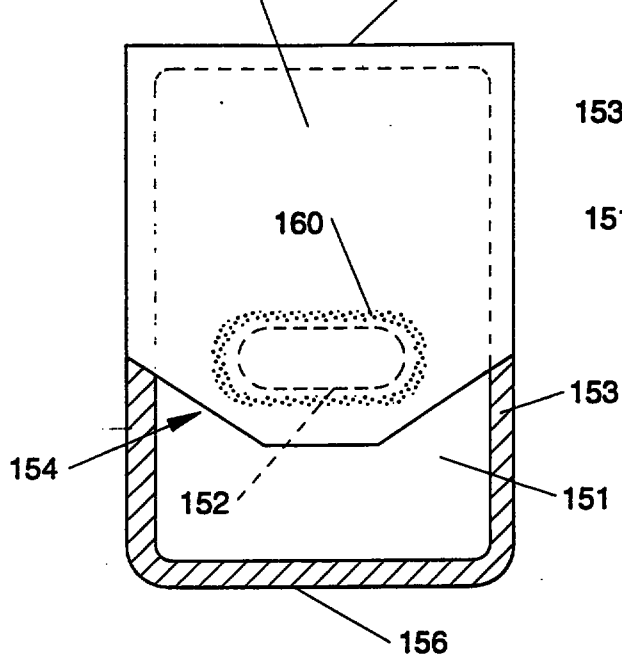


Fig. 4E

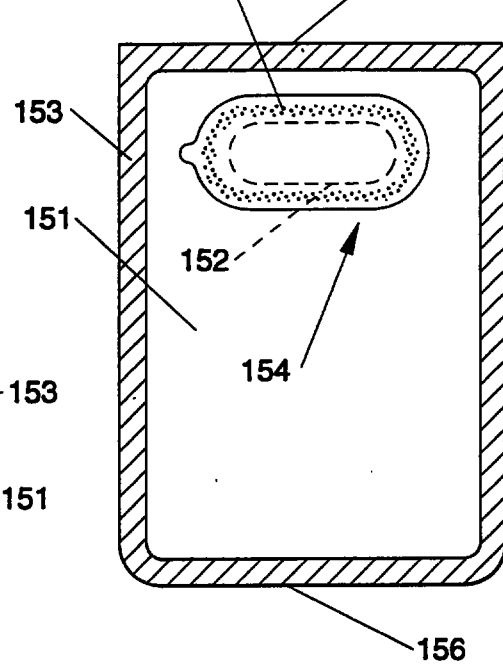


Fig. 4F

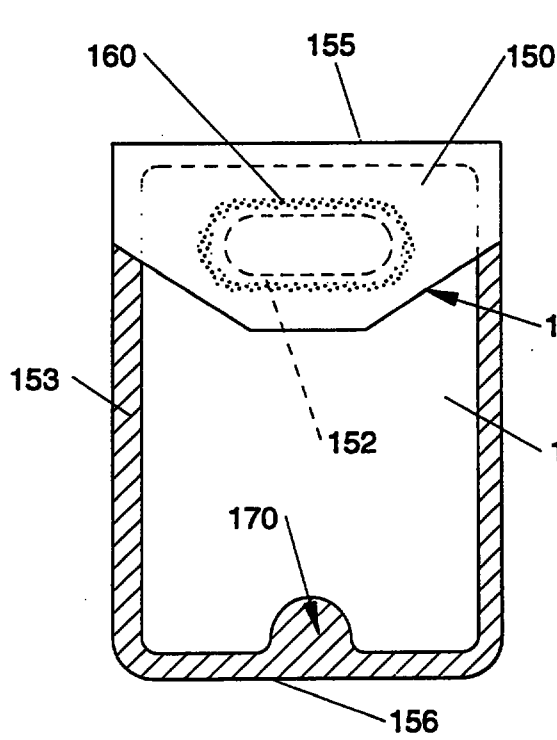


Fig. 4G

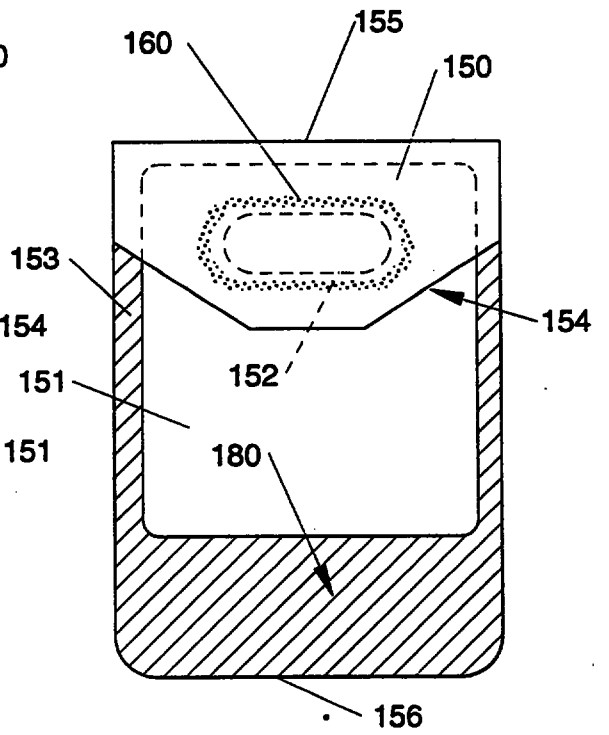
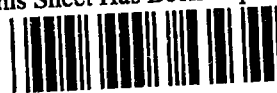


Fig. 4H

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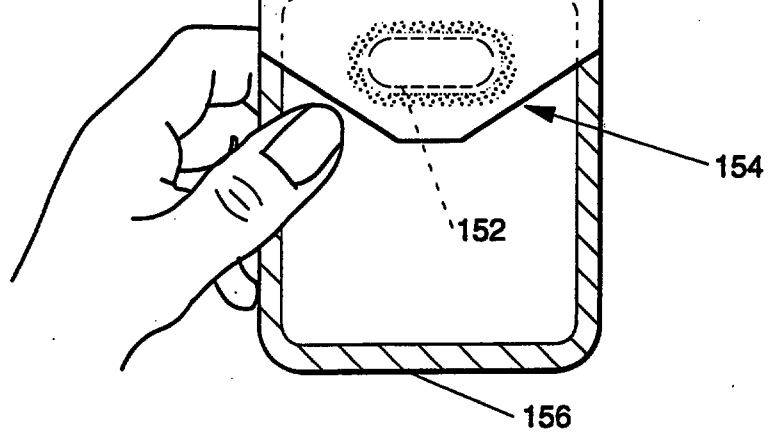


Fig. 5A

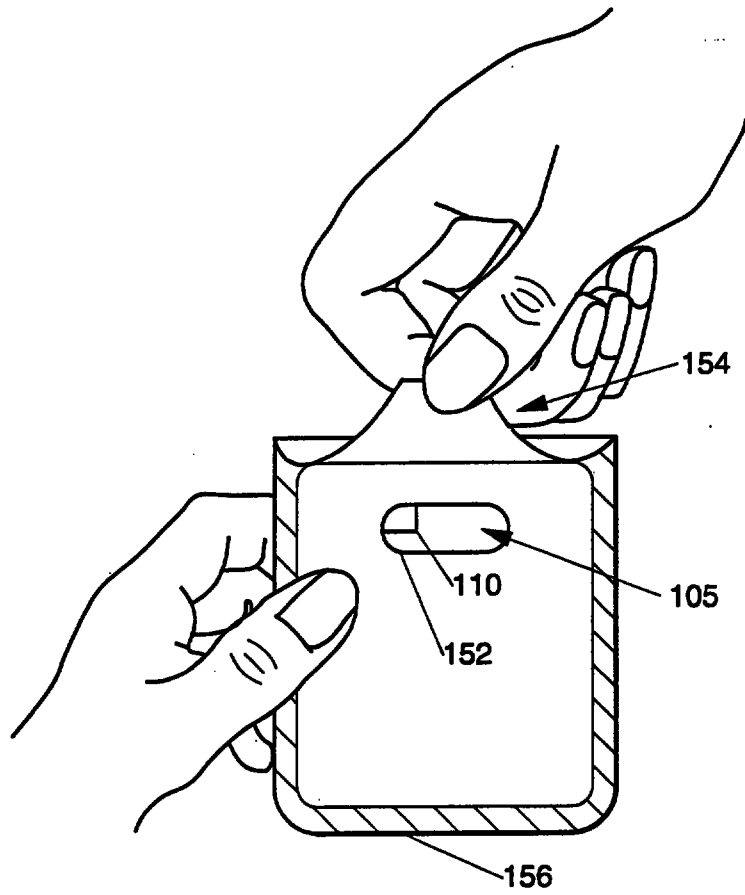


Fig. 5B

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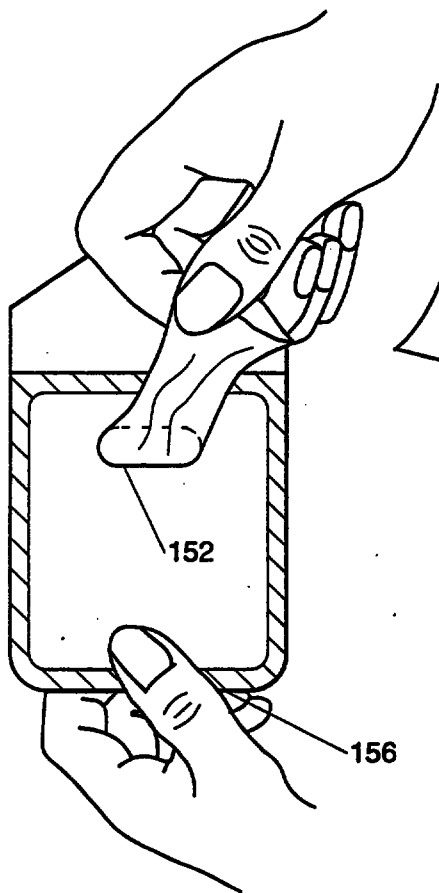


Fig. 5C

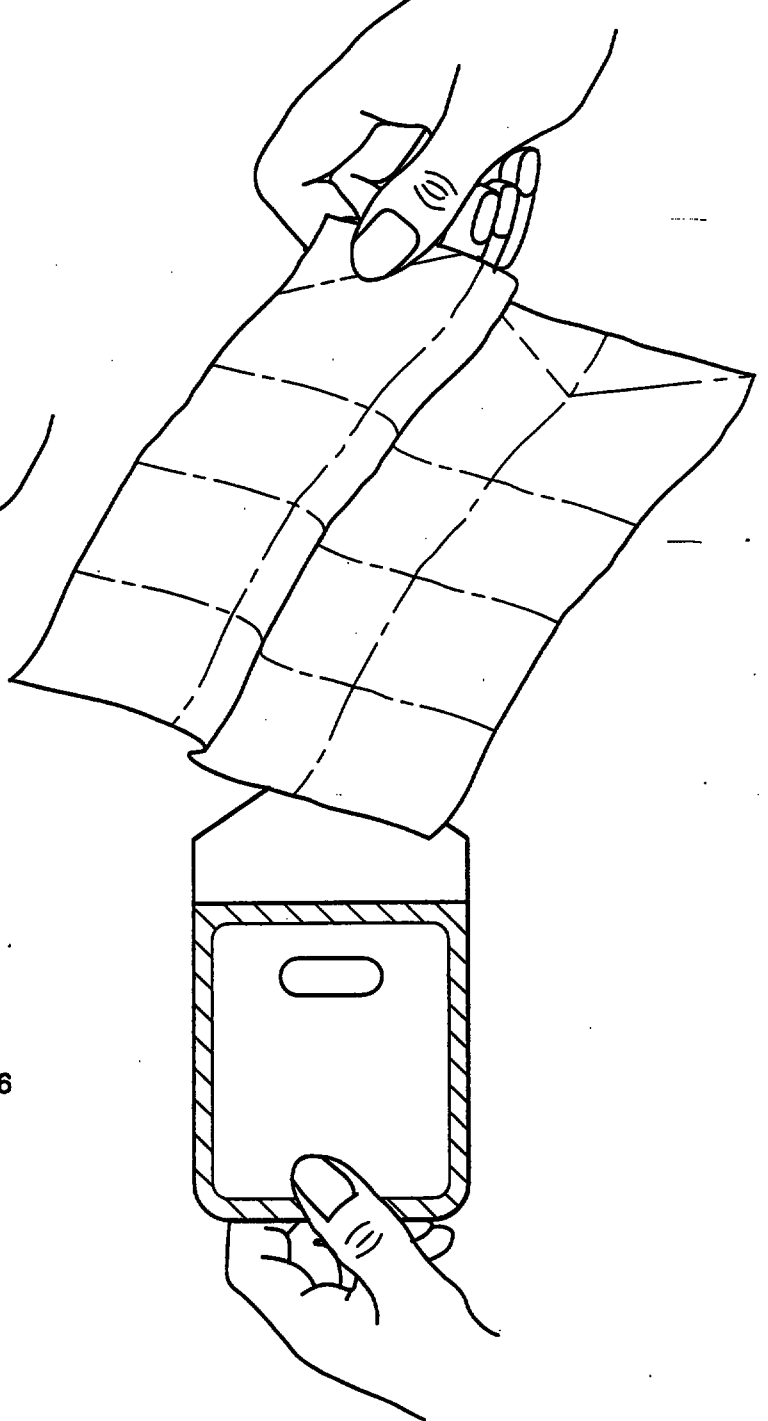


Fig. 5D

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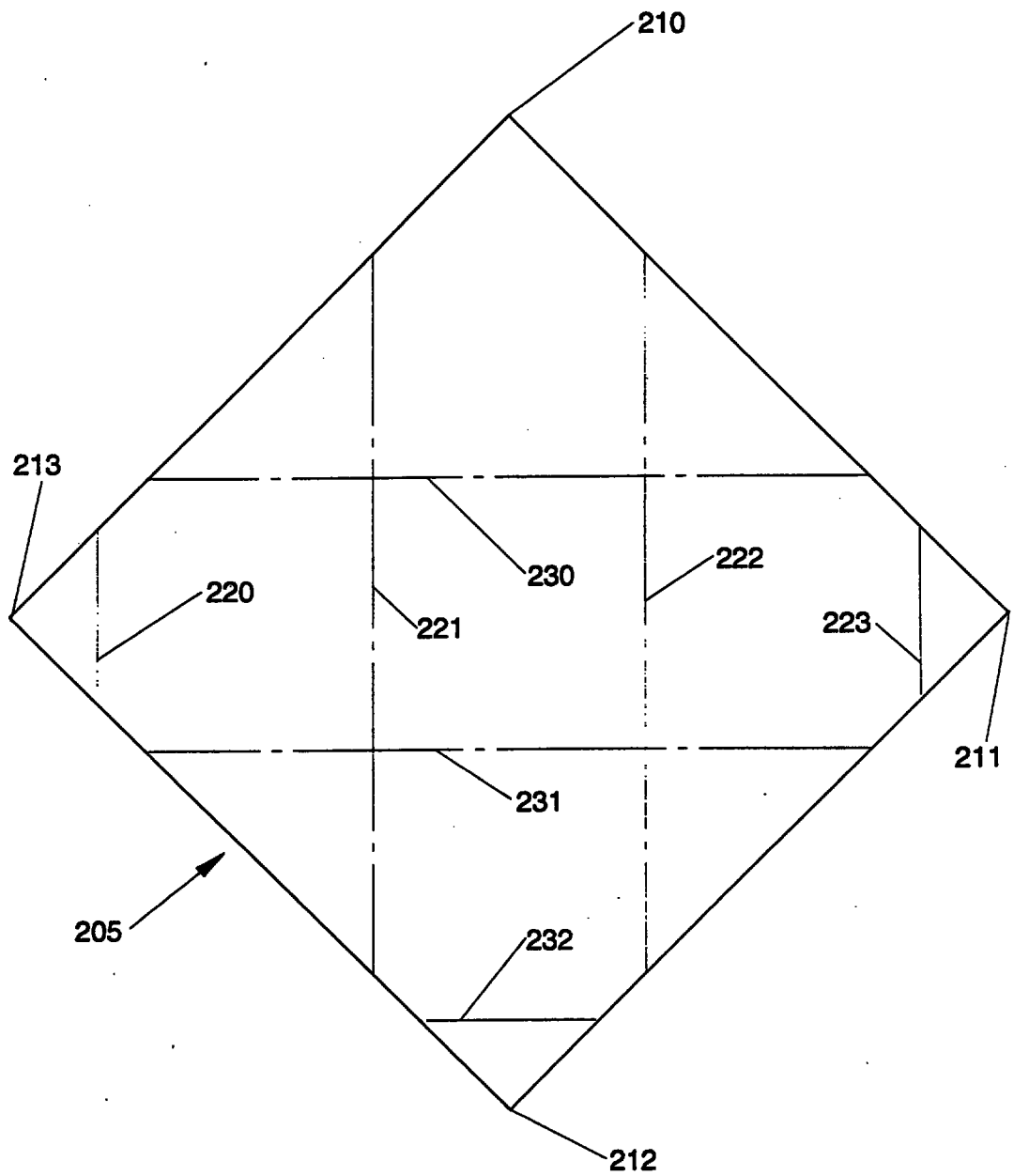


Fig. 6

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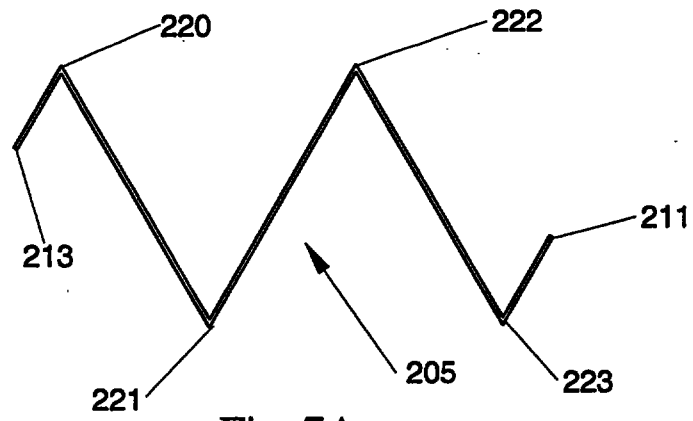


Fig. 7A

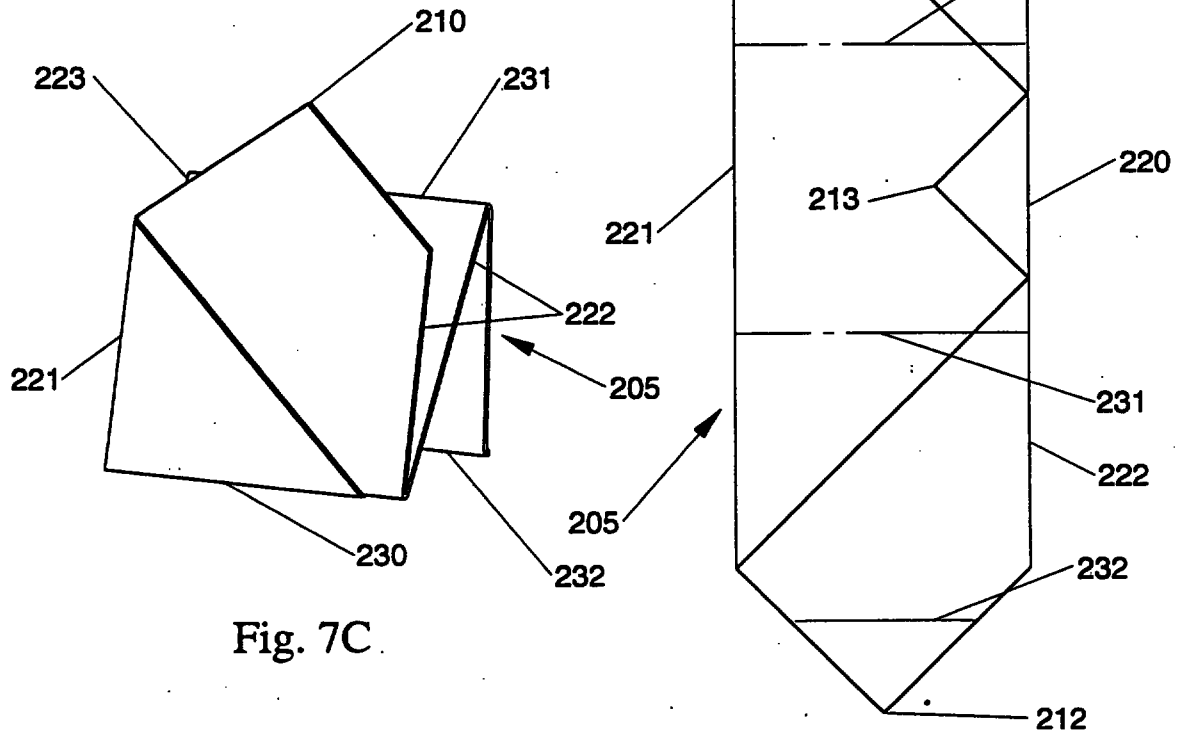


Fig. 7C

Fig. 7B

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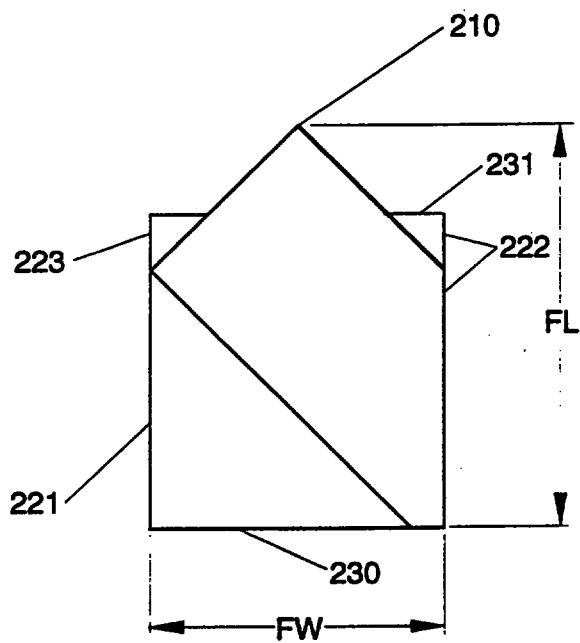


Fig. 8A

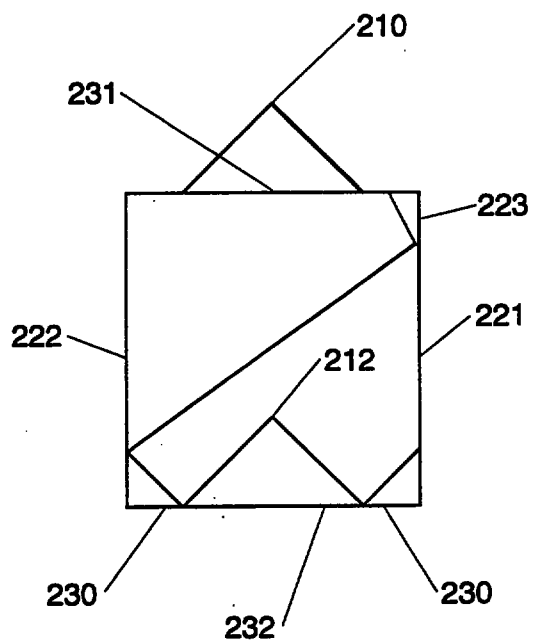


Fig. 8B

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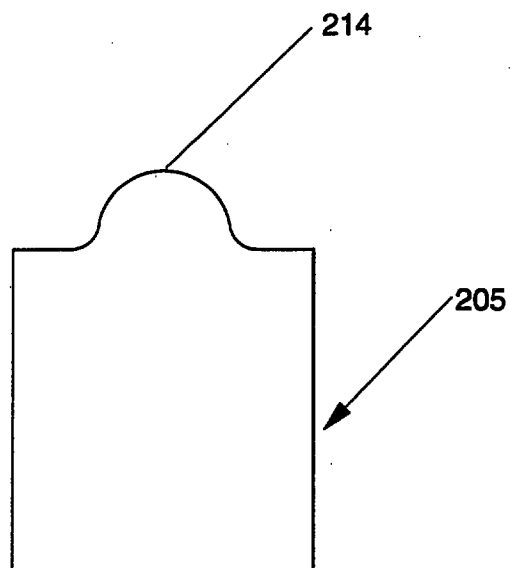
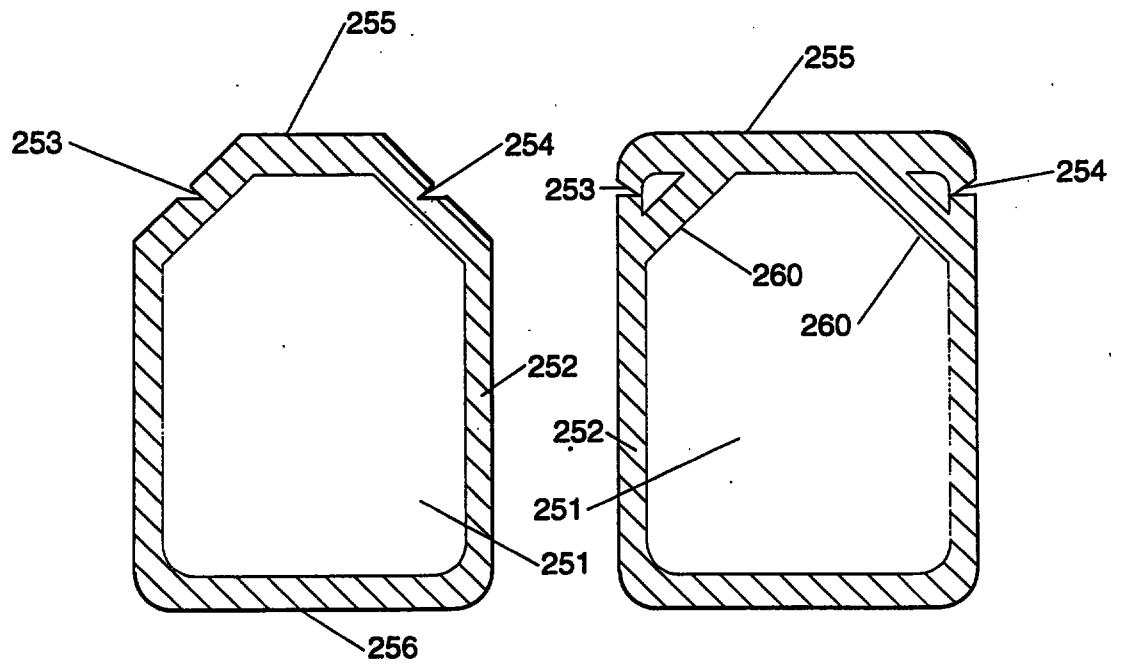
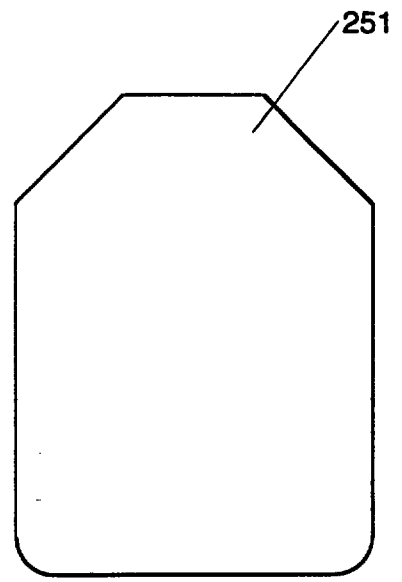
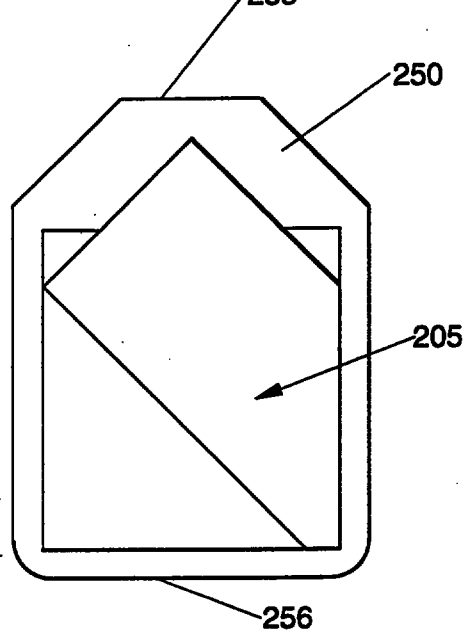


Fig. 8C

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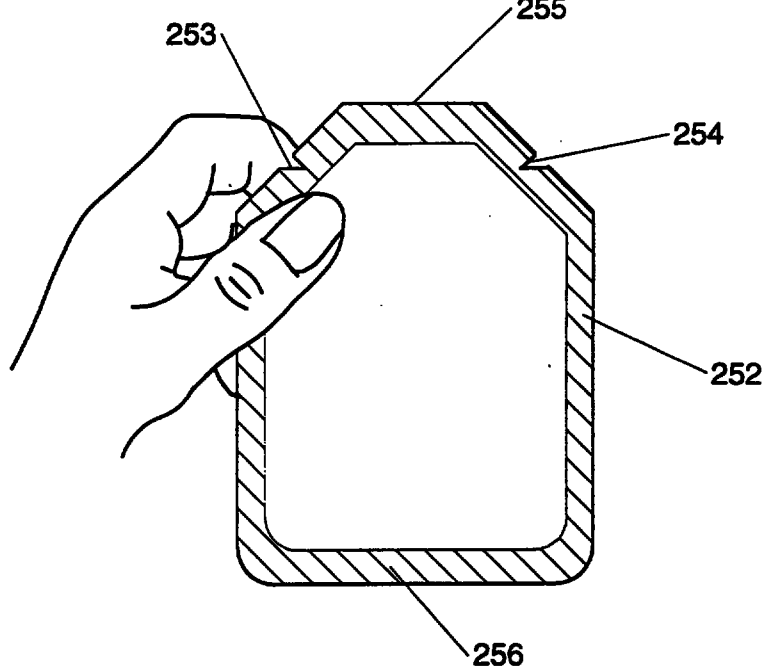


Fig. 10A

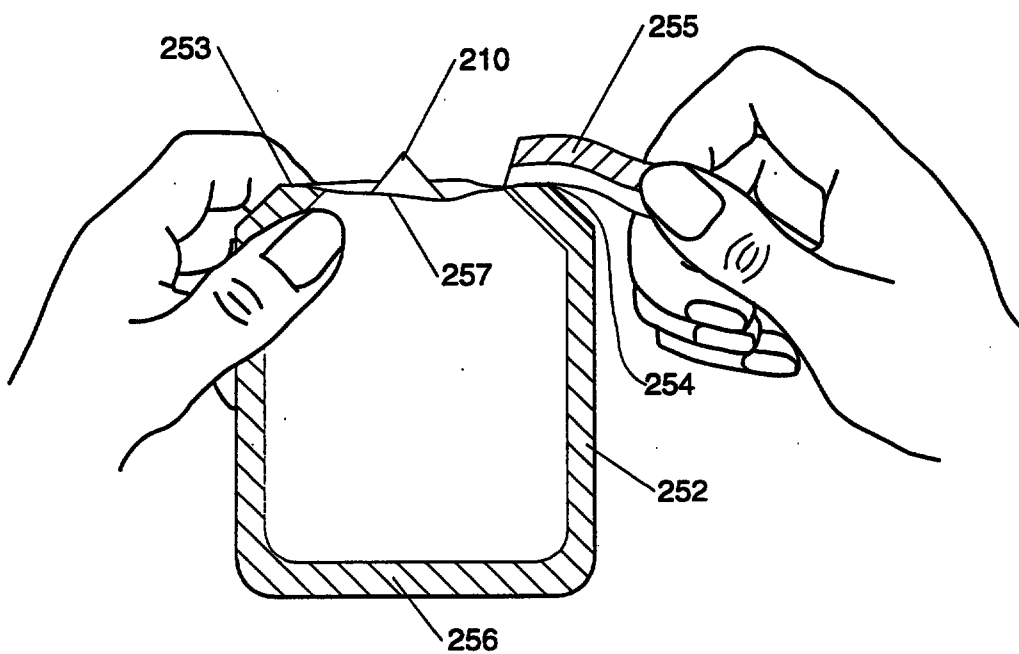


Fig. 10B

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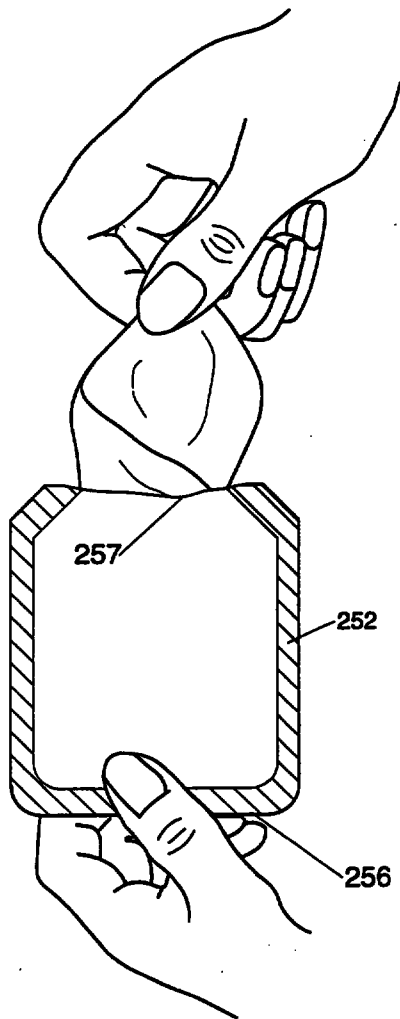


Fig. 10C

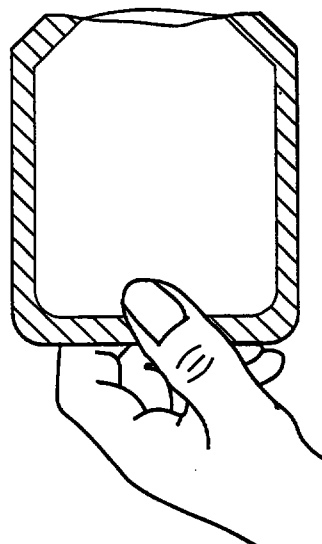
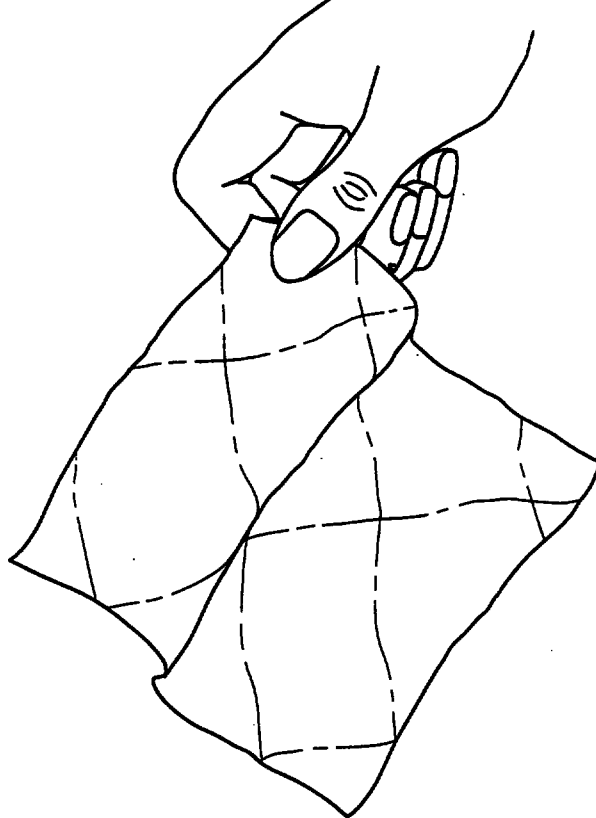


Fig. 10D

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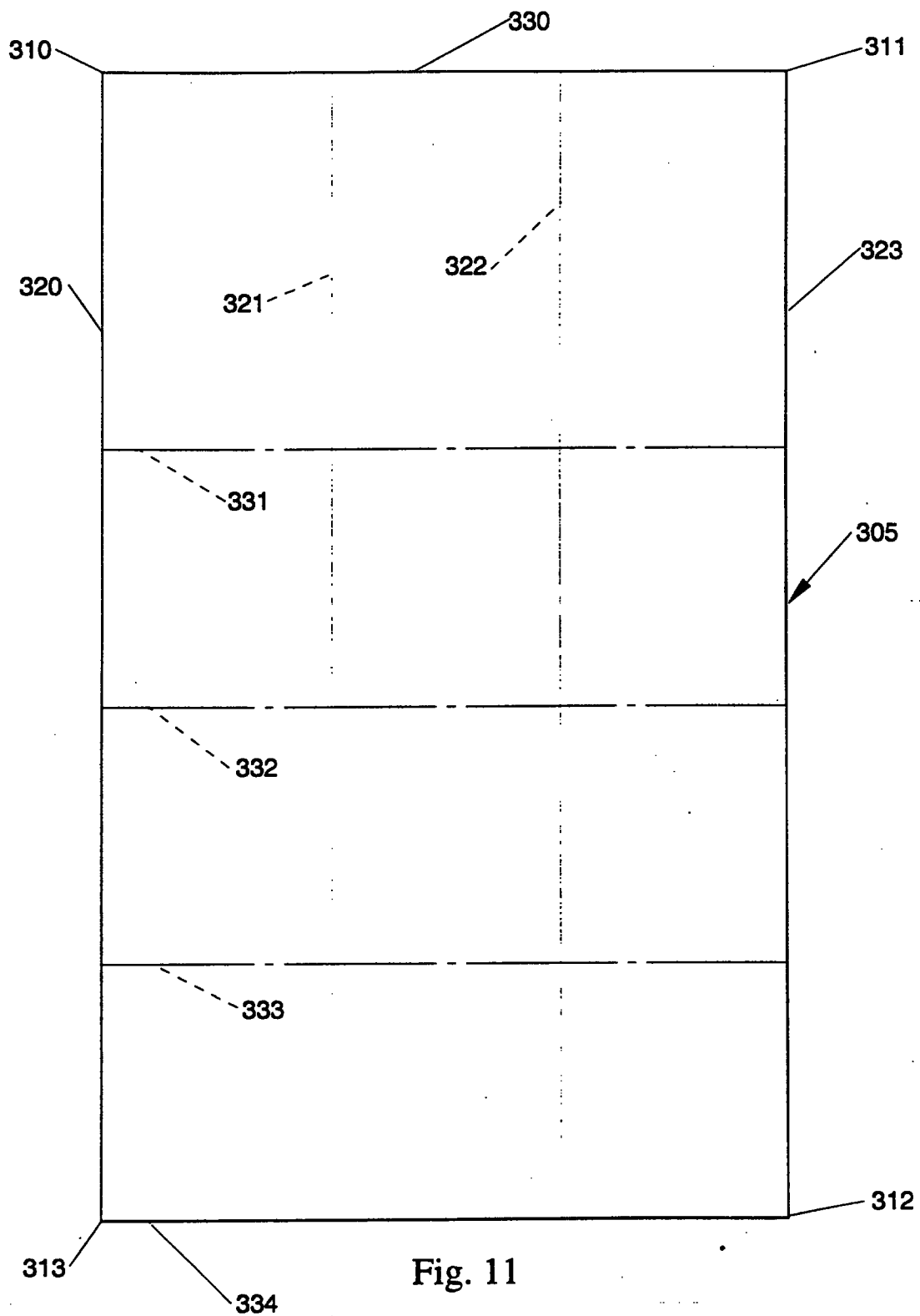


Fig. 11

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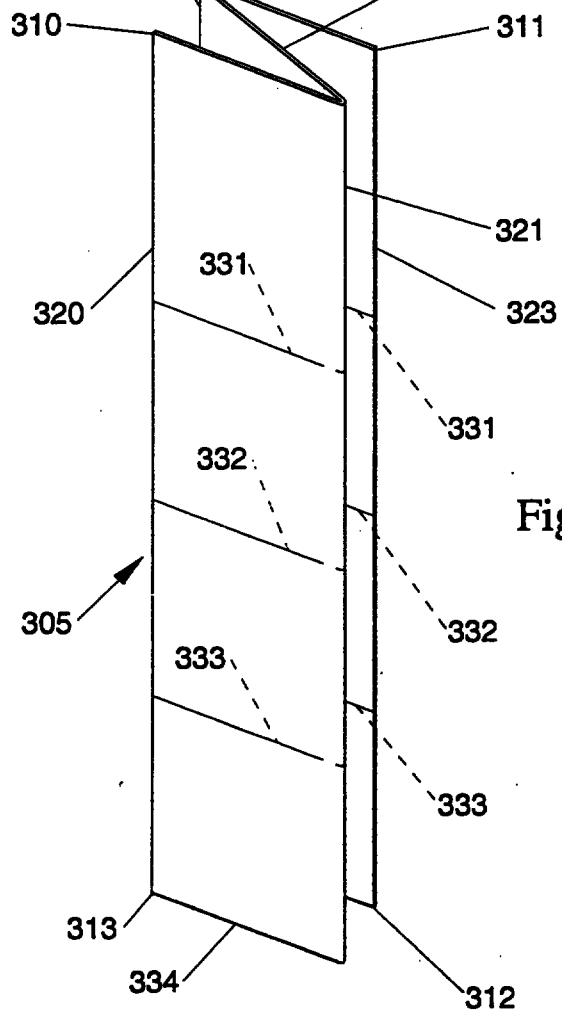


Fig. 12A

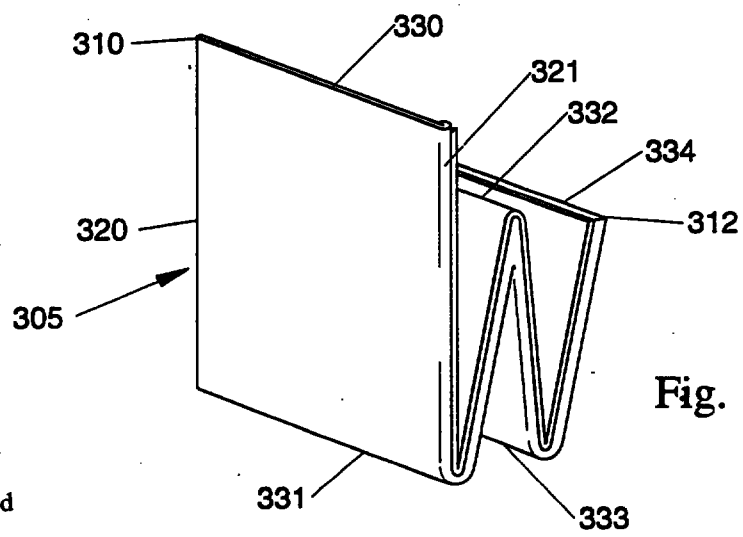


Fig. 12B

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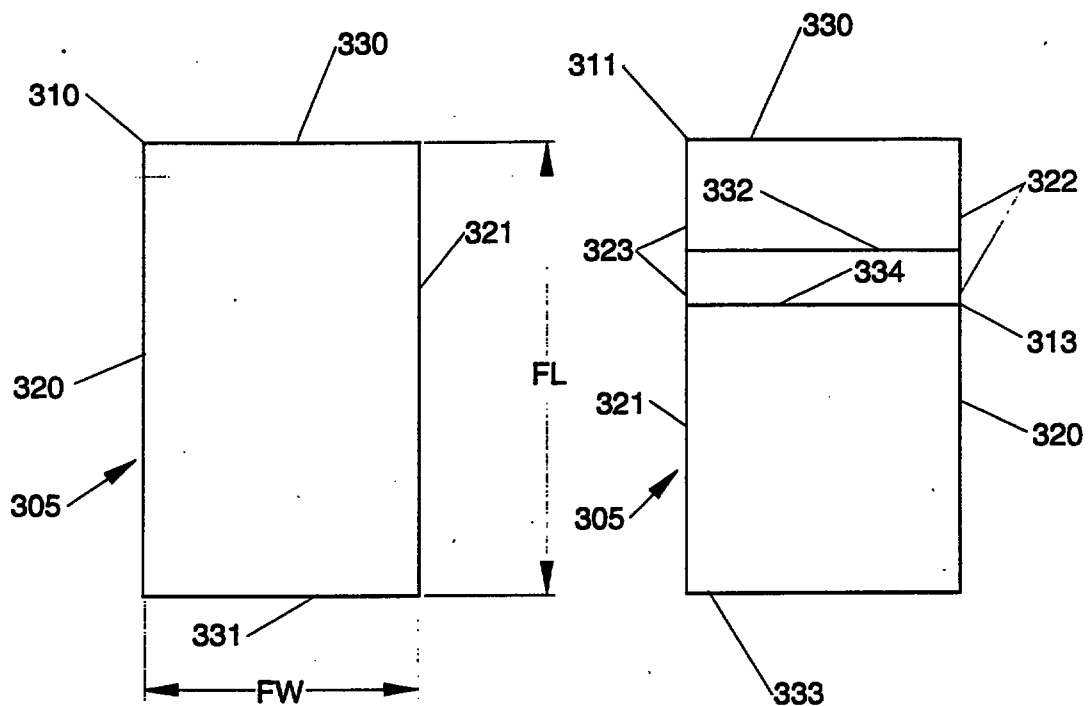


Fig. 13A

Fig. 13B

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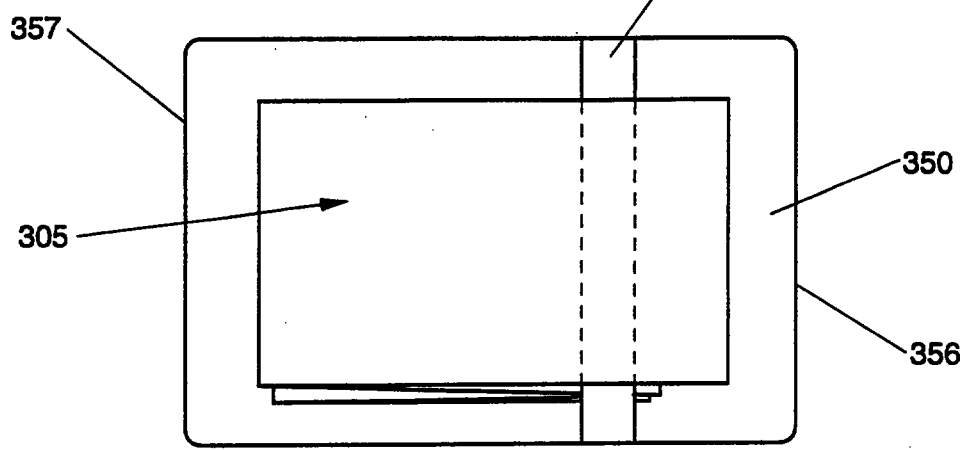


Fig. 14A

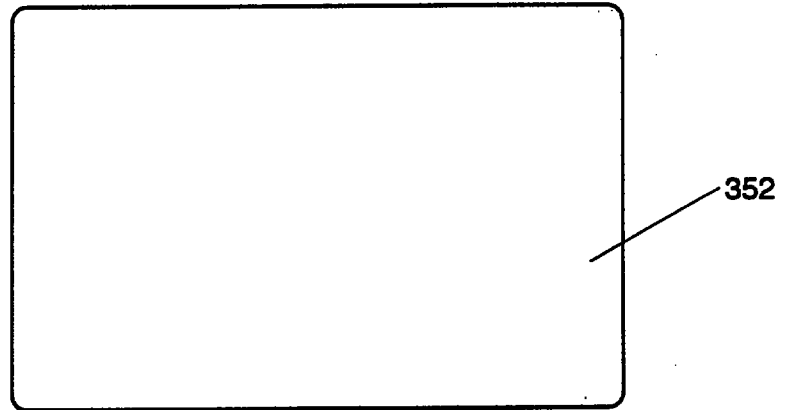


Fig. 14B

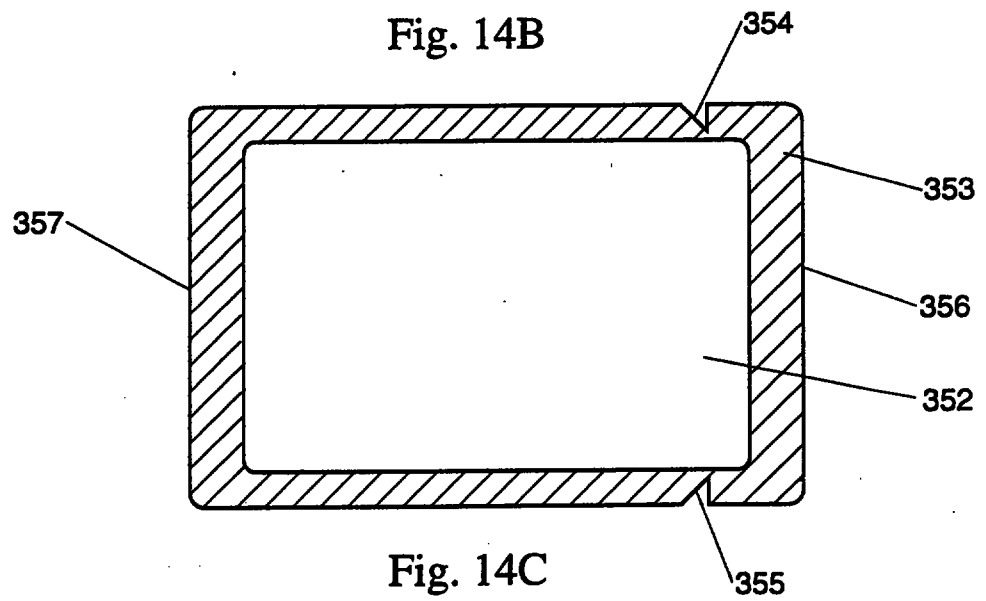


Fig. 14C

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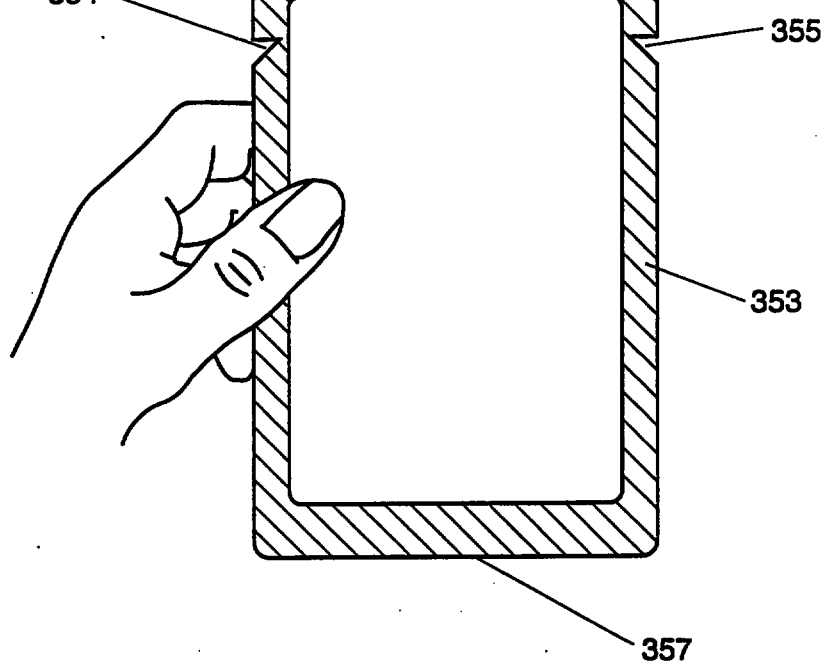


Fig. 15A

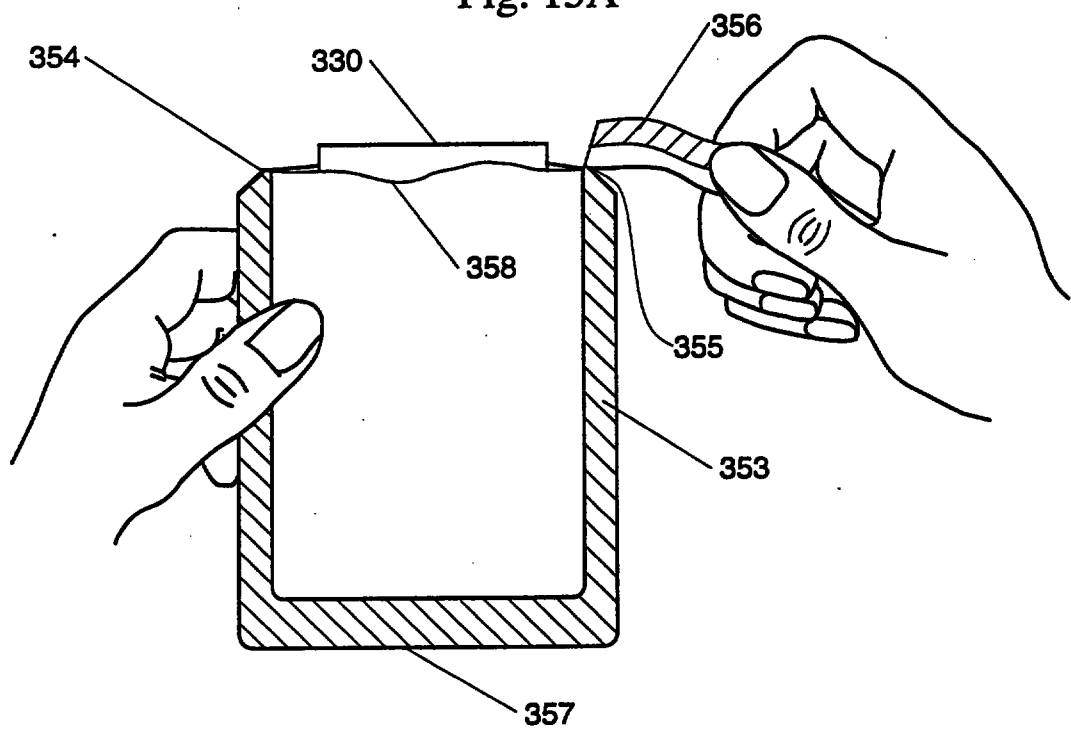


Fig. 15B

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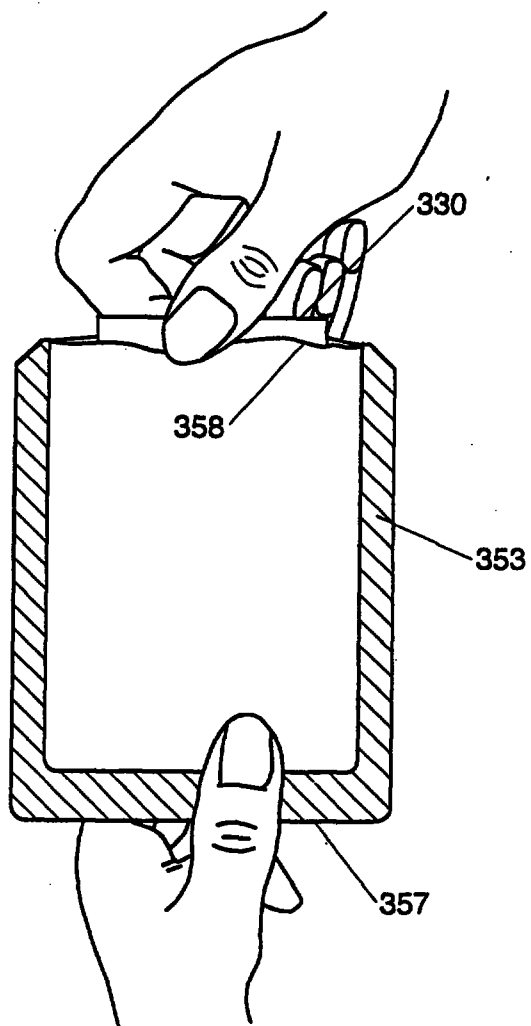


Fig. 15C

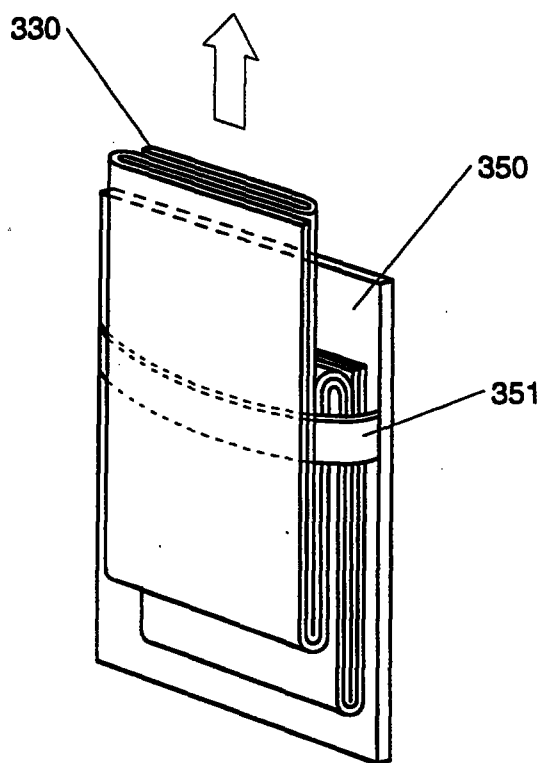
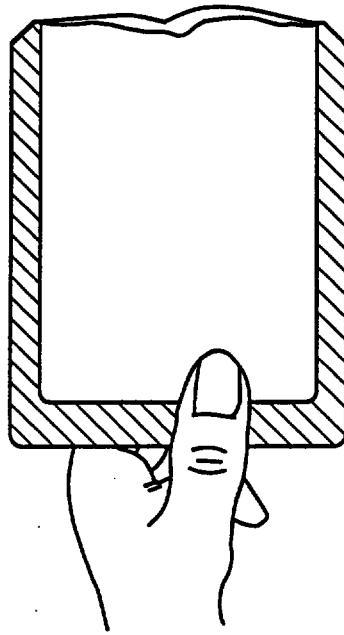
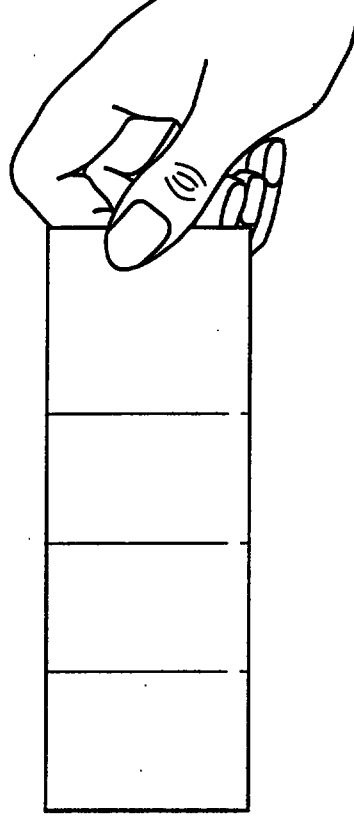


Fig. 15D

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Fig. 15E

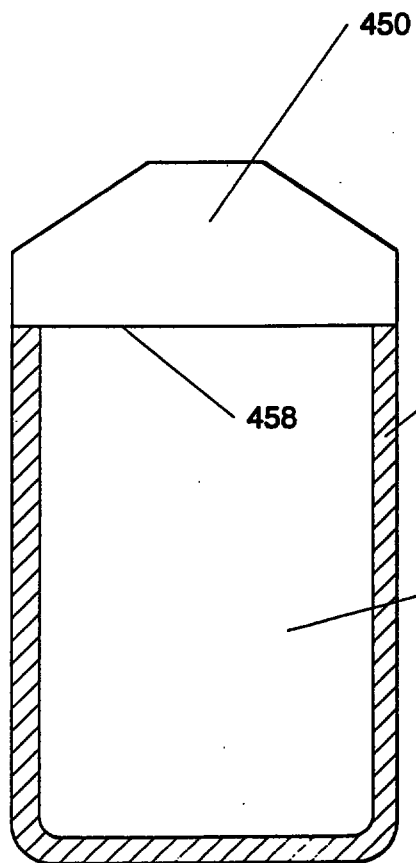


Fig. 16A

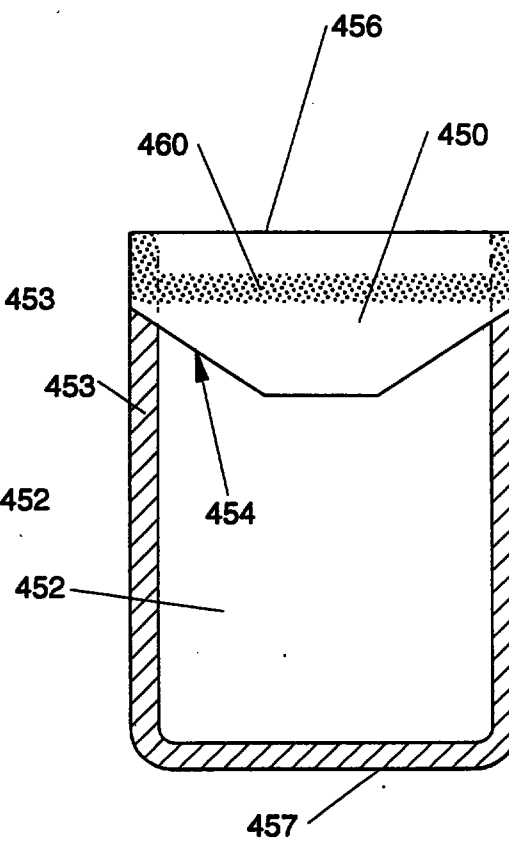


Fig. 16B

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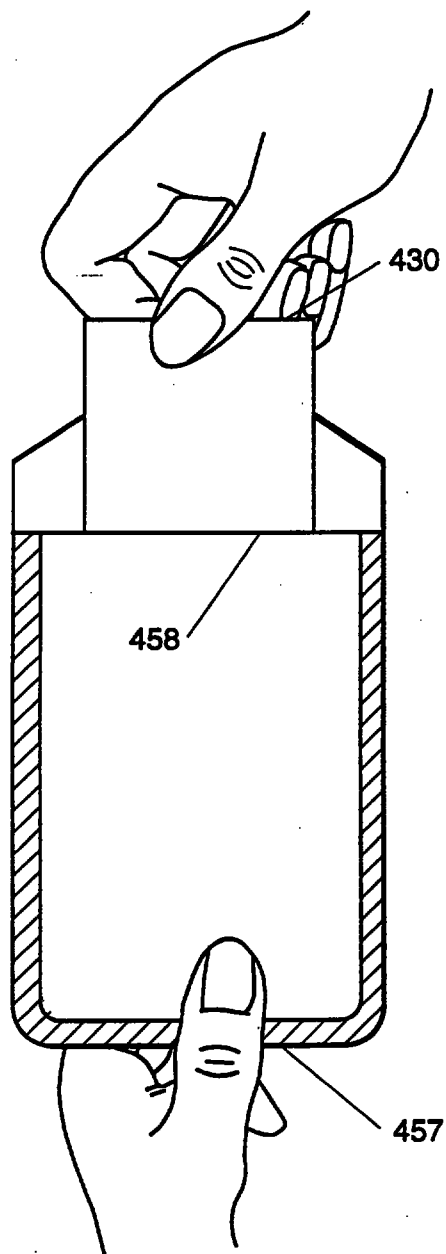


Fig. 17A

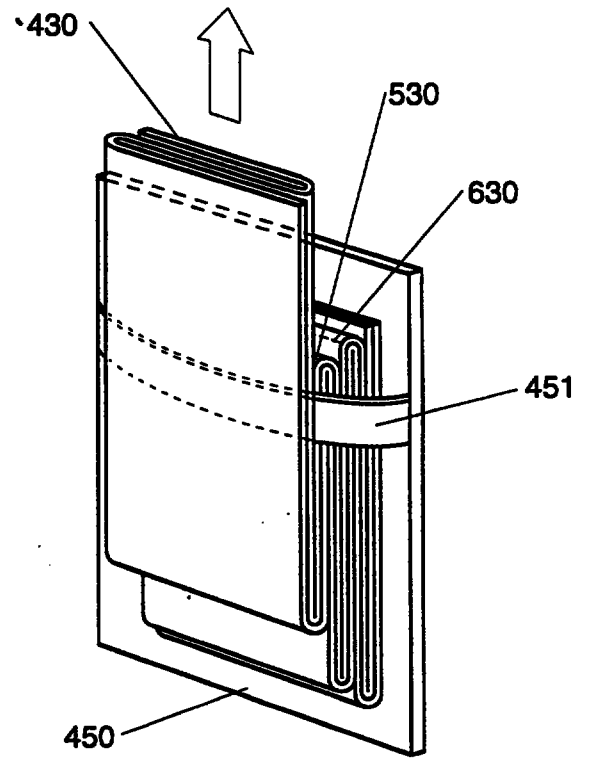
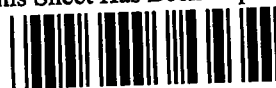


Fig. 17B

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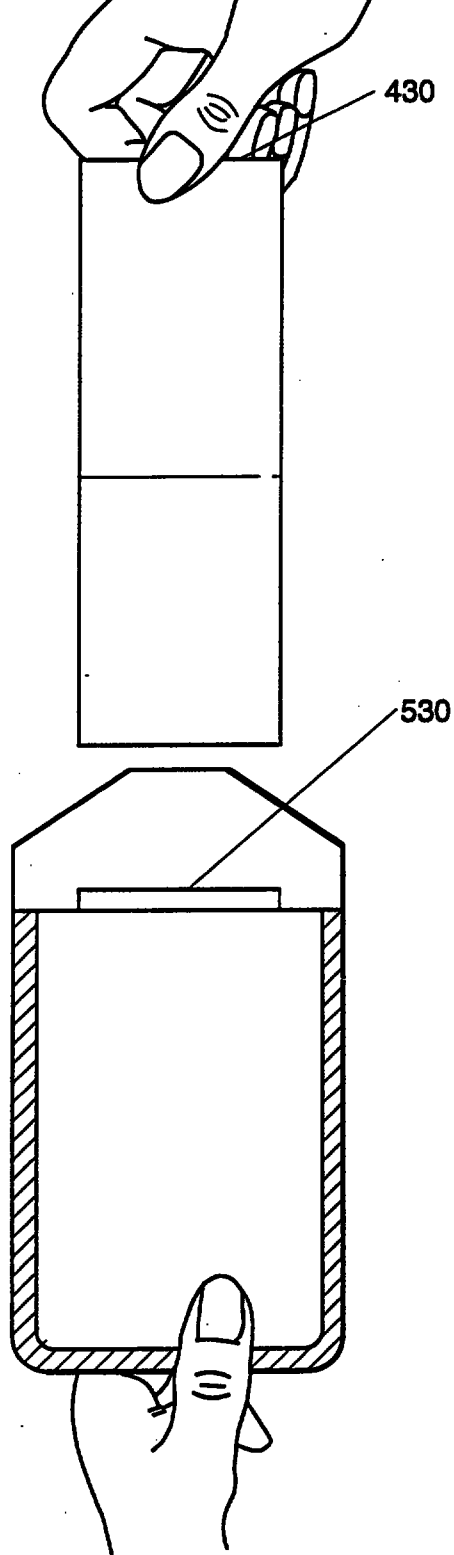


Fig. 17C

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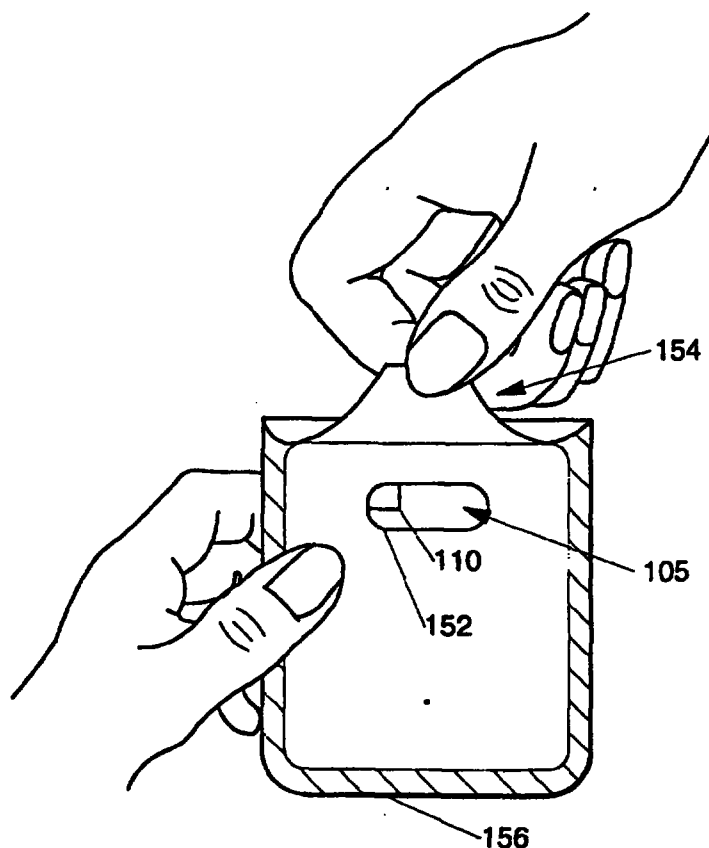
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(54) Title: PACKAGES FOR SINGLE-USE FOLDED TOWELS WHICH PROVIDE FOR UNFOLDING

(57) Abstract

The present invention presents improved packages for single-use, disposable folded towels (105, 205, 305), and more particularly to single- and multi-towel packages which provide for readily grasping a defined portion of the towel upon opening the package and automatic unfolding of the towel upon removal from the package without a separate unfolding step requiring additional consumer action. Single-towel embodiments are disclosed which provide for complete unfolding of the towel by use of: (a) an opening (152, 257) bearing a particular geometrical relationship to the dimensions of the folded towel; or (b) a flexible bar (351, 451) within the package to provide unfolding of the towel in the longitudinal direction. A multi-towel embodiment which provides for the advantageous dispensing features and convenience of an improved single-towel package while providing the added capability of multi-towel transportation is also disclosed. These packages provide for complete containment and protection of the folded towel prior to use, while providing ease of dispensing and unfolding for the consumer at the time of use. Several methods of folding folded towels for use with packages according to the present invention are also disclosed, as well as various methods of fabricating the improved packages according to the present invention.



FIELD OF THE INVENTION

The present invention pertains to improvements in packages for single-use, disposable folded towels. More particularly, the present invention pertains to flexible packages which provide for fully automatic unfolding of a two-directionally folded towel upon removal from the package without a separate unfolding step requiring additional consumer action. The present invention also pertains to flexible packages which provide for automatic unfolding in the withdrawing direction of a two-directionally folded towel upon removal from the package. Both single-towel and multi-towel packages incorporating these advantageous features are presented.

BACKGROUND OF THE INVENTION

In today's society, cleanliness is very important both from a health standpoint and an aesthetic standpoint. However, when one is away from home it is much more difficult to perform personal cleansing due to unavailability of traditional cleansing tools such as soap, cloths, and running water. Cleansing of sensitive areas of the body also requires special consideration, as ordinary towel products, cleansing agents, and other associated materials such as disinfectants may cause irritation and discomfort.

To address this problem, manufacturers of consumer products have developed disposable, paper-based towel products which are pre-moistened with a non-irritating cleansing agent. As used herein, the terms "single-use" and "disposable" are used interchangeably to refer to towels and packages which are to be used once and then discarded, rather than retained (and perhaps cleaned) for reuse. There are two basic types of containers for such pre-moistened towel products, namely multi-towel containers and single-towel disposable packages.

In a typical multi-towel container, a flexible or rigid moisture-impervious container is utilized. The pre-moistened towel products are either on a roll, with perforations defining the ends

REPLACED SHEETS	SG
☐ Description : paged to paged	
☒ Claim(s) : paged <u>1</u> to paged <u>16</u>	
☐ Drawing(s) : paged to paged	
☒ Abstract : paged <u>11</u> to paged <u>1</u>	
DATE OF RECEIPT	

REPLACEMENT SHEETS	SG
☒ Description : paged <u>1</u> to paged <u>16</u>	
☒ Claim(s) : paged <u>13</u> to paged <u>18</u>	
☒ Drawing(s) : paged <u>125</u> to paged <u>25/25</u>	
☒ Abstract : paged <u>11</u> to paged <u>1</u>	
DATE OF RECEIPT <u>30/9/96</u>	

5 dispensing of individual towels, and are usually recloseable to
protect the remaining towels. The major drawback of most
multi-towel containers is that, because of the number of towels
contained, of necessity they have a significant amount of bulk, are
awkward to carry away from home, and render discretion in use
10 practically impossible.

Pocket-sized, single-towel disposable packages designed for
away-from-home use avoid the bulk and awkwardness of the multi-towel
containers, but are not without drawbacks. Most such packages do
not have a defined portion of the towel which is presented to the
15 consumer upon opening the package, and hence the consumer must
typically reach inside the package and fish about for the folded
towel to grasp and extract it. Due to the lack of a roll of towels
to feed from and/or other towels to interact with, in a typical
single-towel package the folded pre-moistened towel is typically
20 dispensed as a small, tightly folded moist pad consisting of the
towel as it remains folded in two directions, i.e., along major axes
of the towel. The consumer must then manually unfold this small pad
of material to have the entire extent of the towel available for
use. This is an undesirable and time-consuming process requiring
25 two hands to accomplish, and without which the towel is of little
practical use. The pre-moistened nature of the towel exaggerates
this problem. The amount of handling of the towel which this
unfolding requires also presents a significant likelihood of
contamination of the towel prior to actual use.

30 The present invention is directed to improving single- and
multi-towel packages to provide the advantageous accessibility and
unfolding features of multi-towel containers while retaining the
transportability and concealability of a single-towel disposable
package, and thus increase consumer satisfaction with this type of
product. A plurality of such single-towel packages, or multi-towel
35 variations of such packages, may thus provide comfort and
convenience as might be required for a day of traveling or a full

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5 The drawbacks of typical single-towel disposable packages may
be remedied by providing some means for presenting the towel for
grasping by the consumer, as well as some means to interact with the
folded towel upon removal from the package so as to cause it to
unfold. Of the possible ways of accomplishing this interaction,
10 most must be ruled out as too costly, too complex, or too bulky in
the context of such a pocket-sized, single-towel disposable package.

Packages according to the present invention provide the
advantageous accessibility and unfolding features of multi-towel
containers while retaining the transportability and concealability
15 of a single-towel package by providing a package design in which
elements of the package itself provide greater accessibility of
defined portions of the towel for grasping, and interact with the
folded towel to provide the desired unfolding action. The total
package remains compact, flexible, liquid-impervious, and simple in
20 its construction. Simplicity equates to low manufacturing costs and
reliability in consumer usage.

The present invention consists of three basic package
configurations which, in combination with the action of removing a
folded, pre-moistened towel, unfold the towel for use. Such
25 packages are sized, and the towels folded to a corresponding size,
so as to be appropriate for carrying in a pocket, travel bag, or
purse for use away from home.

In a first embodiment of the present invention, a package
slightly larger than the folded towel is utilized. On one side, the
30 package has an elongated opening with a major dimension slightly
smaller than the minor dimension (width) of the folded towel and a
minor dimension slightly larger than the thickness of the leading
edge of the folded towel. At the end of the towel adjacent to the
opening, the towel has a grasping portion which provides a grasping
35 point for the consumer. When the consumer exposes/opens this
opening, grasps the grasping portion, and withdraws the folded

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5 in a second embodiment according to the present invention, a
package again slightly larger than the folded towel is utilized. At
one end, the package tapers down to a pre-determined width which,
when torn open by the consumer, provides an elongated opening having
a major dimension slightly smaller than the minor dimension (width)
10 of the folded towel. At the end adjacent to the tapered end, the
towel has a grasping portion which provides a grasping point for the
consumer. When the consumer tears open the tapered end of the
package, grasps the grasping portion, and withdraws the folded
towel, it completely unfolds the towel, leaving the consumer holding
15 a fully unfolded, ready-to-use towel. The geometrical relationship
between the opening formed by tearing open the tapered end and the
folded towel is the key to the unfolding performance of this
embodiment of the present invention.

In a third embodiment according to the present invention, a
20 package again slightly larger than the folded towel is utilized. At
one edge, the package is designed to be torn open by the consumer to
expose one end of the folded towel. Inside the package, extending
completely across the width of the package from one side seam to the
other, a flexible bar-like member formed of a thin, flexible
25 material is located up to approximately one-fourth to one-half of
the way down from the leading edge of the folded towel. This
bar-like member is interleaved with the folds of the towel such
that, when the consumer tears open the package, grasps the leading
edge of the towel, and withdraws the towel, it fully unfolds the
30 towel in the lateral direction. The consumer then merely has to
unfold the towel in the longitudinal direction. The key to the
unfolding performance of this embodiment of the present invention is
the bar-like member forcing the towel to unfold and pass behind it
on the way out through the open edge of the package. This
35 embodiment is particularly well-suited for adaptation as a
multi-towel package.

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5 Figure 1 is a plan view of an unfolded towel according to a first embodiment of the present invention.

 Figures 2A through 2C are perspective views depicting the steps required to fold a towel such as depicted in Figure 1.

10 Figures 3A and 3B are plan views of a towel folded according to Figures 2A-2B, with Figure 3A depicting a front view and Figure 3B depicting a back view.

 Figures 3C and 3D are frontal plan views of alternative folded towel configurations suitable for use with packages according to the first embodiment of the present invention.

15 Figures 4A through 4D are plan views depicting the steps required to assemble an improved package according to a first embodiment of the present invention.

20 Figures 4E through 4H are plan views of alternative package configurations according to the first embodiment of the present invention.

 Figures 5A through 5D are perspective views depicting the steps required to open an improved package and remove the folded towel according to the first embodiment of the present invention.

25 Figure 6 is a plan view of an unfolded towel according to a second embodiment of the present invention.

 Figures 7A through 7C depict the steps required to fold a towel such as depicted in Figure 6, with Figure 7A being an elevational view, Figure 7B being a plan view, and Figure 7C being a perspective view.

30 Figures 8A and 8B are plan views of a towel folded according to Figures 7A-7C, with Figure 8A depicting a front view and Figure 8B depicting a back view.

35 Figure 8C is a frontal plan view of an alternative folded towel configuration suitable for use with packages according to second and third embodiments of the present invention.

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5 configuration according to the second embodiment of the present invention.

Figures 10A through 10D are perspective views depicting the steps required to open an improved package and remove the folded towel according to the second embodiment of the present invention.

10 Figure 11 is a plan view of an unfolded towel according to a third embodiment of the present invention.

Figures 12A and 12B are perspective views depicting the steps required to fold a towel such as depicted in Figure 11.

15 Figures 13A and 13B are plan views of a towel folded according to Figures 12A and 12B, with Figure 13A depicting a front view and Figure 13B depicting a back view.

Figures 14A through 14C are plan views depicting the steps required to assemble an improved package according to a third embodiment of the present invention.

20 Figures 15A through 15E are perspective views depicting the steps required to open an improved package and remove the folded towel according to the third embodiment of the present invention.

25 Figures 16A and 16B are plan views depicting two of the steps required to assemble an improved package according to a multi-towel variation of the third embodiment of the present invention.

Figures 17A through 17C are perspective views depicting three of the steps required to open an improved package and remove the folded towels according to a multi-towel variation of the third embodiment of the present invention.

30 **DETAILED DESCRIPTION OF THE
PREFERRED EMBODIMENTS**

What follows is a description of three possible embodiments of improved packages according to the present invention. While each is accompanied by a description of a presently preferred manner of
35 folding a folded towel for use with each package, it is to be understood that there are many possible ways of folding towels for use with such improved packages, so long as certain common

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5 First, the term "flexible" is intended to encompass materials
which are easily bent and conform to irregular surfaces as, for
example, materials flexible enough to be carried in one's pocket or
purse relatively unobtrusively and without discomfort, as well as
10 materials which are flexible enough to perform the desired wiping or
cleansing tasks.

The term "thin" refers to materials having thicknesses which
are substantially less than their length and/or width such as, for
example, various sheet-like and cord-like materials. Such materials
may typically have thickness on the order of about 1/16 inches (1.59
15 mm) or less, although somewhat thicker materials may be utilized if
they have sufficient flexibility for use with packages according to
the present invention, as discussed above.

The term "liquid-impervious" is intended to encompass materials
which generally deny penetration of liquid material through them in
20 either direction, such as into or out of a package formed of such a
material, the liquid being any common, non-toxic liquid which will
not physically compromise the integrity of the package.

It should be noted that in all Drawing Figures the towel
materials and package materials have a thickness represented by a
25 single line for graphic clarity, although in reality of course the
towel materials and package materials have a finite and measurable
thickness.

In the Drawing Figures, Figures 1 through 5D depict an improved
package and folded towel according to a first embodiment of the
30 present invention.

Figure 1 illustrates a towel for use with a package according
to a first embodiment of the present invention, which is depicted in
its unfolded state. The numeral 105 denotes the towel generally,
and the numerals 110, 111, 112, and 113 are used to identify the
35 four corners of the towel 105, which may be generally rectangular in
shape in a preferred configuration. The towel 105 also has two side
edges 120 and 123, a leading edge 130, and a trailing edge 134.

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lateral fold lines are thus mutually orthogonal. The towel 105 also preferably has three diagonal fold lines 140, 141, and 142 adjacent to leading edge 130.

10 Figures 2A through 2C depict the folding process to fold the towel 105 depicted in Figure 1.

15 In Figure 2A, the towel 105 has been z-folded along fold lines 121 and 122 such that side edge 120 overlies fold line 122, and side edge 123 is behind fold line 121. This folding step has now also formed a rear corner 114, the use of which becomes apparent in
20 Figure 2B. This folding operation has defined the folded width (FW) of the folded towel, measured parallel to the lateral fold lines, and has also defined a first folded thickness (FFT), which is the thickness of the overlying longitudinally folded portions of the towel.

25 In Figure 2B, the corner 110 has been folded diagonally downward and forward to form a free corner, and hence a grasping portion for extracting the folded towel from the improved package. In addition, rear corner 114 is shown being folded diagonally downward and rearward along fold lines 141 and 142 so as to isolate
30 the portion of the leading edge 130 adjacent to the grasping portion formed by free corner 110. This ensures that the consumer will only grasp the front thickness of the folded sheet; and that only by free corner 110, rather than grasping the entire thickness of the folded sheet or one of the more rearward layers. Corner 110 will be the first portion of the towel to be withdrawn from the package, initiating the withdrawal of leading edge 130. Trailing edge 134 will be the last portion of the towel to be removed from the package.

35 In Figure 2C, the towel 105 folded according to Figures 2A and 2B has now been accordion-folded along lateral fold lines 131-133 such that fold line 131 overlies fold line 133. The portion of leading edge 130 which is adjacent to the free corner 110 extends

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5 thickness (SF1), which is the thickness of the overlying laterally folded portions of the towel.

10 Figures 3A and 3B depict front and rear views, respectively, of the towel 105 after it has been folded according to the process depicted in Figures 2A-2C and pressed flat so as to occupy minimal space. The folded towel 105 preferably exhibits a generally rectangular outline, save for the corner 110 folded downward via fold line 140. The distance between leading edge 130 and fold line 131 (measured parallel to the longitudinal fold lines 121 and 122) defines the folded length (FL), and the distance between side edge 15 120 and fold line 121 (measured parallel to the lateral fold lines 131-133) defines the folded width (FW). As the longitudinal fold lines and lateral fold lines are mutually orthogonal, the folded length and folded width are also mutually orthogonal.

20 The various elements of the folded towel 105 which are visible in the folded state are labeled in Figures 3A and 3B to show their final position following the folding operation. The relative positions of these elements of the folded towel have proven to be critical to proper unfolding of the towel as described below with regard to Figures 5A-5D.

25 While a presently preferred manner of folding the folded towel according to this first embodiment of the present invention has been set forth, there are many other ways to fold a towel so as to obtain satisfactory performance with this improved package. For example, the folding methods described with respect to Figures 7A-7C and 30 Figures 12A-12B could be utilized, or any other similar method which incorporates a greater or lesser number of folds. In addition, the grasping portion could be formed as a projection 115 on the leading edge of the folded towel, such as shown in Figure 3C, and folded downward over the front surface of the folded towel so as to align 35 with the opening.

There are three critical aspects of the towel folding operation according to this first embodiment of the present invention. First,

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5 to grasp and withdraw the folded towel by its leading edge.
Finally, the towel must be folded longitudinally first, and then
laterally, with the longitudinal and lateral folds being generally
orthogonal to one another, so as to permit the lateral folds to
unfold first, and then the longitudinal folds, as described below
10 with respect to Figures 5A-5D.

Figures 4A through 4D illustrate the steps required to assemble
a complete package according to this first embodiment of the present
invention.

15 In Figure 4A, the folded towel 105 has been placed on top of a
back sheet 150, which comprises a sheet of thin, flexible, and
preferably liquid-impervious material. Back sheet 150 is sized so
as to be marginally larger than the folded width and somewhat larger
than the folded length of the folded towel 105.

20 In Figure 4B, a front sheet 151 has been placed over the folded
towel 105 and back sheet 150. Front sheet 151 also comprises a
sheet of thin, flexible, and preferably liquid-impervious material,
and front sheet 151 has a size and shape which generally correspond
to the size and shape of the back sheet 150, but having a shorter
length than back sheet 150. Front sheet 151 further includes an
25 opening 152, which is represented by the dotted line.

In Figure 4C, front sheet 151 and back sheet 150 have been
sealed together around the periphery of front sheet 151, as shown at
153, to contain the folded towel. Opening 152 must be in overlying
spaced relation to and in registry with free corner 110, such that
30 when closure 154 is removed the consumer has access to and can grasp
free corner 110 to withdraw and unfold the folded towel 105.

Figure 4D depicts the completed package, after the portion of
back sheet 150 which protrudes beyond front sheet 151 has been
folded downward over opening 152 and bonded to front sheet 151
35 around the periphery of opening 152 (as shown by stippled region
160) so as to constitute a closure 154. The folded towel 105 is now

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5 first embodiment of the present invention.

In Figure 5A, the consumer has grasped the completed package at one side just below opening 152 with one hand. The consumer then grasps the end of closure 154 nearest to the first hand with his or her other hand and, by pulling the closure upward and across the package as shown in Figur 5B, peels the closure so as to expose opening 152. As shown in Figure 5B, this step leaves the opening exposed and provides access to the folded towel 105, with the free corner 110 in registry with opening 152.

15 The consumer in Figure 5C has now shifted one hand so as to grasp the lower edge 156 of the package with one hand and has grasped the free corner 110 with the other hand so as to begin extracting the folded towel from the package.

As this extraction process proceeds, more and more of the towel is withdrawn from the package and simultaneously unfolded such that the exposed portion of the towel is in a substantially unfolded state. The unfolding process culminates in the complete extraction of the towel from the package, as shown in Figure 5D. The consumer is now holding a fully and completely unfolded towel, such that the towel is now ready for the desired use. The empty package may now be disposed of in an appropriate fashion.

25 A unique interaction between the folded towel and the periphery of the opening is the source of the unfolding feature of this embodiment of the present invention. The opening is preferably smaller in both directions than the folded width and folded thickness of the towel. This ensures that the towel cannot simply slide out of the package while remaining in its folded state. The periphery of the opening exerts a force on the towel in a direction which opposes the force exerted by the consumer in withdrawing the towel and serves to accomplish the unfolding of the lateral folds of the towel. Because the opening is also generally smaller than the folded width of the towel, the edges of the opening push inward on the outermost folds and edges of the folded towel as the towel

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5 what dictates the size and shape of the opening, as well as the
manner in which the towel is folded. As stated previously, the
number of folds in each direction is not critical, so long as the
towel ultimately reaches a generally rectangular shape with the
longitudinal folds folded first and the lateral folds folded last.
10 As the towel passes through the opening, the lateral folds unfold
first and the longitudinal folds unfold last, due to the nature of
the forces applied by the opening on the towel.

The forces applied, particularly the inward forces applied to
unfold and separate the longitudinal folds, must be sufficient to
15 overcome the adhesion force between adjacent towel surfaces. This
adhesion force is caused by the use of cleansing agents or other
liquids to moisten the towel. The opening must therefore be sized
to account for not only the dimensions of the folded towel, but also
the "stickiness" of the towel in terms of the adhesion force between
20 adjacent layers. A more detailed discussion of the adhesion force
appears below.

Although the shape of this opening may range from a narrow slit
to an oval to nearly circular depending upon the final dimensions of
the folded towel, two dimensions of the opening will remain constant
25 for a particular folded towel. For the purposes of this invention
the term "circumference" refers to the length of the periphery of
the opening, "maximum width" refers to the maximum extent of the
opening in the direction parallel to the sides of the package (which
represents the minor dimension of the elongated opening), and
30 "maximum length" refers to the maximum extent of the opening in the
direction parallel to the dispensing edge of the package (which
represents the major dimension of the elongated opening), all
regardless of the actual shape of the opening.

In order to achieve the proper unfolding of the folded towel,
35 the opening dimensions must be related to the dimensions and
adhesion properties of the folded towel. For towels and packages
according to this first embodiment of the present invention, this

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5 experimentally determined parameters which account for the adhesion properties and unfolding characteristics of the folded towel in its folded condition.

10 In a package configuration according to this embodiment of the present invention, a trial and error experimental process has revealed that the parameter A is preferably between about 0.8 and about 1.3, more preferably between about 0.9 and about 1.2, and most preferably about 1.0. Likewise, the parameter B is preferably between about 1.0 and about 3.0, more preferably between about 1.0 and about 1.2, and most preferably about 1.1. It should be noted
15 that even though the openings may typically have a maximum width which is larger than the second folded thickness of the folded towel, and may perhaps also have a maximum length which is larger than the folded width of the towel, due to the fact that the towel is being extracted from the package by pulling in a direction which
20 lies in the plane of the package, both sides of the folded towel do contact and interact with the edges of the opening defining the maximum width.

As the adhesion force required to separate adjoining layers of the towel (discussed in greater detail below) increases, the
25 parameters A and B tend toward the lower end of these ranges so as to result in increased force exerted inwardly on the towel. As the towel becomes stiffer and/or has a higher basis weight, and hence harder to compress inward in a direction parallel to the folded width (FW), and/or as the number of longitudinal folds increases,
30 the parameters A and B tend toward the higher end of these ranges. Surface textures which increase resistance to sliding of towel layers with respect to each other also lead to parameters A and B which tend toward the higher end of these ranges. These relationships hold generally constant for a wide range of folded
35 towel dimensions, although for towels which have unusually large or small folded dimensions, these ranges may need to be adjusted up or down to achieve acceptable unfolding performance.

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5 the towel while the remainder of the towel remains folded within the package. Second, the package itself may tear, particularly in the vicinity of the opening, allowing the towel to emerge from the package while still in its folded state, or only partially unfolded. Of course, neither of these occurrences are desirable, and with
10 proper assessment of the adhesion forces present the package can be designed appropriately.

Thus, once a towel material, cleansing agent, and folded towel dimensions are selected, these relationships can be utilized to properly size and configure an opening which will provide the
15 unfolding feature of the present invention.

As shown in Figure 4B, a presently preferred opening configuration is one in which the opening 152 has an elongated, generally oval shape. According to this first embodiment, regardless of the exact size or shape of the opening, the location
20 of the opening will be generally toward one end of the front sheet, which preferably has an overall shape of a generally rectangular nature.

This location facilitates the extrication of the folded towel from the package by enabling the consumer to grasp the edge of the
25 package farthest from the opening with one hand and exert a pulling force on the towel with the other hand. As shown in Figure 5C, this pulling force is exerted generally in the plane of the package, rather than perpendicular to the plane of the package. The location nearer to one edge, the dispensing edge 155, maintains the planar
30 orientation/relationship of the package and towel during the unfolding process, and increases the relative amount of package containing the towel while minimizing the empty portion of the package between the opening and the "drawing" end of the package.

The opening, therefore, is preferably located up to about
35 one-half, more preferably up to about one-third, and most preferably up to about one-quarter of the length of the package from the dispensing edge 155. As illustrated in Figures 4A and 5B, this

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5 of the package remaining unoccupied, the leading edge of the towel
is preferably folded downward over the front side of the folded
towel (and the free corner 110 folded oppositely to that shown in
Figure 2B) as shown in Figure 3D such that the grasping portion 110
10 of the folded towel is also more centrally located and is in
registry with the opening.

In an embodiment of the aforementioned type, the consumer must
withdraw the folded towel by pulling the towel through the opening
generally perpendicularly to the plane of the package to achieve
unfolding of the towel. This necessitates restraining the package
15 by holding two opposite edges or corners of the package while
withdrawing the towel.

Various means of forming opening 152 and closure 154 are
possible, all of which permit performance of the necessary
interaction between the folded towel and the opening. For example,
20 as depicted in Figure 4B, opening 152 can comprise an orifice cut
out of front sheet 151, such that the front sheet material within
the dotted lines is removed entirely. The closure 154 is then
formed by bonding the flap depicted in Figure 4C over opening 152 so
as to seal the package. When closure 154 is peeled away as depicted
25 in Figure 5B, the opening 152 is exposed for use.

Alternatively, the opening could be formed by fully perforating
or partially perforating (only through the outermost layer of front
sheet 151, so as to maintain package integrity), slitting, or
scoring (such as by use of a laser or sharp edge) the front sheet so
30 as to outline the opening, then bonding the closure over the
outlined opening in the manner described above, and further
including bonding the closure to the portion of the front sheet
bounded by the outlined opening. When the closure is peeled away,
the portion of the front sheet within the perforation, slitting, or
35 scoring outline remains attached to the closure and is torn free
from the remainder of the front sheet, thus exposing the opening for
use.

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depicted in Figure 4F. The opening is formed as above described, and when the closure 154 is removed from the front sheet 151, the opening is exposed for use.

Many other ways of forming the closure are possible, and all are deemed to be within the scope of the present invention.

In all circumstances where the forming of the opening constitutes a breach (or a potential breach) of the liquid-impervious nature of the front sheet, the closure must provide a liquid-tight and air-tight seal over the opening so as to prevent possible contamination and/or drying out of the folded towel prior to use. This can be accomplished by the use of adhesives applied to the underside of the closure, the surface of the front sheet around the opening, or both, and extending uninterrupted entirely around the periphery of the opening. Alternatively, a two-sided adhesive tape, preferably a high tack/low tack tape such as tape number 9415PC, manufactured by the 3M Corporation, could be utilized, again extending uninterrupted entirely around the periphery of the opening with the high tack side preferably facing the front surface of the package. Another alternative would be to use some sort of thermal bonding of the closure to the front sheet, such as described below with respect to sealing the front and back sheets together. The use of the two-sided high tack/low tack tape is a presently preferred method of affixing the closures of packages according to this embodiment of the present invention.

While with regard to single-towel packages reclosability and resealability of the closure are not critical, if the package were adapted to provide multi-towel capabilities the closure would preferably be resealable in order to protect the remaining unused towels from contamination and drying out.

As shown in Figures 4B-4F and 5A-5B, removable closures utilized in this first embodiment preferably incorporate some sort of protruding tab which is not firmly bonded to the outer surface of

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5 projection.

As shown in Figures 5C and 5D, it is important that when withdrawing the towel 105 from the package the consumer grasps the package in the sealed region 153 as close to the lower edge 156 as possible. If the consumer grasps the package above the sealed area 153, there is the possibility that he or she may in fact squeeze the package in the open interior region containing the folded towel, and thereby pinch the folded towel between the front and back sheets, and thus make withdrawal of the towel more difficult.

Depending upon the width of sealed area 153 at the lower edge 156, it may be desirable to provide a larger sealed region for grasping, such as shown in Figures 4G and 4H. This larger sealed region ensures that the towel will be located farther from the lower edge of the package, and may take the form of a single, generally central extension 170, as shown in Figure 4G, or a generally wider sealed area 180 extending entirely across the package, as shown in Figure 4H. The overall package length may need to be adjusted accordingly to maintain sufficient interior volume for the folded towel.

Figures 6 through 10D depict an improved package and folded towel according to a second embodiment of the present invention, which is a presently preferred embodiment.

Figure 6 illustrates a towel for use with a package according to a second embodiment of the present invention, which is depicted in its unfolded state. The numeral 205 denotes the towel generally, and the numerals 210, 211, 212, and 213 are used to identify the four corners of the towel 205, which may be generally rectangular in shape in a preferred configuration.

In Figure 6, the fold lines of towel 205 are illustrated through the use of dotted lines. In a preferred configuration, the towel has four longitudinal fold lines 220, 221, 222, and 223 parallel to an imaginary line connecting corners 210 and 212, and three lateral fold lines 230, 231, and 232 which are perpendicular

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Figure 6 is a plan view looking downward on the unfolded towel 205 as it lies on a horizontal surface; hence, Figure 7A is an elevational view looking horizontally at the towel from the direction of corner 212. In Figure 7A, the folding of the towel 205 along the longitudinal fold lines 220-223 has been initiated.

10 In Figure 7B, which returns to the same viewpoint as Figure 6, the longitudinal folding process has been completed. Fold line 221 now overlies fold line 223, and fold line 220 now overlies fold line 222. Corner 210 has now become a free corner to form a grasping portion for the consumer to grasp to initiate the unfolding and
15 withdrawal process, and as such will be the first portion of the towel to be withdrawn from the package. Corner 212 has now become a trailing corner, and will be the last portion of the towel to be removed from the package. Corners 211 and 213 have now been folded out of the way via fold lines 220 and 223, respectively, such that
20 in the longitudinal direction the outer margins of the folded towel consist of only folded edges. This folding operation has defined the folded width (FW) of the folded towel, measured parallel to the lateral fold lines, and has also defined a first folded thickness (FFT), which is the thickness of the overlying folded portions of
25 the towel.

In Figure 7C, the towel 205 folded according to Figures 7A and 7B has now been accordion-folded along lateral fold lines 230-232, such that fold line 230 now overlies fold line 232. Free corner 210 extends beyond fold line 231 to ensure that the consumer will only
30 grasp the free corner 210 rather than the entire thickness of the folded towel. This ensures the proper unfolding of the towel. This folding operation has defined the folded length (FL) of the folded towel, measured parallel to the longitudinal fold lines, and has also defined a second folded thickness (SFT), which is the thickness
35 of the overlying laterally folded portions of the towel.

Figures 8A and 8B depict front and rear views, respectively, of the towel 205 after it has been folded according to the process

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5 defines the folded length (FL), and the distance between fold lines 221 and 222 (measured parallel to the lateral fold lines 230-232) defines the folded width (FW). As the longitudinal fold lines and lateral fold lines are mutually orthogonal, the folded length and folded width are also mutually orthogonal.

10 The various elements of the folded towel 205 which are visible in the folded state are labeled in Figures 8A and 8B to show their final position following the folding operation. The relative positions of these elements of the folded towel have proven to be critical to proper unfolding of the towel as described below.

15 While a presently preferred manner of folding the folded towel according to this second embodiment of the present invention has been set forth, there are many other ways to fold a towel so as to obtain satisfactory performance with this improved package. For example, the folding methods described with respect to Figures 2A-2C and Figures 12A-12B could be utilized, or any other similar method 20 which incorporates a greater or lesser number of folds. In addition, the grasping portion could be formed as a projection 214 on the leading edge of the folded towel, such as shown in Figure 8C, particularly if the towel is folded parallel to its edges as 25 illustrated in Figures 2A-2C and 12A-12B rather than diagonally as illustrated in Figures 7A-7C.

There are three critical aspects of the towel folding operation according to this second embodiment of the present invention. First, the towel in its finally folded state must have a generally 30 rectangular overall shape. Second, a grasping portion must be located near the dispensing edge 255, as shown in Figure 9A, so as to present a defined portion of the towel for the consumer to grasp and withdraw the folded towel by its leading edge. Finally, the towel must be folded longitudinally first, and then laterally, with 35 the longitudinal and lateral folds being generally orthogonal to one another, so as to permit the lateral folds to unfold first, and then

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5 present invention.

10 In Figure 9A, the folded towel 205 has been placed on top of a back sheet 250, which comprises a sheet of thin, flexible, and preferably liquid-impervious material. Back sheet 250 is sized so as to be marginally larger than the folded width and folded length of the folded towel 205, and is preferably shaped so as to have the edge 255 nearest to the free corner 210 shorter than the opposing edge 256.

15 In Figure 9B, a front sheet 251 has been placed over the folded towel 205 and back sheet 250. Front sheet 251 also comprises a sheet of thin, flexible, and preferably liquid-impervious material, and front sheet 251 has a size and shape which generally correspond to the size and shape of the back sheet 250.

20 Figure 9C depicts the completed package, after front sheet 251 and back sheet 250 have been sealed together around their peripheries as shown at 252. Near the dispensing edge 255, two notches 253 and 254 are preferably formed which extend part way through the seal 252 so as to form a means for initiating a tear line across the front and back sheets, as will be described below. The folded towel 205 is now completely contained inside an airtight and moisture-tight package, where it will remain clean and ready for use.

25 Figures 10A through 10D depict the process of opening the completed package and extracting the folded towel according to the second embodiment of the present invention.

30 In Figure 10A, the consumer has grasped the completed package at one side just below one of the notches, in this case 253. The consumer grasps the package with his or her other hand just above the notch 253, and by pulling his or her hands in opposite directions perpendicular to the plane of the package initiates a tear line 257 across the end of the package near dispensing edge 255 as shown in Figure 10B. As the grain of the package material used for front sheet 251 and back sheet 250 (if the package material has

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5 exposed and protruding beyond the tear line 257 so that it may be readily grasped, as described below.

10 Tear line 257 actually comprises a torn edge on front sheet 251 and a torn edge on back sheet 250, the two torn edges being joined to one another by the inner edges of the sealed portion 252 adjacent to the notches 253 and 254. The two torn edges free of the sealed portion 252 define the periphery of an opening which has a circumference equal to the sum of the lengths of the two torn edges, which are preferably nearly equal.

15 As shown in Figure 10C, the consumer may completely tear off the upper portion of the package and discard it in an appropriate fashion, or may alternatively leave it partially attached, so long as the attachment does not extend inward beyond the inner edge of the sealed area 252 and thus diminish the size of the opening defined by tear line 257 and bounded at each end by the inner margin of sealed area 252. The consumer in Figure 10C has now shifted one hand so as to grasp the lower edge 256 of the package with one hand and has grasped the free corner 210 with the other hand so as to begin extracting the folded towel from the package.

25 As this extraction process proceeds, more and more of the towel is withdrawn from the package and simultaneously unfolded such that the exposed portion of the towel is in a substantially unfolded state. The unfolding process culminates in the complete extraction of the towel from the package, as shown in Figure 10D. The consumer is now holding a fully and completely unfolded towel, such that the towel is now ready for the desired use. The empty package and the torn-off portion may now be disposed of in an appropriate fashion.

30 A unique interaction between the folded towel and the periphery of the opening is the source of the unfolding feature of this embodiment of the present invention. The opening preferably has a length smaller than the folded width of the towel, and which is also smaller than the bottom edge of the package. During the withdrawal of the towel, the opening becomes even shorter in length as the

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remaining in its folded state.

10 The periphery of the opening exerts a force on the towel in a direction which opposes the force exerted by the consumer in withdrawing the towel and serves to accomplish the unfolding of the lateral folds of the towel. Because the opening is also generally smaller than the folded width of the towel, the "ends" of the opening push inward on the outermost folds and edges of the folded towel as the towel passes through the opening, thus serving to cause the overlying surfaces of the towel between the longitudinal folds
15 to separate and effectuate the unfolding of the longitudinal folds of the towel.

20 This interaction between the folded towel and the opening is what dictates the size and shape of the opening, as well as the manner in which the towel is folded. As stated previously, the number of folds in each direction is not critical, so long as the towel ultimately reaches a generally rectangular shape with the longitudinal folds folded first and the lateral folds folded last. As the towel passes through the opening, the lateral folds unfold first and the longitudinal folds unfold last, due to the nature of
25 the forces applied by the opening on the towel.

The forces applied, particularly the inward forces applied to unfold and separate the longitudinal folds, must be sufficient to overcome the adhesion force between adjacent towel surfaces. This adhesion force is caused by the use of cleansing agents or other
30 liquids to moisten the towel. The opening must therefore be sized to account for not only the dimensions of the folded towel, but also the "stickiness" of the towel in terms of the adhesion force between adjacent layers. A more detailed discussion of the adhesion force appears below.

35 Although the shape of this opening may range from a narrow slit to an oval to nearly circular during the course of the withdrawal of the folded towel, the circumference of the opening will remain

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5 the opening (before beginning to withdraw the towel) in the
direction parallel to the dispensing edge of the package (which
represents the major dimension of the opening), and "maximum width"
refers to the maximum extent of the opening in the direction
10 perpendicular to the plane of the package (which represents the
minor dimension of the elongated opening) as the opening is reshaped
by the towel passing through it, all regardless of the actual shape
of the opening.

In order to achieve the proper unfolding of the folded towel,
the maximum length must be related to the dimensions and adhesion
15 properties of the folded towel. For towels and packages according
to this second embodiment of the present invention, this
relationship assumes the form $ML = C \times FW$, where ML is the maximum
length of the opening, FW is the folded width of the folded towel,
and C is an experimentally determined parameter which accounts for
20 the adhesion properties and unfolding characteristics of the folded
towel in its folded condition.

In a package configuration according to this embodiment of the
present invention, the maximum length of the opening is typically
always less than the folded width of the folded towel, and the
25 maximum width of the opening as it is reshaped during towel
withdrawal is dictated by the performance of the towel during the
withdrawal process, i.e., will seek its own size in response to the
extraction of the towel. A trial and error experimental process has
revealed that the parameter C is preferably less than about 1.0,
30 more preferably between about 0.5 and about 0.9, and most preferably
about 0.6. As packages made according to this embodiment of the
present invention are more sensitive to towel characteristics than
the other embodiments, the opening size will need to be adjusted for
each particular towel type for best results.

35 As the adhesion force required to separate adjoining layers of
the towel (discussed in greater detail below) increases, the
parameter C tends toward the lower end of these ranges so as to

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Surface textures which increase resistance to sliding of towel layers with respect to each other also lead to a parameters C which tends toward the higher end of these ranges. These relationships hold generally constant for a wide range of folded towel dimensions, although for towels which have unusually large or small folded dimensions, these ranges may need to be adjusted up or down to achieve acceptable unfolding performance.

If the opening is sized too small for towel of given dimensions and adhesion characteristics, or if the towel surfaces adhere too strongly, one of two things is likely to occur. First, the towel may tear, leaving the consumer holding only a portion of the towel while the remainder of the towel remains folded within the package. Second, the package itself may tear, particularly in the vicinity of the opening, allowing the towel to emerge from the package while still in its folded state, or only partially unfolded. Of course, neither of these occurrences are desirable, and with proper assessment of the adhesion forces present the package can be designed appropriately.

Thus, once a towel material, cleansing agent, and folded towel dimensions are selected, this relationship can be utilized to properly size and configure an opening which will provide the unfolding feature of the present invention.

As shown in Figure 9C, a presently preferred package configuration is one in which the preferably generally rectangular package tapers such that the dispensing edge is smaller than the lower edge and the remainder of the package. The critical length, the "maximum length" defined above, corresponds to the free length of the two torn edges, which are bounded at each end by the inward boundary of the bond between the front and back sides of the package.

This tapering facilitates the extrication of the folded towel from the package by providing a smooth transition from the wide

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5 The consumer grasps the end of the package farthest from the opening
with one hand and exert a pulling force on the towel with the other
hand. As shown in Figure 10C, this pulling force is exerted
generally in the plane of the package, rather than perpendicular to
the plane of the package. The location of the opening generally
10 centrally at one of the shorter edges of the package maintains the
planar orientation/relationship of the package and towel during the
unfolding process.

This tapering to facilitate extrication can also be
accomplished by forming tapering bonded regions joining the front
15 sheet and back sheet, as depicted in Figure 9D and identified by the
numeral 260. In this manner, the overall package shape can be
rectangular or other similar shape, while the tapered bonded regions
260 properly size the opening resulting when the dispensing edge 255
is opened and provide the desirable smooth transition for the folded
20 towel. Thus, regardless of whether or not the dispensing edge as a
whole is shorter than the bottom edge, a properly sized opening
which is preferably shorter than the bottom edge may be obtained
upon the opening of the dispensing edge.

Many other ways of forming and properly sizing the dispensing
25 edge are possible, and all are deemed to be within the scope of the
present invention.

As shown in Figures 10C and 10D, it is important that when
withdrawing the towel 205 from the package the consumer grasps the
package in the sealed region 252 as close to the lower edge 256 as
30 possible. If the consumer grasps the package above the sealed area
252, there is the possibility that he or she may in fact squeeze the
package in the open interior region containing the folded towel, and
thereby pinch the folded towel between the front and back sheets,
and thus make withdrawal of the towel more difficult.

35 As with packages according to the first embodiment of the
present invention, depending upon the width of sealed area 252 at
the lower edge 256, it may be desirable to provide a larger sealed

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generally wider spaced area 100 extending generally across the package, as shown in Figure 4H. The overall package length may need to be adjusted accordingly to maintain sufficient interior volume for the folded towel.

10 Figures 11 through 15E depict an improved package and folded towel according to a third embodiment of the present invention.

Figure 11 illustrates a towel for use with a package according to a third embodiment of the present invention, which is depicted in its unfolded state. The numeral 305 denotes the towel generally, and the numerals 310, 311, 312, and 313 are used to identify the 15 four corners of the towel 305, which may be generally rectangular in shape in a preferred configuration. The towel 305 also has two side edges 320 and 323, a leading edge 330, and a trailing edge 334.

In Figure 11, the fold lines of towel 305 are illustrated through the use of dotted lines. In a preferred configuration, the 20 towel has two longitudinal fold lines 321 and 322 parallel to the side edges, and three lateral fold lines 331, 332, and 333 parallel to the leading and trailing edges. The longitudinal fold lines and lateral fold lines are thus mutually orthogonal.

Figures 12A and 12B depict the folding process to fold the 25 towel 305 depicted in Figure 11.

In Figure 12A, the towel 305 has been z-folded along fold lines 321 and 322 such that side edge 320 overlies fold line 322, and side edge 323 is behind fold line 321. This folding step is precisely analogous to the folding step depicted in Figure 2A with respect to 30 the first embodiment of the present invention. This folding operation has defined the folded width (FW) of the folded towel, measured parallel to the lateral fold lines, and has also defined a first folded thickness (FFT), which is the thickness of the overlying folded portions of the towel.

35 In Figure 12B, the towel 305 folded according to Figure 12A has now been accordion-folded along lateral fold lines 331-333 such that fold line 331 overlies fold line 333. Leading edge 330 extends

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the first portion of the towel to be removed from the package. This folding operation has defined the folded length (FL) of the folded towel, measured parallel to the longitudinal fold lines, and has also defined a second folded thickness (SFT), which is the thickness of the overlying laterally folded portions of the towel.

10 Figures 13A and 13B depict front and rear views, respectively, of the towel 305 after it has been folded according to the process depicted in Figures 12A and 12B and pressed flat so as to occupy minimal space. The folded towel 305 preferably exhibits a generally rectangular outline. The distance between leading edge 330 and fold line 331 (measured parallel to the longitudinal fold lines 321 and 322) defines the folded length (FL), and the distance between side edge 320 and fold line 321 (measured parallel to the lateral fold lines 331-333) defines the folded width (FW). As the longitudinal fold lines and lateral fold lines are mutually orthogonal, the folded length and folded width are also mutually orthogonal.

20 The various elements of the folded towel 305 which are visible in the folded state are labeled in Figures 13A and 13B to show their final position following the folding operation. The relative positions of these elements of the folded towel have proven to be critical to proper unfolding of the towel as described below.

25 While a presently preferred manner of folding the folded towel according to this third embodiment of the present invention has been set forth, there are many other ways to fold a towel so as to obtain satisfactory performance with this improved package. For example, 30 the folding methods described with respect to Figures 2A-2C and Figures 7A-7C could be utilized, or any other similar method which incorporates a greater or lesser number of folds. In addition, the grasping portion could be formed as a projection on the leading edge of the folded towel, such as that identified with the numeral 214 in 35 Figure 8C, or in this configuration may merely constitute the leading edge of the towel, so long as it is near the dispensing edge 356 for the consumer to grasp, as shown in Figure 14A.

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5 the dispensing edge 356, as shown in Figure 14A, so as to present a defined portion of the towel for the consumer to grasp and withdraw the folded towel by its leading edge. Finally, the towel must be folded longitudinally first, and then laterally, with the longitudinal and lateral folds being generally orthogonal to one another, so as to permit the lateral folds to unfold first, as described below with respect to Figures 15A-15E.

Figures 14A through 14C illustrate the steps required to assemble a complete package according to this third embodiment of the present invention.

15 In Figure 14A, the folded towel 305 has been placed on top of a back sheet 350, which comprises a sheet of thin, flexible, and preferably liquid-impervious material. Back sheet 350 is sized so as to be marginally larger than the folded width and folded length of the folded towel 305. A flexible bar 351, comprising a strip of flexible and preferably thin material, has been placed through the folded towel 305 such that it isolates the portion of the folded towel bounded by leading edge 330 and lateral fold line 331 from the portion of the folded towel bounded by lateral fold lines 331 and 332, as well as the rest of the folded towel. Flexible bar 351 is thus parallel to the lateral fold lines 331-333, and is sized so as to match the width of back sheet 350. The importance of flexible bar 351 will be discussed below.

30 In Figure 14B, a front sheet 352 has been placed over the folded towel 305 and back sheet 350. Front sheet 352 also comprises a sheet of thin, flexible, and preferably liquid-impervious material, and front sheet 352 has a size and shape which generally correspond to the size and shape of the back sheet 350.

35 Figure 14C depicts the completed package, after front sheet 352 and back sheet 350 have been sealed together as shown at 353. This seal 353 also firmly attaches the flexible bar 351 at each end to the respective margins of the package. Near the dispensing edge 356, two notches 354 and 355 are preferably formed which extend part

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Figures 15A through 15E depict the process of opening the completed package and extracting the folded towel according to the third embodiment of the present invention.

10 In Figure 15A, the consumer has grasped the completed package at one side just below one of the notches, in this case 354. The consumer grasps the package with his or her other hand just above the notch 354, and by pulling his or her hands in opposite directions perpendicular to the plane of the package initiates a tear line 358 across the end of the package near dispensing edge 356 as shown in Figure 15B. As the grain of the package material used for front sheet 352 and back sheet 350 preferably runs parallel to edge 356, the material tears across each sheet in a generally straight line from one notch 354 to the other notch 355. As also shown in Figure 15B, this tearing operation leaves leading edge 330 exposed and protruding beyond the tear line 358 so that it may be readily grasped, as described below.

20 Tear line 358 actually comprises a torn edge on front sheet 352 and a torn edge on back sheet 350, the two torn edges being joined to one another by the inner edges of the sealed portion 353 adjacent to the notches 354 and 355. The two torn edges free of the sealed portion 353 define the periphery of an opening which has a circumference equal to the sum of the lengths of the two torn edges, which are preferably nearly equal.

30 Although the shape of this opening may change from a narrow slit to an oval to nearly circular during the course of extracting the folded towel, depending upon the quantity of towel material passing through the opening at any instant in time, the circumference of the opening remains constant throughout the withdrawal process. As such, for the purposes of this invention the term "circumference" refers to the length of the periphery of the opening, regardless of its shape at any point in time. The circumference of the opening according to this embodiment of the

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the upper portion of the package and discard it in an appropriate fashion, or may alternatively leave it partially attached, so long as the attachment does not extend inward beyond the inner edge of the sealed area 353 and thus diminish the size of the opening defined by tear line 358 and bounded at each end by the inner margin of sealed area 353. The consumer in Figure 15C has now shifted one hand so as to grasp the lower edge 357 of the package with one hand and has grasped the leading edge with the other hand so as to begin extracting the folded towel from the package.

Figure 15D illustrates the role of the flexible bar 351 in the unfolding process, with the front sheet 352 removed for clarity. As the towel is pulled from the package, the towel material is forced to pass between the flexible bar 351 and the front sheet 352, such that only one thickness of the towel at a time can pass between them. Due to the initial relationship between the folds of the towel 305 and the flexible bar 351, this ensures that all of the lateral folds 331-333 will be pulled taught and unfolded as the respective portions of the towel are aligned for passage between the flexible bar 351 and front sheet 352. As this extraction process proceeds, more and more of the towel is withdrawn from the package and simultaneously unfolded such that the exposed portion of the towel is completely unfolded in the longitudinal direction, i.e., the exposed portion of the towel is free of lateral folds 331-333.

The unfolding process culminates in the complete extraction of the towel from the package, as shown in Figure 15E. The consumer is now holding the towel by the leading edge 330, the towel having been completely unfolded in the longitudinal direction. The towel is now in the same folded state as depicted in Figure 12A, i.e., the longitudinal folds are still folded. All the consumer needs to do in order to utilize the towel is to shake or otherwise move the towel such that the longitudinal folds fall unfolded, or manually separate the adjacent towel surfaces. The towel is then ready for

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5 present invention. As stated above, the flexible bar is interleaved
between the lateral folds of the towel so as to isolate the portion
between the leading edge and the first lateral fold. Because the
bar will exert a force on the towel in a direction opposing the
force exerted by the consumer in withdrawing the towel, and because
10 the bar is captured between two layers of the towel joined by this
first fold, the towel cannot simply slide out of the package while
remaining in its folded state. The flexible bar thus forces the
towel to unfold laterally and pass between the front side of the
package and the bar on its way out of the package.

15 This interaction between the folded towel and the opening is
what dictates the size and shape of the opening, as well as the
manner in which the towel is folded. As stated previously, the
number of folds in each direction is not critical, so long as the
towel ultimately reaches a generally rectangular shape with the
20 longitudinal folds folded first and the lateral folds folded last.
As the towel passes between the flexible bar the front side of the
package on its way out through the dispensing edge, the lateral
folds unfold due to the nature of the forces applied by the flexible
bar on the towel.

25 The forces applied must be sufficient to overcome the adhesion
force between adjacent towel surfaces. This adhesion force is
caused by the use of cleansing agents or other liquids to moisten
the towel. The flexible bar must therefore be sized to account for
not only the dimensions of the folded towel, but also the
30 "stickiness" of the towel in terms of the adhesion force between
adjacent layers, because as the adhesion force becomes greater, the
more likely the flexible bar is to deform and perhaps fail. A more
detailed discussion of the adhesion force appears below. As the
towel becomes stiffer and/or has a higher basis weight, and hence
35 harder to compress inward in a direction parallel to the folded
width (FW), and/or as the number of longitudinal folds increases,
the more likely the flexible bar is to deform and perhaps fail.

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5 dimensions and adhesion characteristics, or if the towel surfaces
adhere too strongly, one of two things is likely to occur. First,
the flexible bar may fail, allowing the towel to emerge from the
package while still in its folded state, or only partially laterally
10 unfolded. Second, the package itself may tear, particularly in the
vicinity of the attachment of the flexible bar, allowing the towel
to again emerge still at least partially laterally folded. Of
course, neither of these occurrences are desirable, and with proper
assessment of the adhesion forces present the package can be
designed appropriately.

15 The flexible bar 351 according to this embodiment of the
present invention is preferably of sufficient width (measured
perpendicular to dispensing edge 356) as to have only minimal
deformation during withdrawal of the folded towel. The width
20 required depends on the length of the bar required to traverse the
overall width of the package, the material utilized, and the
rigidity of its attachment to the edges of the package. The
criticality of the width is that it must be sufficient to withstand
the forces exerted on it by the withdrawing of the folded towel
25 without bowing significantly toward the dispensing edge and also so
as to permit enough of its ends to be sealed and affixed to the
package edges to prevent its being torn free. Conversely, using a
bar which is too wide results in wasted material. For a typical
package which may be approximately 3 inches (76.2 mm) wide, this
width is preferably between about 1/4 and about 2 inches (6.4-50.8
30 mm), more preferably between about 3/8 and about 1 inch (9.5-25.4
mm), and most preferably about 1/2 inch (12.7 mm). The material
utilized for the flexible bar preferably has characteristics similar
to the overall package material in terms of thickness and
flexibility, and if the bar material has a grain direction
35 associated with it, the grain preferably runs parallel to the length
of the flexible bar.

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5 leading edge 330 toward the first lateral fold. This orientation
has been found to provide for the best unfolding performance because
it allows more of the folded portion of the towel to remain unbound
by the flexible bar in the lower portion of the package during the
10 unfolding operation. It is critical, however, that the flexible bar
be located sufficiently far from the leading edge 330 that the other
folds of the folded towel are isolated from the portion of the
folded towel between the leading edge 330 and the first lateral
fold, in this case fold line 331.

15 As shown in Figures 15C and 15E, it is important that when
withdrawing the towel 305 from the package the consumer grasps the
package in the sealed region 353 as close to the lower edge 357 as
possible. If the consumer grasps the package above the sealed area
353, there is the possibility that he or she may in fact squeeze the
20 package in the open interior region containing the folded towel, and
thereby pinch the folded towel between the front and back sheets,
and thus make withdrawal of the towel more difficult.

As with packages according to the first and second embodiments
of the present invention, depending upon the width of sealed area
353 at the lower edge 357, it may be desirable to provide a larger
25 sealed region for grasping, such as shown in Figures 4G and 4H.
This larger sealed region ensures that the towel will be located
farther from the lower edge of the package, and may take the form of
a single, generally central extension 170, as shown in Figure 4G, or
a generally wider sealed area 180 extending entirely across the
30 package, as shown in Figure 4H. The overall package length may need
to be adjusted accordingly to maintain sufficient interior volume
for the folded towel.

It is within the scope of the present invention that improved
single-towel packages according to each of the foregoing embodiments
35 may be modified and adapted to function as multi-towel packages
while still maintaining the advantageous accessibility and unfolding
features of a single-towel package. The third embodiment of Figures

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5 With a multi-towel package, some means of resealing the package
to protect the remaining towels is often desirable (in the event all
are not used at the same time). Thus, the tear-to-open dispensing
edge of the single-towel version of the third embodiment could be
replaced by some form of resealable closure. Figures 16A and 16B
10 would replace the sealing and notching step depicted in Figure 14C
(steps depicted in Figures 14A and 14B would remain essentially the
same), and correspond generally to the formation of the flap closure
of Figures 4C and 4D. The difference in Figure 16A is that the edge
of front sheet 452 nearest the dispensing edge 456 is left unsealed
15 to form an open end 458, which functions precisely the same as the
tear line 358 of Figures 15B-15E. Front sheet 452 and back sheet
450 are joined around three sides at 453, sealing a flexible bar 451
(see Figure 17B) between them. As shown in Figure 16B, the unsealed
portion of the back sheet 450 is then folded over the open end 458
20 to form a closure 454.

The stippled region 460 indicates a region of bonding between
the flap closure 454 and the front sheet 452, extending entirely
across the package below the open end 458 so as to form an air-tight
and liquid-tight seal. This seal may be formed by any of the
25 above-described methods, so long as it results in a reclosable and
resealable seal, but the use of the two-sided tape discussed above
with respect to the first embodiment is presently preferred. The
dispensing edge is thus preferably releasably sealed by a resealable
closure (the flap), which may be opened by a consumer to expose the
30 open end 458 for access to the towels.

If it were desired to form a package wherein all towels would
be utilized on a single occasion, or if the recloseable feature were
not desired for a specific application, other means of closing the
open end could be utilized. For example, the dispensing edge
35 configuration of the second and third embodiments discussed above
could be utilized to form a tear-to-open package. For permitting
more consumer discretion in the pattern of usage, however, some sort

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5 has been opened as depicted in Figures 5A and 5B. The lower edge of
the package 457 (which may be enlarged, as previously described) is
grasped by the consumer, and the leading edge 430 of the first towel
is grasped and withdrawn through the open end 458 as previously
10 described. The leading edge 530 of the next towel is then presented
since it is attached to the trailing edge of the first towel, and
the consumer then momentarily pinches the lower portion of this next
towel between the front and back sheets (or otherwise restrains this
sheet) so that the pulling force exerted on the extracted towel will
15 cause the towel to tear free of the towel remaining within the
package. After this next towel is withdrawn, the leading edge 630
of the next towel is presented, and this process is repeated until
the supply of towels is exhausted. The flap closure may be resealed
to protect the remaining towels, until such time as the last towel
is withdrawn and the package disposed of in a suitable manner.

20 Although the towels may be folded in any suitable manner,
including the folding operations previously described, it is
presently preferred that the towels have fewer lateral folds,
preferably only about one, such that the towels only traverse the
length of the package twice and the leading and trailing edges are
25 near the dispensing edge, as shown in Figure 17B. The towels are
detachably joined in any suitable manner such as, for example, by
straight, curvilinear, or angled perforated lines, such that the
trailing edge of a leading towel is joined to the leading edge of a
trailing towel. While any number of towels may be utilized in such
30 a package, the presently preferred number of towels is three to keep
package size to a minimum. A stacked towel arrangement is
presently preferred, although other towel arrangements may be
equally suitable for use, such as side-by-side, etc..

35 In operation, the first towel passes behind the flexible bar
and longitudinally unfolds on its way out of the package, as with
the single-towel version of the third embodiment. Figure 17C
corresponds to Figure 15E in that the towel as shown is in the same

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5 towel surfaces. The towel is then ready for the desired use.

Once the first towel is entirely out of the package, and the leading edge of the next towel appears at the open end, the consumer tears off the first towel as previously described. The towels and package are then as shown in Figure 17C, and the package can then be
10 resealed if desired. When a subsequent towel is desired, the package can then be reopened and the leading edge of the next towel can be grasped and the towel withdrawn (as above described), and it likewise will pass behind the flexible bar and unfold longitudinally. Of course, more than one towel can be withdrawn at
15 a time, if desired, and the towels will all follow one another behind the flexible bar and longitudinally unfold as they exit the package.

The overall shape and size of the flexible packages in each of the three embodiments of the present invention discussed above are
20 not critical in terms of performing the unfolding operation, so long as certain common attributes are retained. For example, regardless of their exact shape the package must necessarily be somewhat larger than the final folded dimensions of the folded towel in order to entirely surround and contain the folded towel. If the package is
25 too much larger than the folded towel, however, the package will be more bulky for the consumer to carry, and furthermore the package will be more easily distorted during the unfolding and withdrawal process. Therefore, both from a material usage standpoint and a performance standpoint, as depicted in the Drawing Figures the
30 flexible packages of the present invention are preferably only marginally larger in all directions than the folded towels they contain, and their overall shape generally corresponds to the shape of the folded towel. Typical overall package dimensions from about
35 2 inches by about 3 inches (51 x 76 mm) to about 3 inches by about 4 inches (76 x 102 mm) have performed satisfactorily.

In addition, for those embodiments which incorporate a tearing operation to form a dispensing opening, the package must be designed

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5 is presently preferred that all packages according to the present
invention have a somewhat elongated, generally rectangular overall
shape with somewhat rounded corners. Such a shape is easy for the
consumer to carry, such as in a pocket or purse, and aids in the
proper orientation of the package during the withdrawal and
10 unfolding process. Other shapes may be utilized, however, such as
oblong or oval shapes, square shapes, or any other desired shape.

With regard to each of the foregoing embodiments, it may be
desirable to provide multi-package sets of single- or multi-towel
packages suitable for more extended away-from-home use. Such sets
15 may comprise individual packages joined at their side, top, or
bottom edges to form a frangible web by some easily detachable
means, such as, for example, perforated or partially slitted or
scored lines. Such joints could be formed by only partially
severing the packages during the sealing and cutting operations, or
20 by forming such joints by some sort of bonding operation after the
individual packages have been separated. The multi-package sets
would thus lend themselves to accordion-folding, etc., to still
facilitate easy transportation and concealment in a pocket or purse.
Individual packages could then be removed individually as desired
25 for use, and subsequent disposal, without affecting the sealed
integrity of the remaining packages in the set.

With respect to each of the three embodiments discussed above,
the unfolding advantages obtained according to the present invention
may be achieved by the use of a substantially moisture-free (dry)
30 towel, i.e., without any liquid cleansing agents or other liquids to
moisten the towel. However, the towels preferably contain some
quantity of a suitable cleansing agent, such as a mixture of water,
polyethylene glycol, ethanol, and a perfume, and perhaps lanolin and
a bacteriostat. For other uses, particularly medical uses, it may
35 be desirable to moisten the towel with a disinfecting solution, such
as alcohol. Such cleansing agents improve the effectiveness of the
towel in use, but in general cause the layers of the towel to cling

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5 this clinging tendency through selective applications of force to
certain regions of the folded towel during the withdrawal process.
While the towels may be entirely "dry", and unfold satisfactorily in
such packages, or moistened with a liquid which does not impart as
much "stickiness" or "clinginess" to the towel, the improved
10 packages according to the present invention perform the unfolding
process satisfactorily up to an upper limit of cleansing agent
content and/or stickiness. While the quantity of the agent may vary
according to the composition of the agent, and hence its
"stickiness", the adhesion force quantifies a critical parameter.
15 Other factors which affect the resistance of the towel to unfolding
include the surface finish and texture of the towel, the resistance
to sliding between adjacent towel layers, and the relative moisture
content of the towel.

With all of the above factors combined, if too much force is
20 required to separate the layers and unfold the folds, one of two
things may be expected to occur. First, the towel itself may emerge
from the package still in its folded state, or only partially
unfolded, due either to the towel "roping" together while passing
through an opening rather than unfolding, or due to a failure of an
25 element of the package itself. Second, the towel may tear, leaving
the consumer holding only a portion of the towel while the remainder
of the towel remains folded within the package. Of course, neither
of these occurrences are desirable, and with proper assessment of
the adhesion forces present the package can be designed
30 appropriately.

The towel itself can be formed of any commonly-used tissue-type
paper material, or any other similar thin and flexible sheet-like
material deemed suitable for use in such a package, including, for
example, woven and non-woven fabric-type materials. Such materials
35 include single- and two-ply sheets of tissue paper, having
sufficient strength to avoid tearing during the withdrawing
operation, especially when in a moistened condition. The basis

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5 the size of the towel to the desired folded dimensions. Two-ply
paper towels with basis weights (per ply) of about 0.0087 lb/ft²
(0.0043 g/cm²) and single-ply paper towels with basis weights of
10 about 0.0082 lb/ft² (0.0040 g/cm²) have performed well, and towel
dimensions of from about 3 inches by about 5 inches (76 x 127 mm) to
about 6 inches by about 10 inches (152 x 254 mm) have been used
successfully.

15 Towels suitable for use with packages according to any
particular embodiment of the present invention may be folded with
the fold lines parallel to the respective edges of the towel (such
as depicted in Figures 1 and 11, for example), or non-parallel to
the respective edges of the towel (such as depicted in Figure 6, for
example), so long as the longitudinal and lateral folds are
generally orthogonal to one another, as described above.

20 The thin, flexible, and substantially liquid-impervious
material utilized for the package can be any suitable single or
multiple layer sheet material. Commonly used materials include
metallic foils, plastic films, or treated paper products. Suitable
materials include high density polyethylene, polyethylene-based
25 copolymers, polyesters (PET, PETG), polypropylene, nylon, and a
paper/foil/low density polyethylene laminate utilized with the paper
side toward the outside of the package, and a
nylon/polyethylene/aluminum foil/linear low density polyethylene
laminate utilized with the nylon side toward the outside of the
package. One presently preferred material for packages according to
30 the third embodiment of the present invention is the
nylon/polyethylene/aluminum foil/linear low density polyethylene
laminate, while for the first and second embodiments the presently
preferred material is the paper/foil/low density polyethylene
laminate. The material utilized must have sufficient strength and
35 rigidity to maintain its shape and avoid tearing during the
unfolding process.

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5 with a folded towel moistened with a cleansing agent or other liquid. The flexible bar may even be fabricated from a thin, flexible line or cord material, such as a synthetic (nylon) monofilament line, although to provide maximum attachment area within the edge seals a sheet-like material is presently preferred.

10 For package configurations which utilize a tearing process to open the package and create a dispensing opening, if the package material has a grain direction associated with it, the grain direction preferably runs parallel to the direction of the tear so as to facilitate a generally straight tear line across the package.
15 If there is no tearing operation associated with the opening of a particular package configuration, the grain direction is not critical. If the material utilized for the flexible bar of the third embodiment has a grain direction, the grain direction preferably runs across the package along the length of the flexible
20 bar so as to afford maximum strength and resistance to tearing of the bar.

The edges of the front and back sheets of packages according to all embodiments of the present invention are preferably joined in a manner which provides a substantially liquid-tight and air-tight
25 seal. This seal, in combination with the substantially liquid-impervious sheet material and closure (if applicable), defines a substantially air-tight and liquid-tight package for containing the folded towel. This in turn protects the folded towel from contamination and also prevents any cleansing agent from
30 evaporating or leaking out of the package, thus keeping the towel in a condition suitable for use.

This seal may be formed by a variety of acceptable methods, including crimping, clamping, taping, bonding with various adhesives, and thermal bonding. The presently preferred method of
35 sealing the periphery of the front and back sheets is thermal bonding. The term "thermal bonding", sometimes called "heat sealing", may include a number of methods of generating and applying

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hot air sealing, hot wire sealing, ultrasonic sealing, and impulse sealing, with the impulse sealing process being presently preferred.

10 The width of the seals, i.e., how far inward they extend from the periphery of the front and back sheets, however they are formed, is not critical so long as sufficient seal width is provided to maintain a durable seal. Seals which are too narrow may be prone to rupture during transport of the package prior to use, particularly in a purse or pocket environment.

15 For ease of manufacture, it is preferable to form the heat seals, cut the front and back sheets from larger sheets, and form the tear-initiating notches (if applicable) all at the same time, although such steps can be accomplished separately. Where such notches are formed so as to extend part way through the heat seals, it is critical that the innermost portion of the heat seal remain
20 intact so as not to lose the liquid-tight and air-tight integrity of the package.

With respect to the third embodiment of the present invention, wherein the flexible bar is joined to the side edges of the package by the seals, it is critical that the seals firmly retain the ends
25 of the flexible bar to withstand the forces exerted upon the bar during the withdrawal process. As such, it is preferable to have the ends of the flexible bar extend entirely through the seals and terminate approximately at the outer periphery of the front and back sheets so as to afford maximum contact area within the seal. If
30 heat sealing is the method of sealing selected, the flexible material utilized for the flexible bar must be appropriate for the sealing operation, i.e., capable of fusing to the inner surfaces of both the front and back sheets.

35 There are several possible ways to facilitate the tearing open of the dispensing edges of packages formed according to the second and third embodiments of the present invention. The front and back sheets could be partially scored, slitted, or perforated along the

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of the tearing opening of the package of the second and third
embodiments is to provide opposing notches in the side edges of the
packages near the dispensing edge, as depicted in the Drawing
Figures. The notches provide a region of stress concentration which
ensures that the tearing of the front and back sheets will begin at
10 the point of the notch and propagate across the package.
Orientation of the grain of the package material (if it has a grain
direction) parallel to the line of the desired tearing helps to
ensure that the propagation of the tear lines will be generally
straight across the package from one notch to the other.

15 It will be apparent to one skilled in the art that many
variations of the present invention are possible. For example, the
packages may differ in size, thickness, and/or shape from those
disclosed above. Different materials may also be utilized, as well
as different manufacturing techniques. Furthermore, depending on
20 the physical properties of the materials used to form the packages
and folded towels, and their methods of manufacture, in order to
obtain best results it may be necessary to vary the dimensions and
proportions from those discussed above. All such modifications and
variations are within the scope and intent of the appended Claims.

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- (a) at least one folded sheet, said sheet being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said second folded thickness being greater than said first folded thickness, said sheet further having a grasping portion for grasping by a consumer, said grasping portion overlying a front surface of said sheet and preferably comprising a free corner folded diagonally downward over said front surface of said sheet;
- (b) a package formed of a thin, flexible, and preferably liquid-impermeable material, said package entirely surrounding and containing said sheet, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a top edge opposing said bottom edge, each of said edges joining said front side and said back side, said package having an elongated opening, preferably generally oval in shape, on said front side, said elongated opening defining a minor dimension parallel to said folded length and a major dimension parallel to said folded width, said front surface of said sheet and said front side of said package being in overlying spaced relation to one another, said elongated opening being releasably sealed by a closure and adapted to be opened by a consumer for access to said sheet, said elongated opening further being disposed on said front side such that said grasping portion of said sheet is registered in underlying spaced relationship to said opening; and
- (c) said minor dimension of said elongated opening having a maximum width which is between 1.0 and 3.0 times, preferably between 1.0 and 1.2 times, said second folded thickness, said major dimension having a maximum length which is between 0.8 and 1.3 times, preferably between 0.9 and 1.2 times, said folded width;

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or said sheet to substantially unfold.

2. The flexible package of Claim 1, further characterized in that said closure comprises a flap folded downward over said elongated opening.
3. A flexible package for dispensing a folded sheet, characterized in that said package comprises:
 - (a) at least one folded sheet, said sheet being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said second folded thickness being greater than said first folded thickness, said sheet further having a grasping portion for grasping by a consumer, said grasping portion extending lengthwise beyond a remainder of said sheet and preferably comprising a free corner of said sheet;
 - (b) a package formed of a thin, flexible, and preferably liquid-impervious material, said package entirely surrounding and containing said sheet, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a dispensing edge opposing said bottom edge, each of said edges joining said front side and said back side, said dispensing edge being adapted to be opened by a consumer for access to said sheet, said dispensing edge and said grasping portion of said sheet being adjacent to one another; and
 - (c) said dispensing edge being designed such that when said dispensing edge is opened by said consumer, an elongated opening having a length which is shorter than said bottom edge is formed, said elongated opening defining a minor dimension parallel to said first folded thickness and a major dimension

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whereby when said consumer opens said dispensing edge and forms said opening, said grasping portion is presented for grasping, and whereby grasping said grasping portion and withdrawing said sheet from said package through said dispensing edge automatically causes said longitudinal folds and said lateral folds of said sheet to substantially unfold.

4. The flexible package of Claim 3, further characterized in that said side edges are provided with opposed notches near said dispensing edge to facilitate opening by said consumer, and in that said dispensing edge has a shorter length than said bottom edge.
5. A flexible package for dispensing a folded sheet, characterized in that said package comprises:
 - (a) at least one folded sheet, said sheet being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said second folded thickness being greater than said first folded thickness, said sheet further having a grasping portion for grasping by a consumer, said grasping portion extending lengthwise beyond a remainder of said sheet;
 - (b) a package formed of a thin, flexible, and preferably liquid-impervious material, said package entirely surrounding and containing said sheet, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a dispensing edge opposing said bottom edge, each of said edges joining said front side and said back side, said dispensing edge being adapted to be opened by a consumer for access to said sheet, said dispensing edge and said grasping portion of said sheet being

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said back side, said flexible bar being interleaved between said lateral folds of said sheet such that a portion of said sheet between said grasping portion and a first lateral fold is on an opposite side of said flexible bar from said remainder of said sheet, said flexible bar having a width which is smaller than said folded length, said flexible bar further having a length sufficient to fully extend from one of said side edges to the other of said side edges, said flexible bar being located up to one-half, preferably up to one-fourth, of said folded length from said grasping portion toward said first lateral fold, and said flexible bar being firmly affixed to said side edges;

whereby when said consumer opens said dispensing edge said grasping portion of said sheet is presented for grasping, and whereby upon grasping said grasping portion and withdrawing said sheet from said package through said dispensing edge, said flexible bar automatically causes said lateral folds of said sheet to substantially unfold.

6. The flexible package of Claim 5, further characterized in that said side edges are provided with opposed notches near said dispensing edge to facilitate opening by said consumer.
7. A flexible package for dispensing folded sheets, characterized in that said package comprises:
 - (a) a first folded sheet, said first sheet being first folded longitudinally to define a predetermined folded width and then folded laterally to define a predetermined folded length, such that said first sheet has longitudinal folds generally parallel to its length and at least one lateral fold generally parallel to its width, said longitudinal folds and said lateral fold being generally orthogonal to one another, said first sheet further having a grasping portion for grasping by a consumer and a trailing edge, said grasping portion extending lengthwise beyond a remainder of said first sheet;

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...folds generally parallel to its length and at least one lateral fold generally parallel to its width, said longitudinal folds and said lateral fold being generally orthogonal to one another, said additional sheet further having a grasping portion for grasping by a consumer and a trailing edge, said grasping portion of said additional sheet being detachably joined to said trailing edge of said first sheet;

- (c) a package formed of a thin, flexible, and preferably liquid-impervious material, said package entirely surrounding and containing said sheets, said package further having a front side and a back side, said package further having two opposing side edges, a bottom edge, and a dispensing edge opposing said bottom edge, each of said edges joining said front side and said back side, said dispensing edge being adapted to be opened by a consumer to form an open end for access to said sheets, said dispensing edge and said grasping portion of said first sheet being adjacent to one another; and
- (d) said package further comprising a flexible bar formed of a flexible material, said flexible bar being disposed inside said package between said front side and said back side, said flexible bar being interleaved between portions of said first sheet such that a portion of said first sheet between said grasping portion and said lateral fold is on an opposite side of said flexible bar from said remainder of said first sheet and said additional sheet, said flexible bar having a width which is smaller than said folded lengths of said sheets, said flexible bar further having a length sufficient to fully extend from one of said side edges to the other of said side edges, said flexible bar being located up to one-half, preferably up to one-fourth, of said folded length from said grasping portion of said first sheet toward said lateral fold, and said flexible bar being firmly affixed to said side edges;

whereby when said consumer opens said closure said grasping portion of said first sheet is presented for grasping, and whereby upon grasping said grasping portion of said first sheet and withdrawing said first sheet from said package

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8. The flexible package of Claim 7, further characterized in that said dispensing edge is releasably sealed by a resealable closure, said closure preferably comprising a resealable flap folded downward over said open end.
9. A flexible package according to any one of Claims 5 to 8, further characterized in that said flexible bar is formed of a thin, flexible sheet material or a thin, flexible cord material.
10. A flexible package according to any one of Claims 1 to 9, further characterized in that said sheet is moistened with a cleansing agent.

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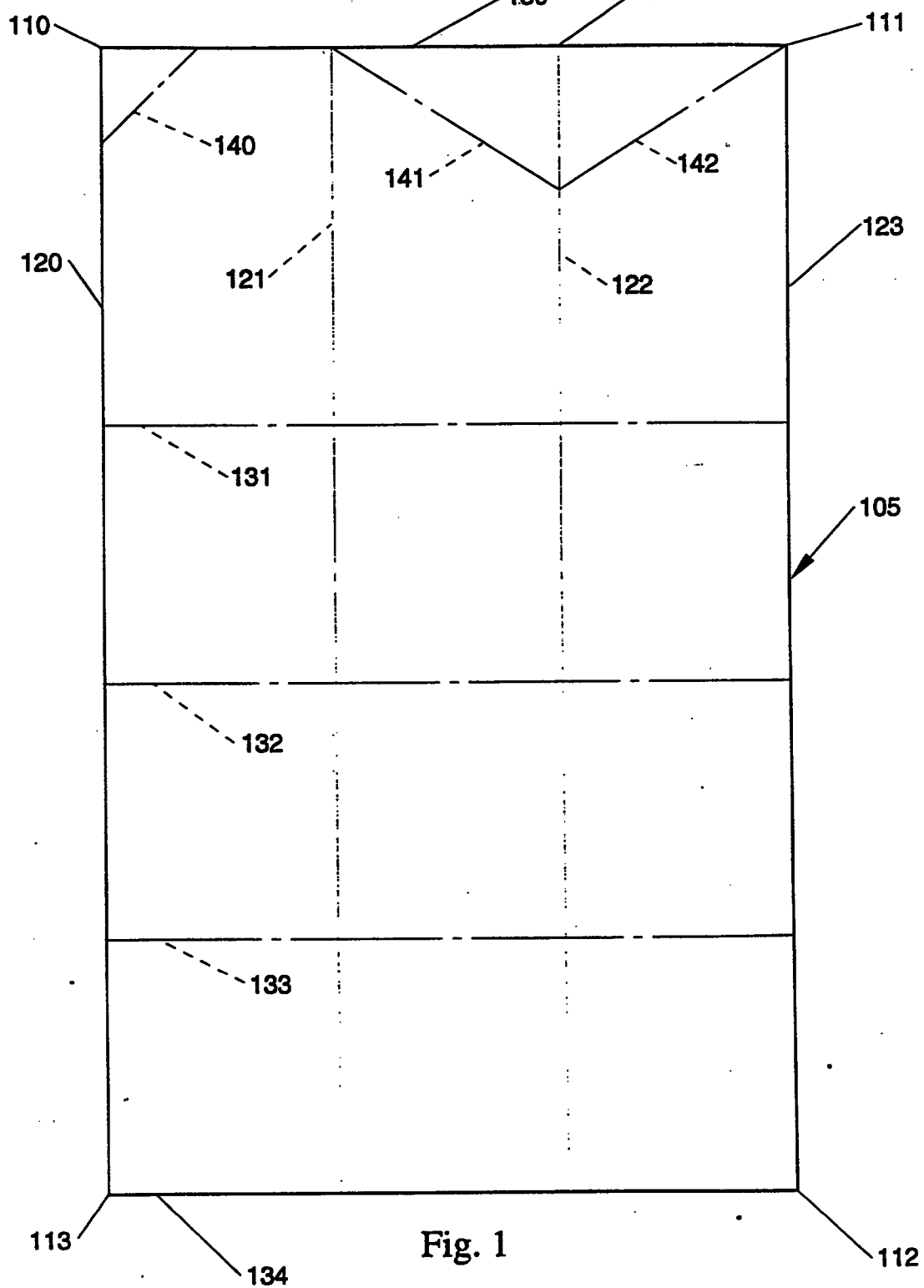
The present invention presents improved packages for single-use, disposable folded towels (105, 205, 305), and more particularly to single- and multi-towel packages which provide for readily grasping a defined portion of the towel upon opening the package and automatic unfolding of the towel upon removal from the package without a separate unfolding step requiring additional consumer action. Single-towel embodiments are disclosed which provide for complete unfolding of the towel by use of: (a) an opening (152, 257) bearing a particular geometrical relationship to the dimensions of the folded towel; or (b) a flexible bar (361, 451) within the package to provide unfolding of the towel in the longitudinal direction. A multi-towel embodiment which provides for the advantageous dispensing features and convenience of an improved single-towel package while providing the added capability of multi-towel transportation is also disclosed. These packages provide for complete containment and protection of the folded towel prior to use, while providing ease of dispensing and unfolding for the consumer at the time of use. Several methods of folding folded towels for use with packages according to the present invention are also disclosed, as well as various methods of fabricating the improved packages according to the present invention.

Figure 5b



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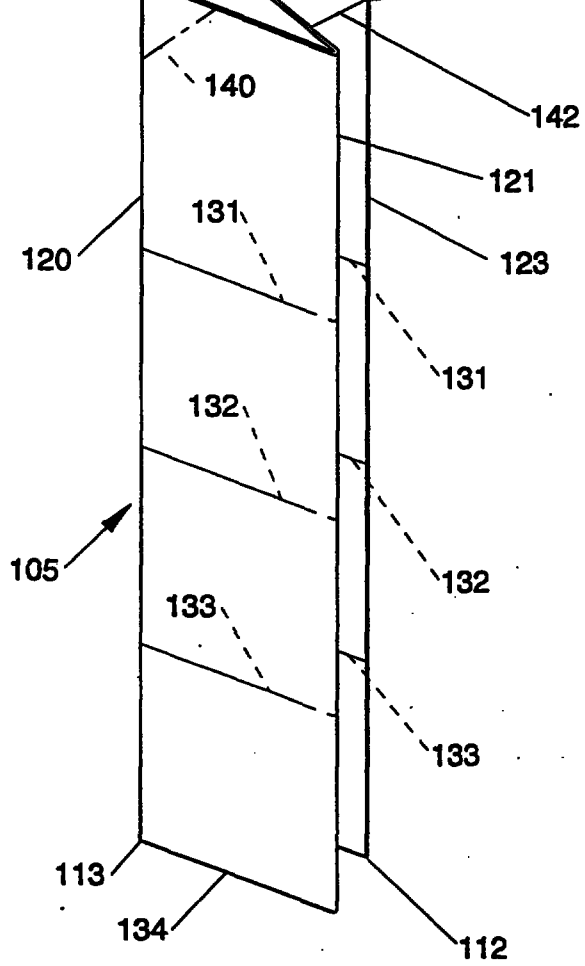


Fig. 2A

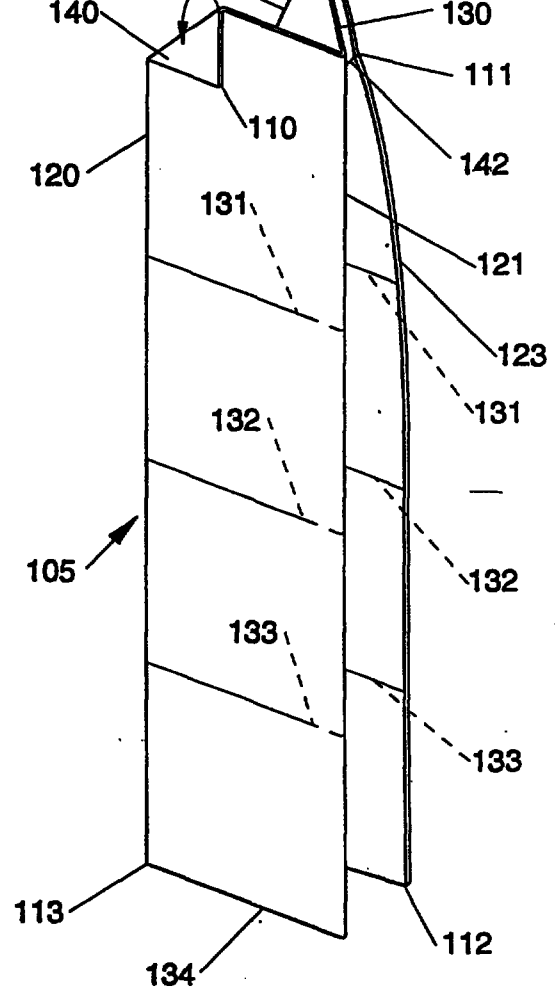


Fig. 2B

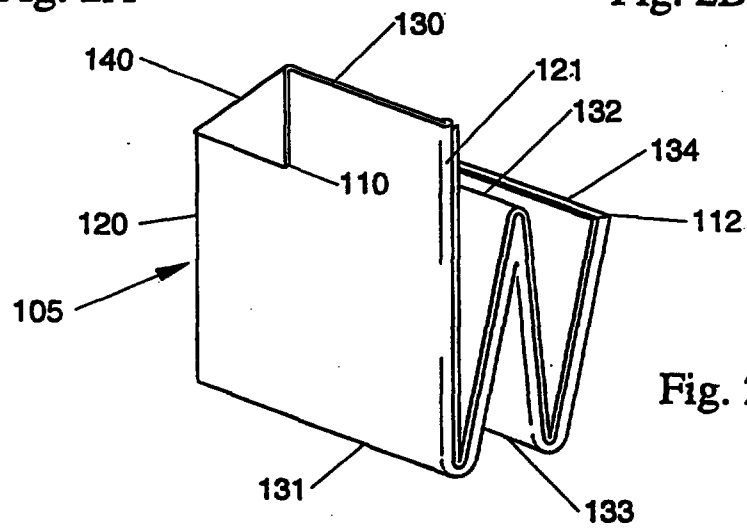


Fig. 2C

This is the replacement sheet

Date: 30 SEP 1996

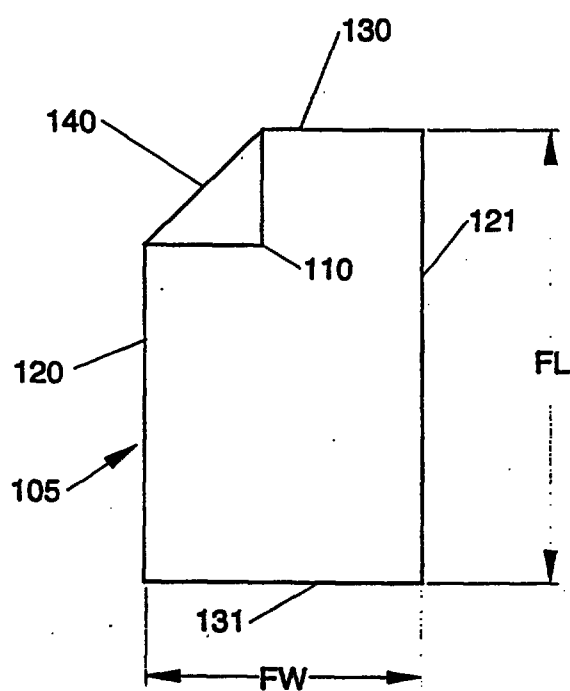


Fig. 3A

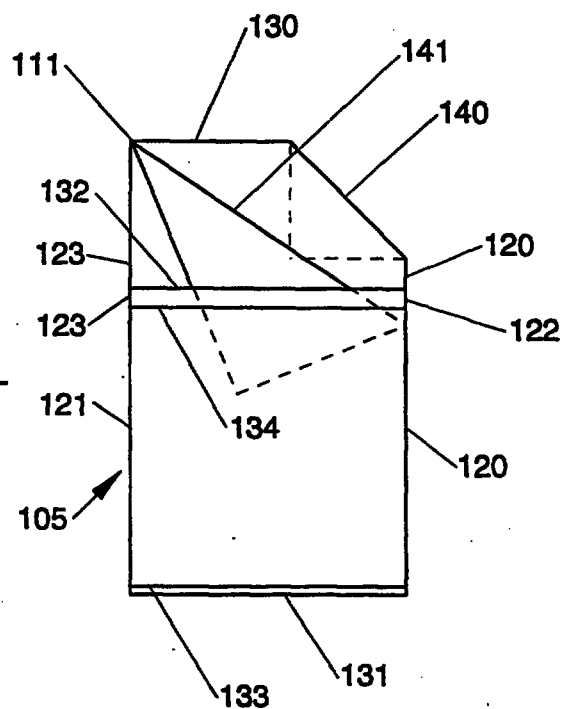


Fig. 3B

This is the replacement sheet

Date: 30 SEP 1996

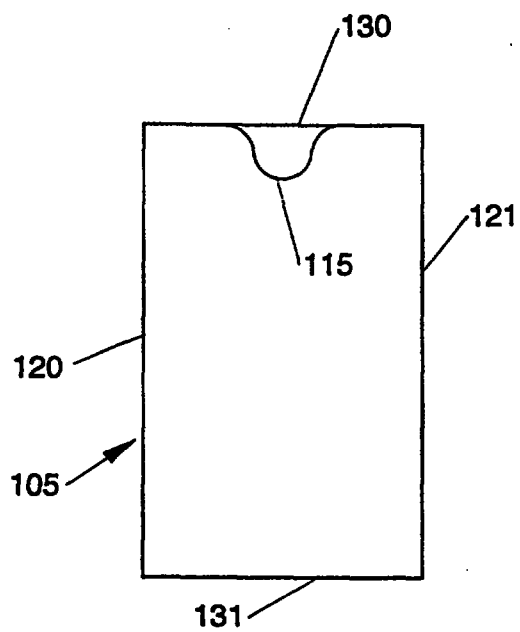


Fig. 3C

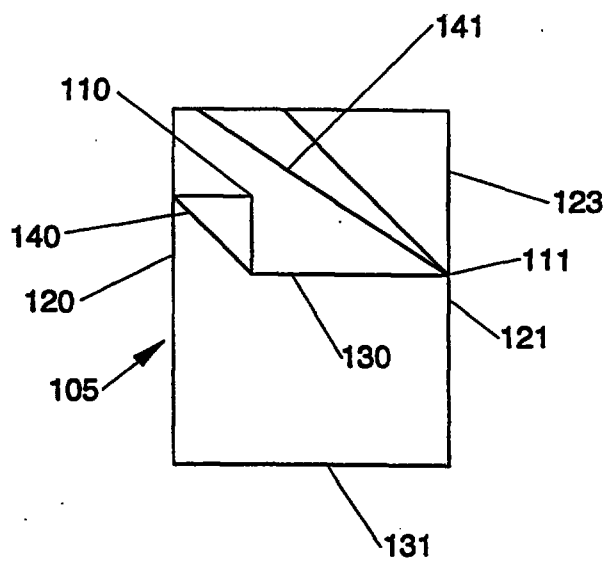


Fig. 3D

This is the replacement sheet

Date: 30 SEP 1996

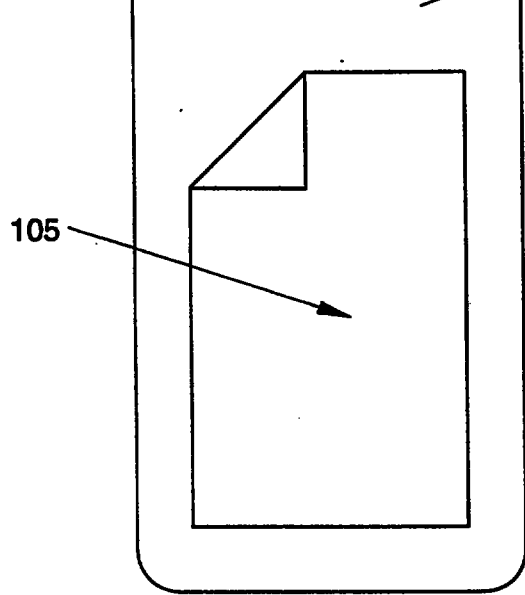


Fig. 4A

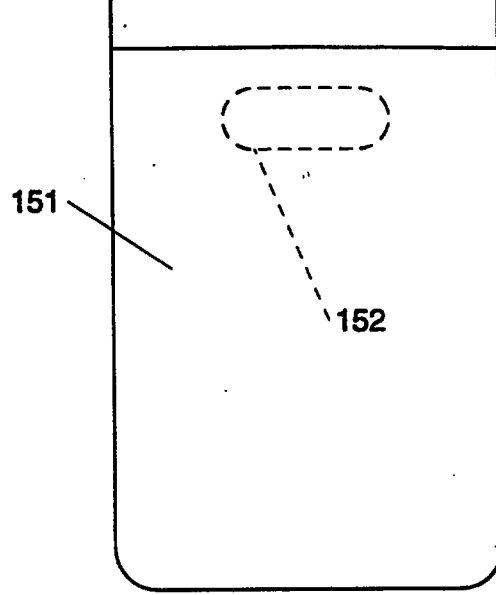


Fig. 4B

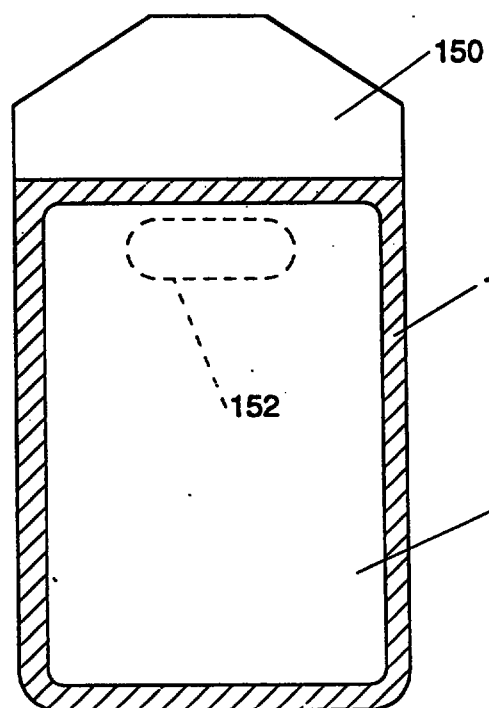


Fig. 4C

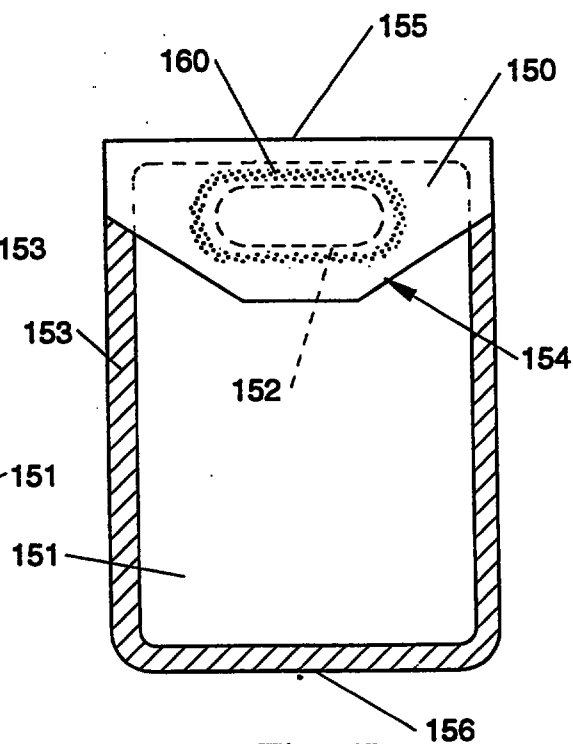


Fig. 4D

This is the replacement sheet

Date: 30 SEP 1996

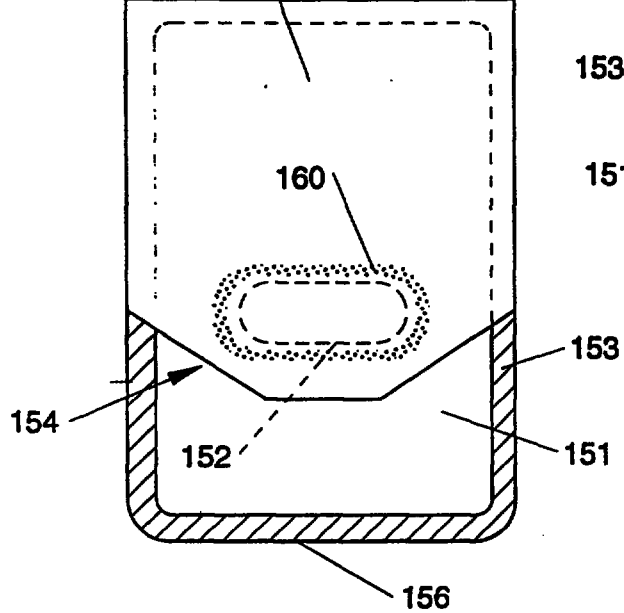


Fig. 4E

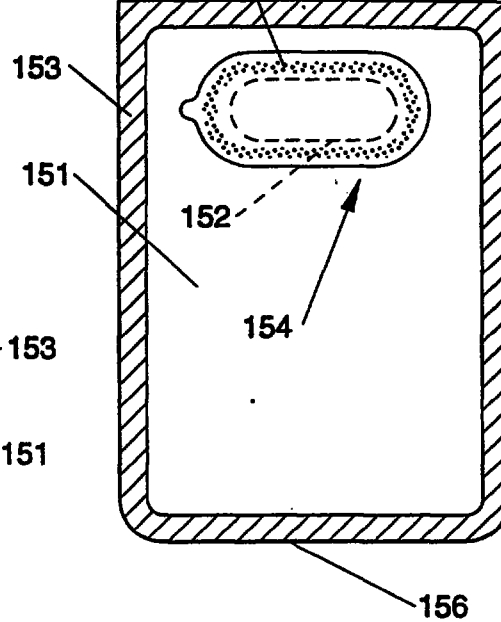


Fig. 4F

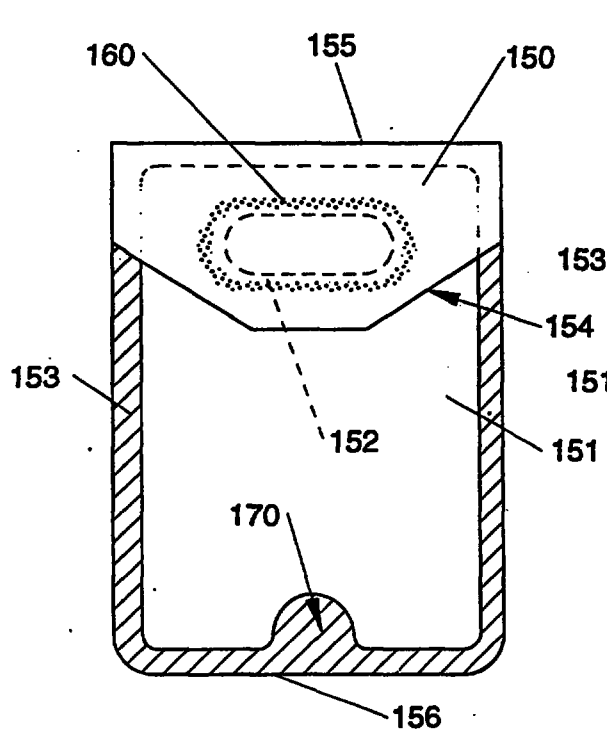


Fig. 4G

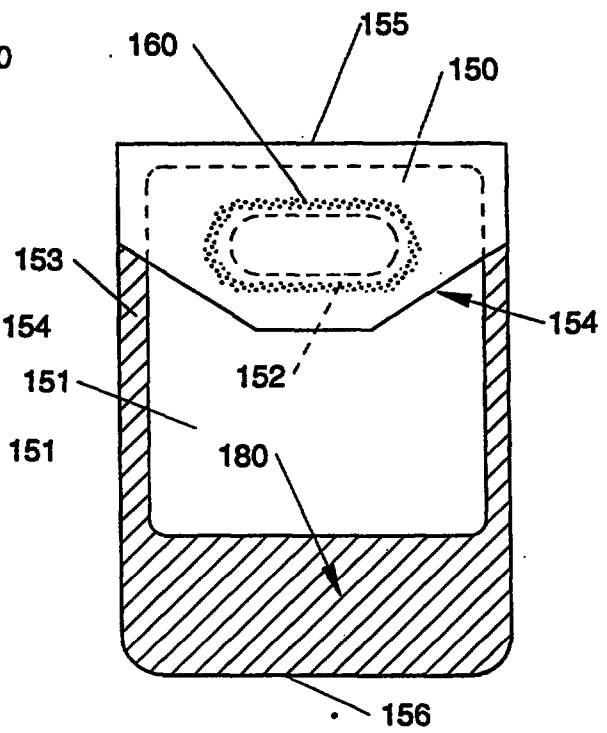


Fig. 4H

This is the replacement sheet

Date: 30 SEP 1996

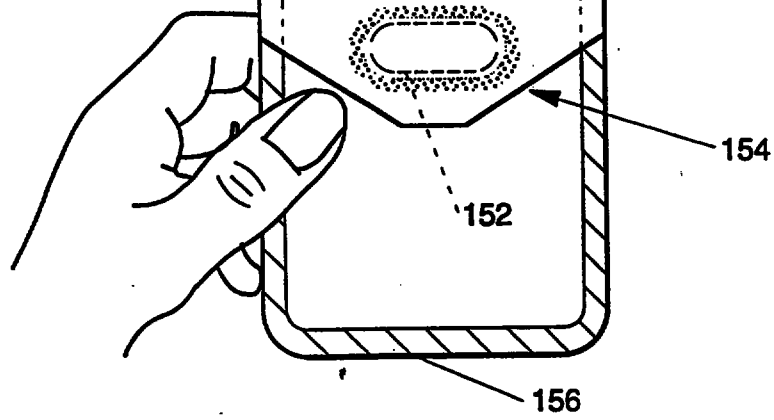


Fig. 5A

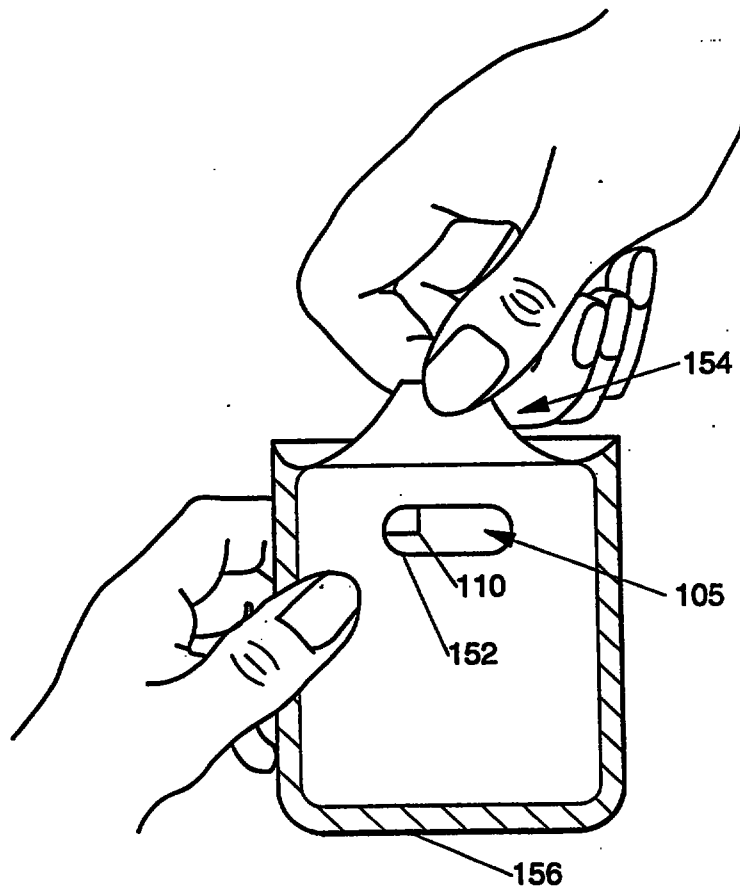


Fig. 5B

This is the replacement sheet

Date: 30 SEP 1996

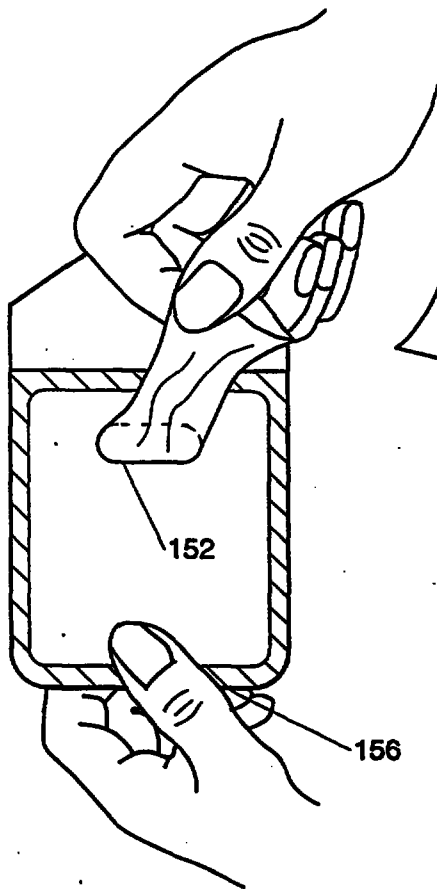


Fig. 5C

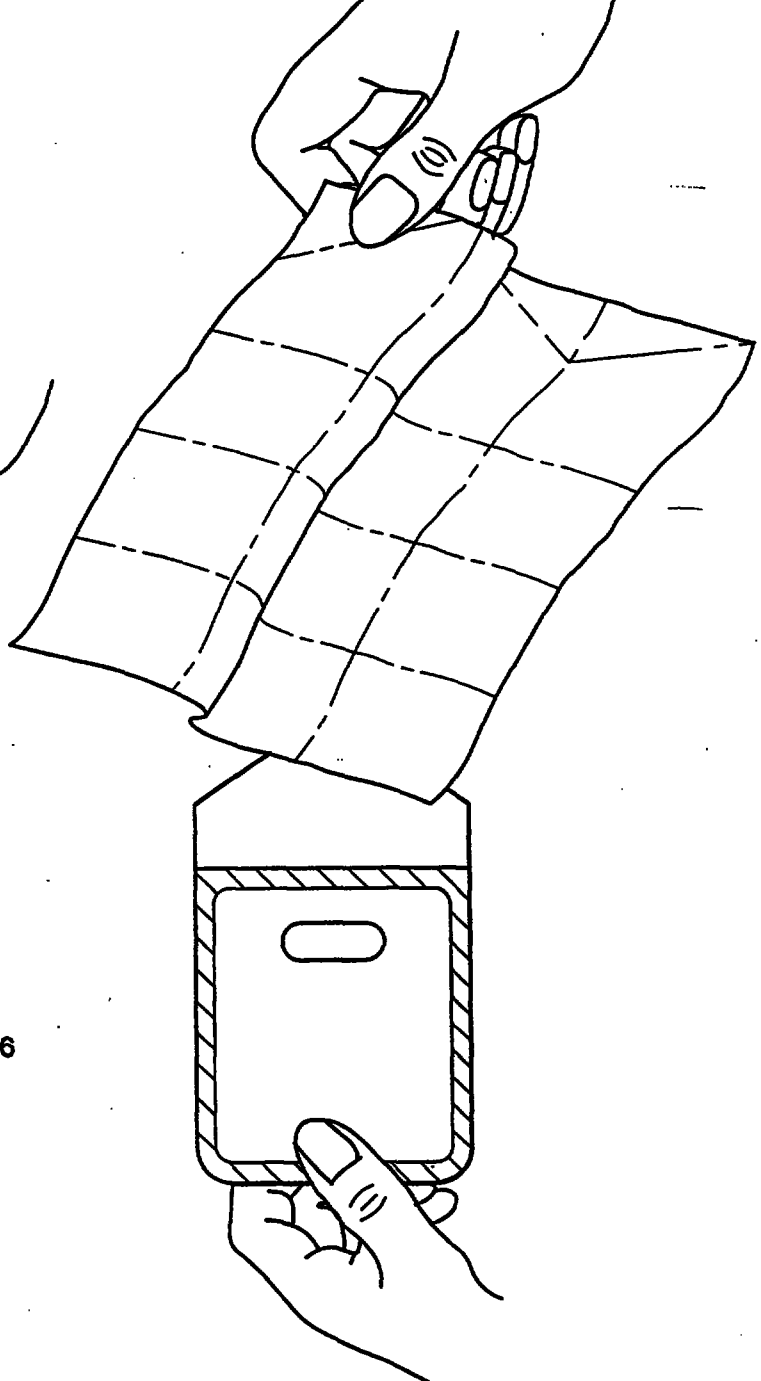


Fig. 5D

This is the replacement sheet

Date: 30 SEP 1996

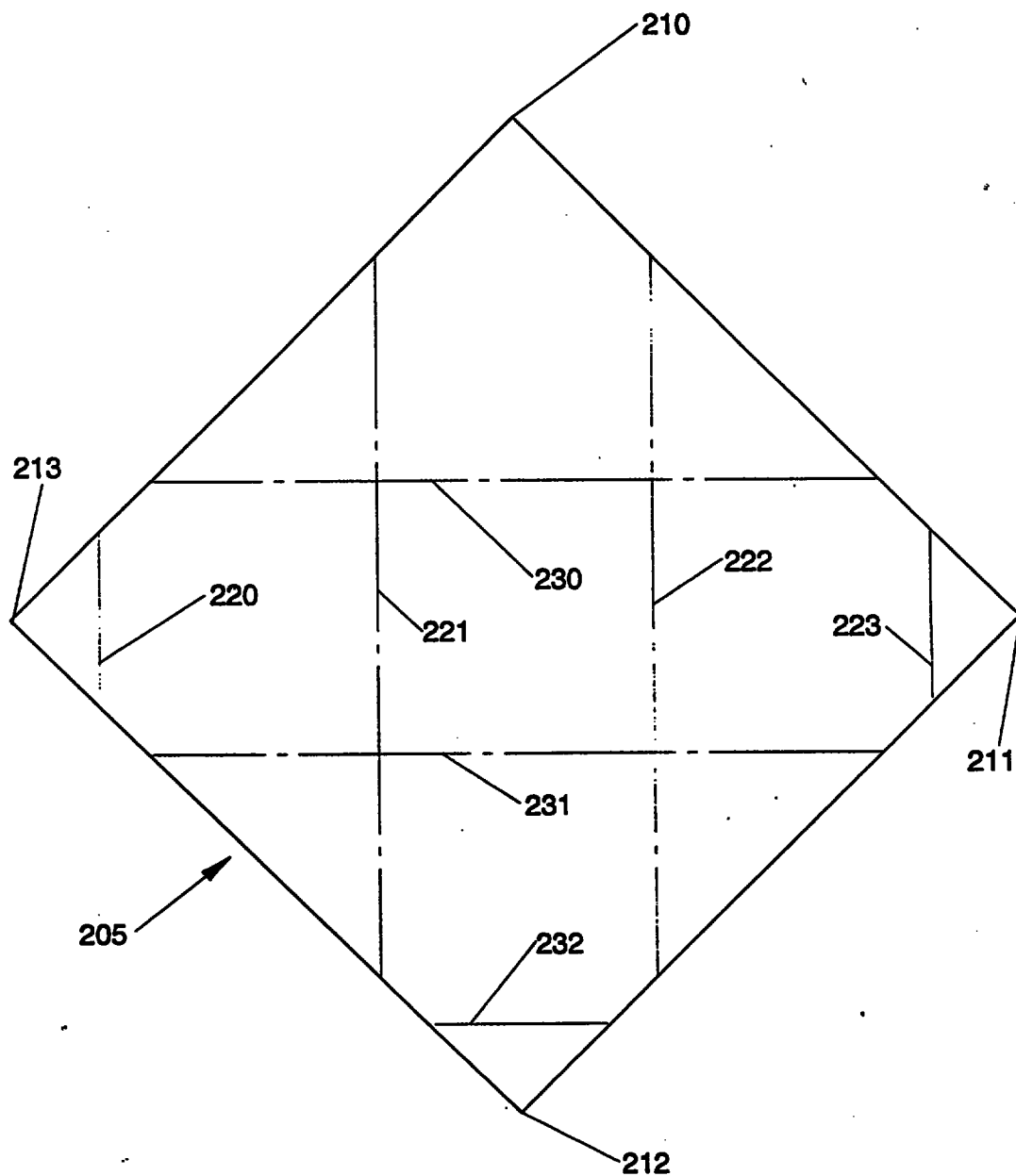


Fig. 6

This is the replacement sheet

Date: 30 SEP 1996

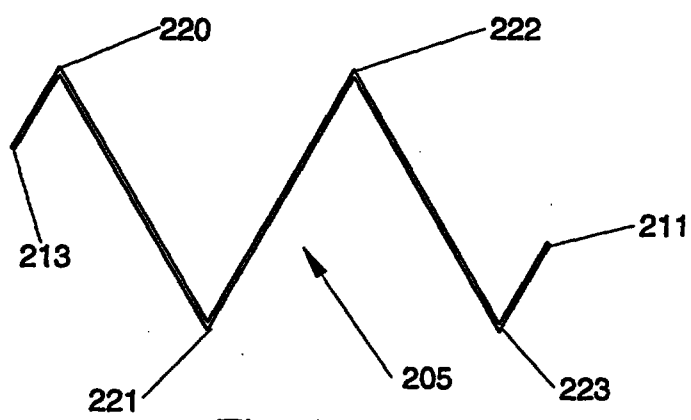


Fig. 7A

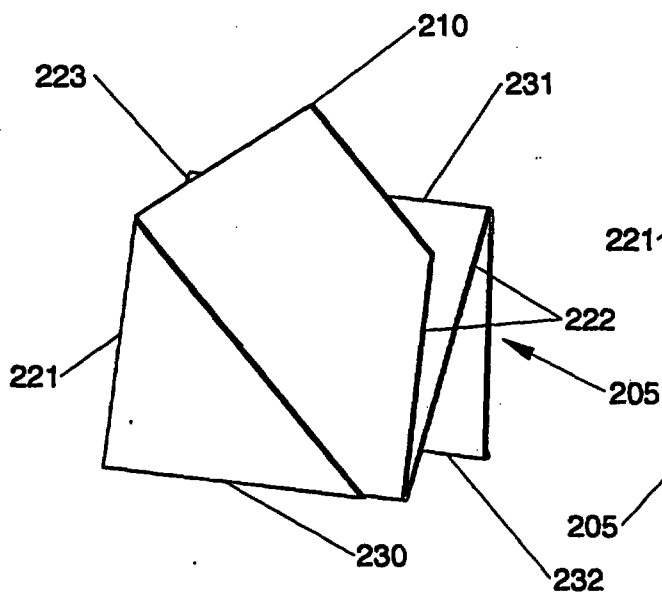


Fig. 7C

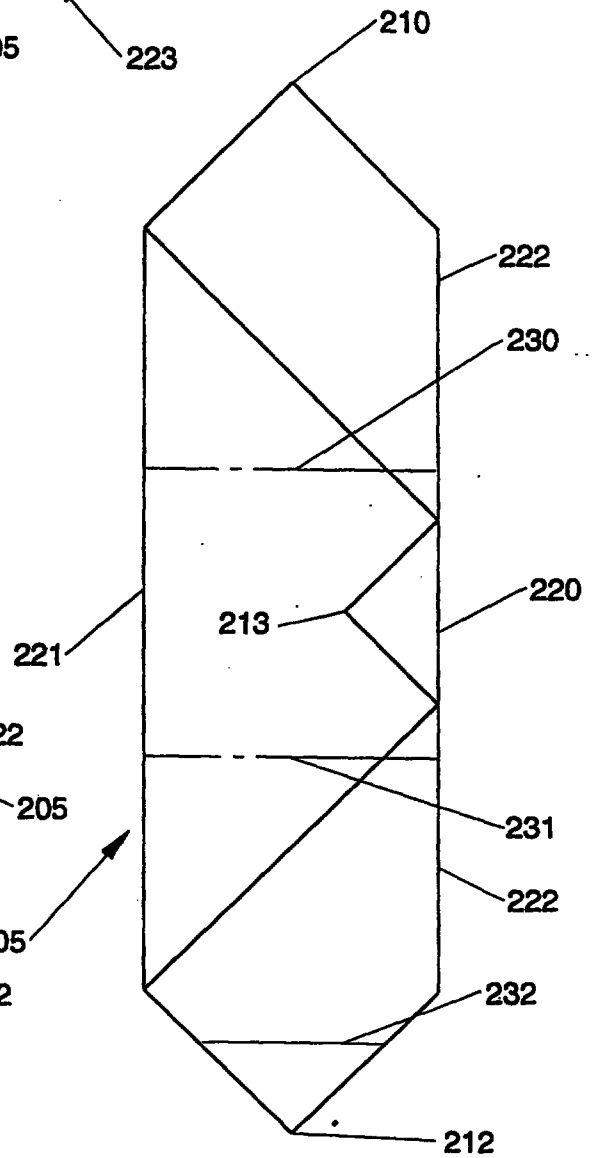


Fig. 7B

This is the replacement sheet

Date: 30 SEP 1996

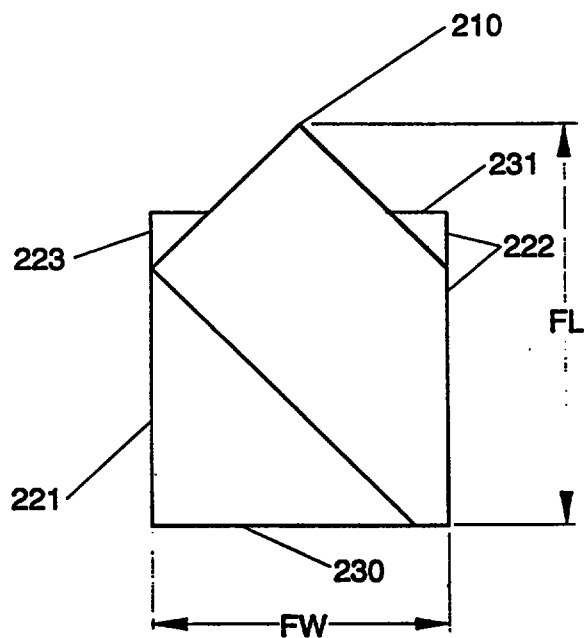


Fig. 8A

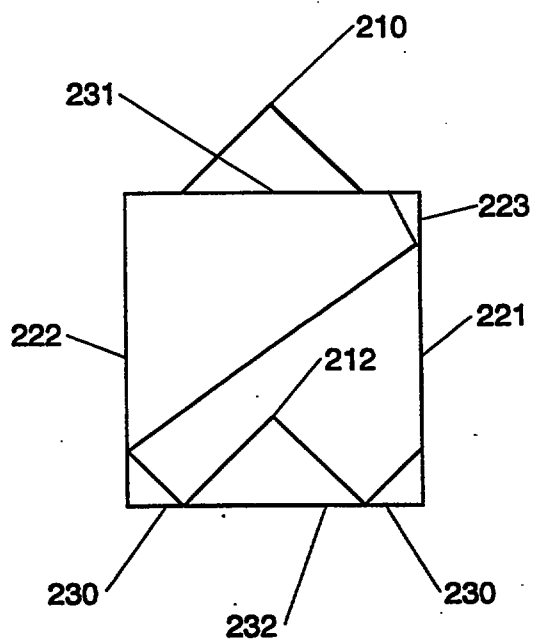


Fig. 8B

This is the replacement sheet

Date: 30 SEP 1996

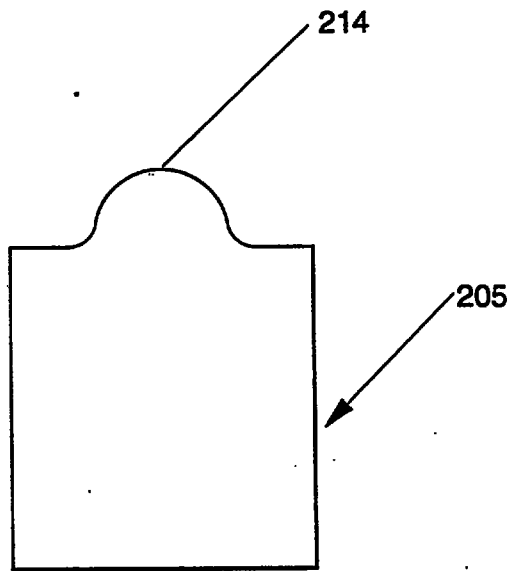


Fig. 8C

This is the replacement sheet

Date: 30 SEP 1996

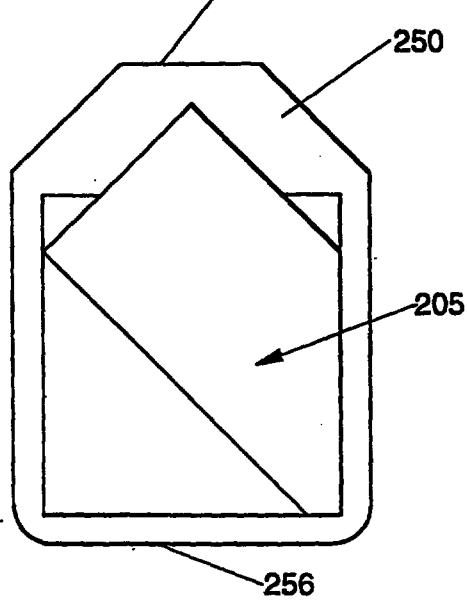


Fig. 9A

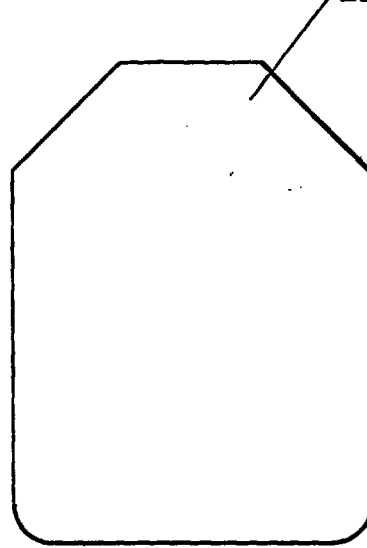


Fig. 9B

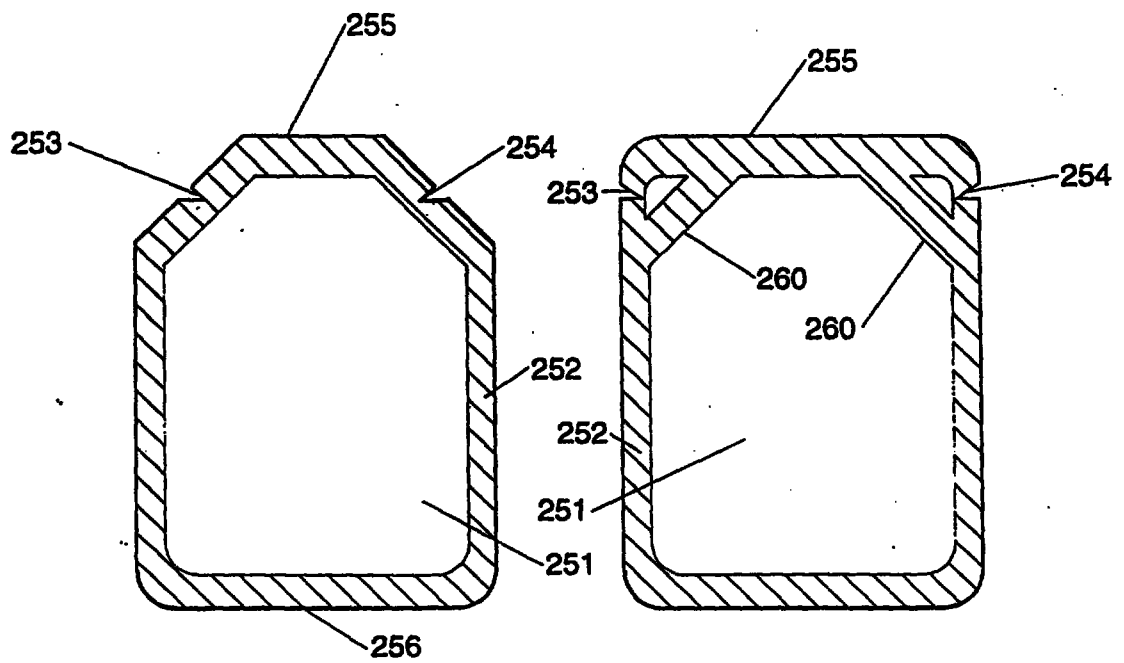


Fig. 9C

Fig. 9D

This is the replacement sheet

Date: 30 SEP 1996

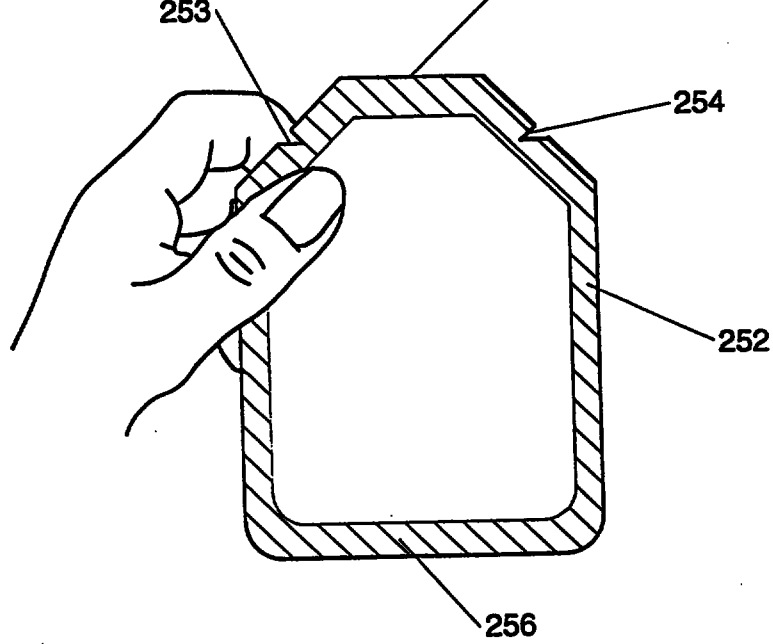


Fig. 10A

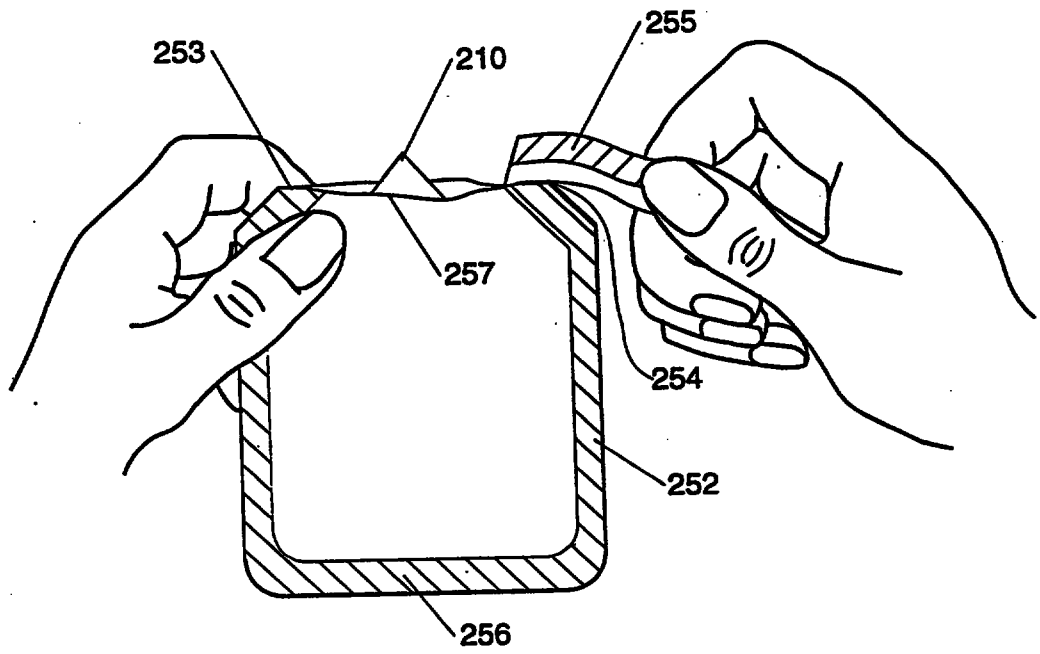


Fig. 10B

This is the replacement sheet

Date: 30 SEP 1996

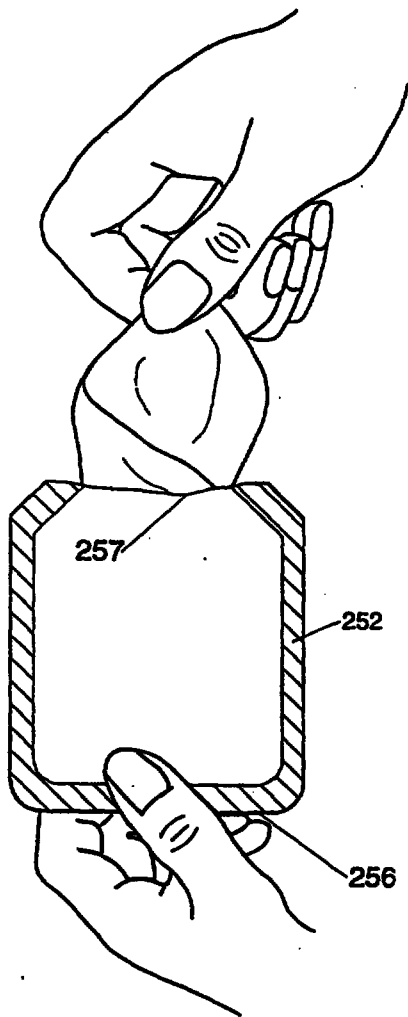


Fig. 10C

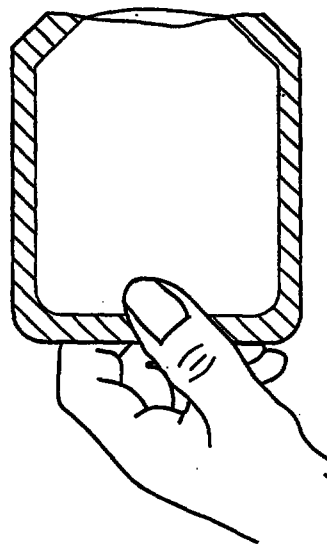
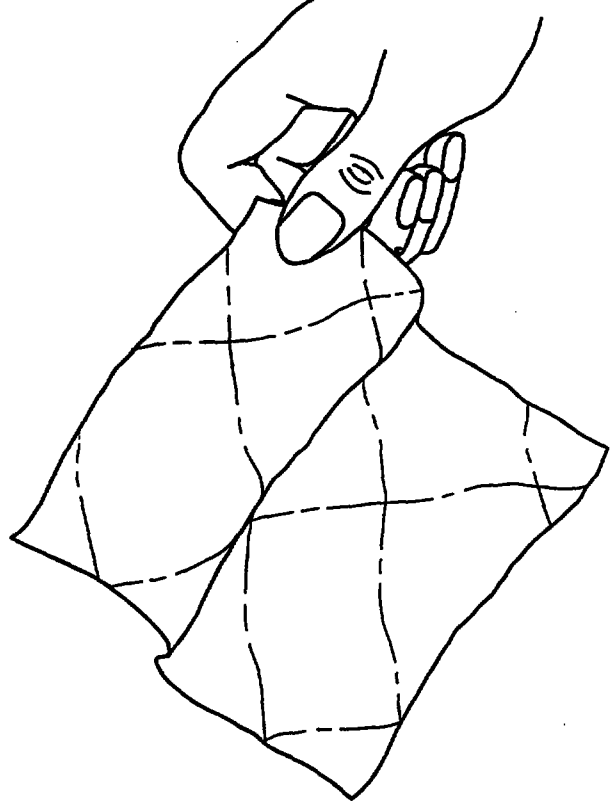
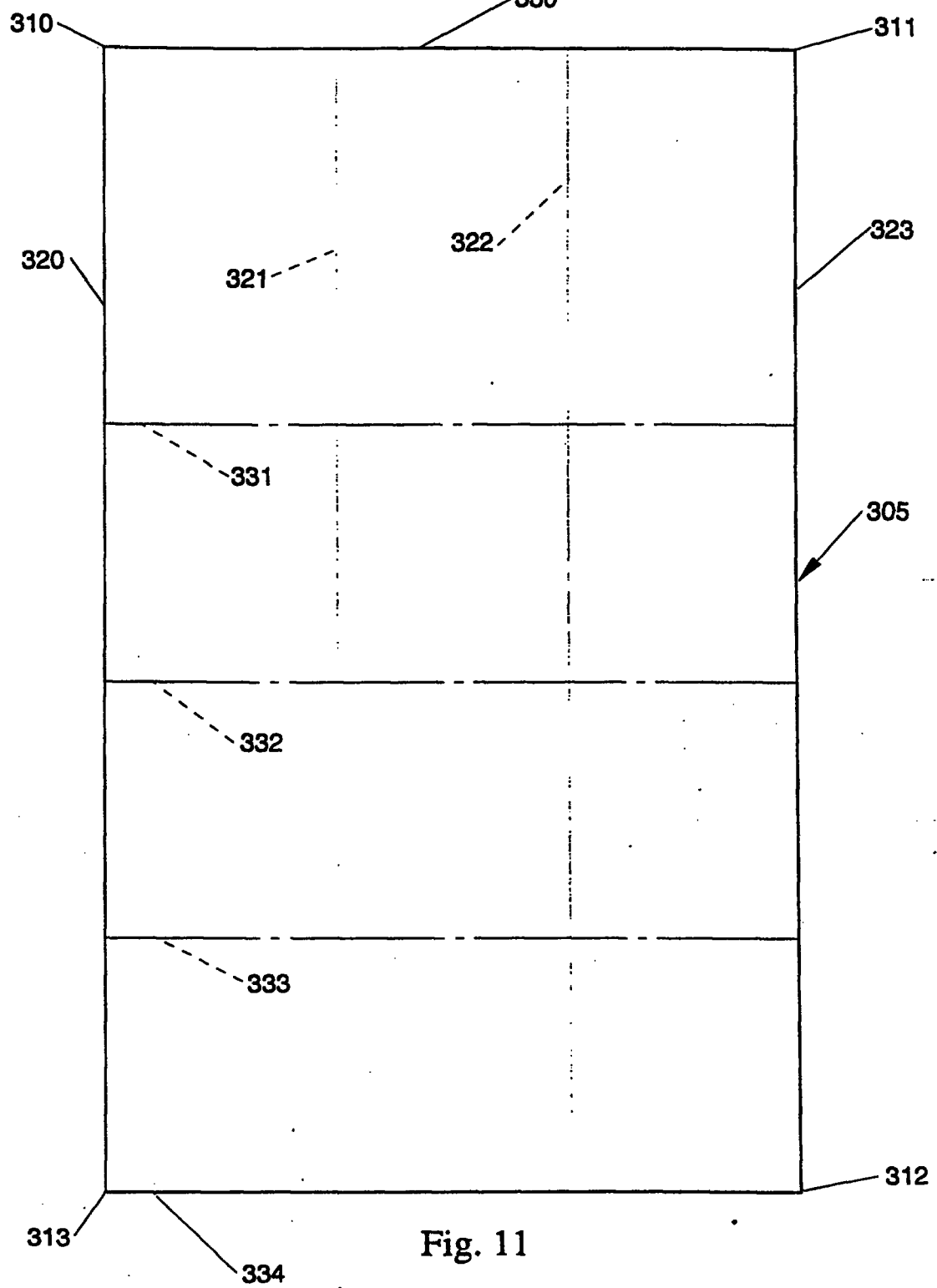


Fig. 10D

This is the replacement sheet

Date: 30 SEP 1996



This is the replacement sheet

Date: 30 SEP 1996

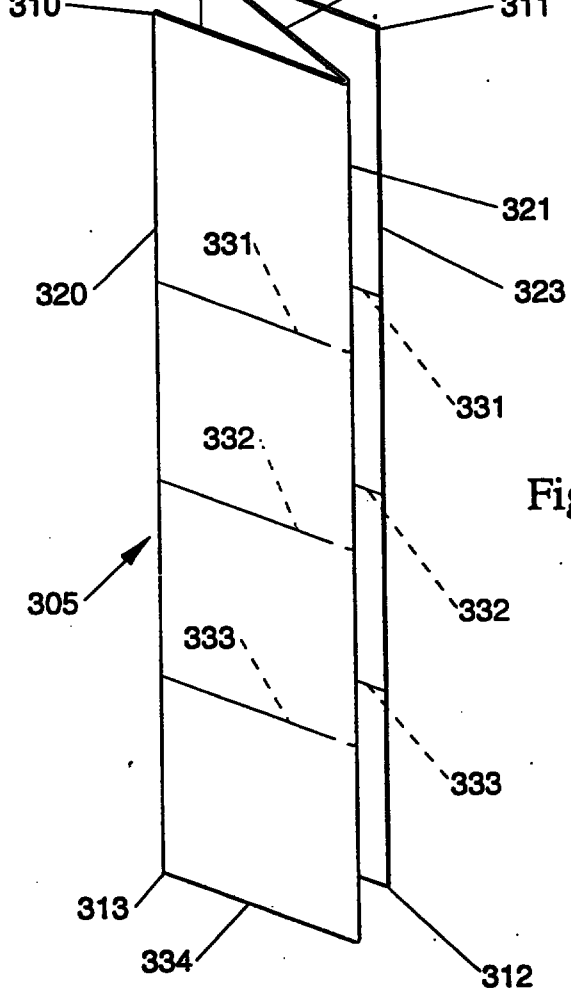


Fig. 12A

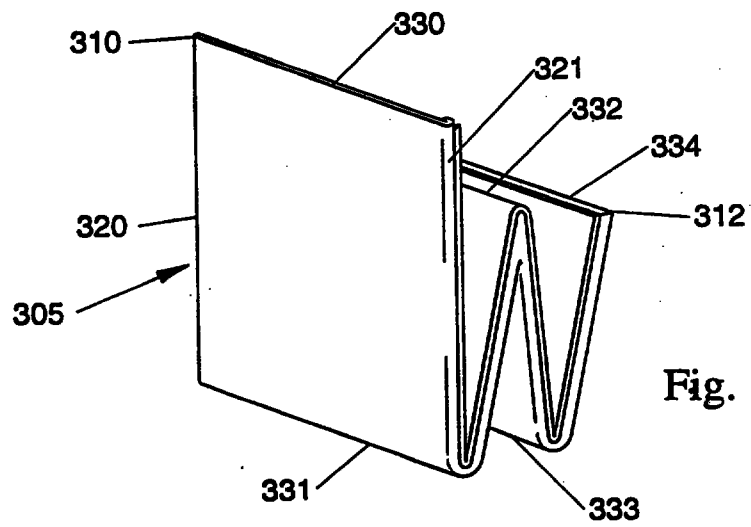


Fig. 12B

This is the replacement sheet

Date: 30 SEP 1996

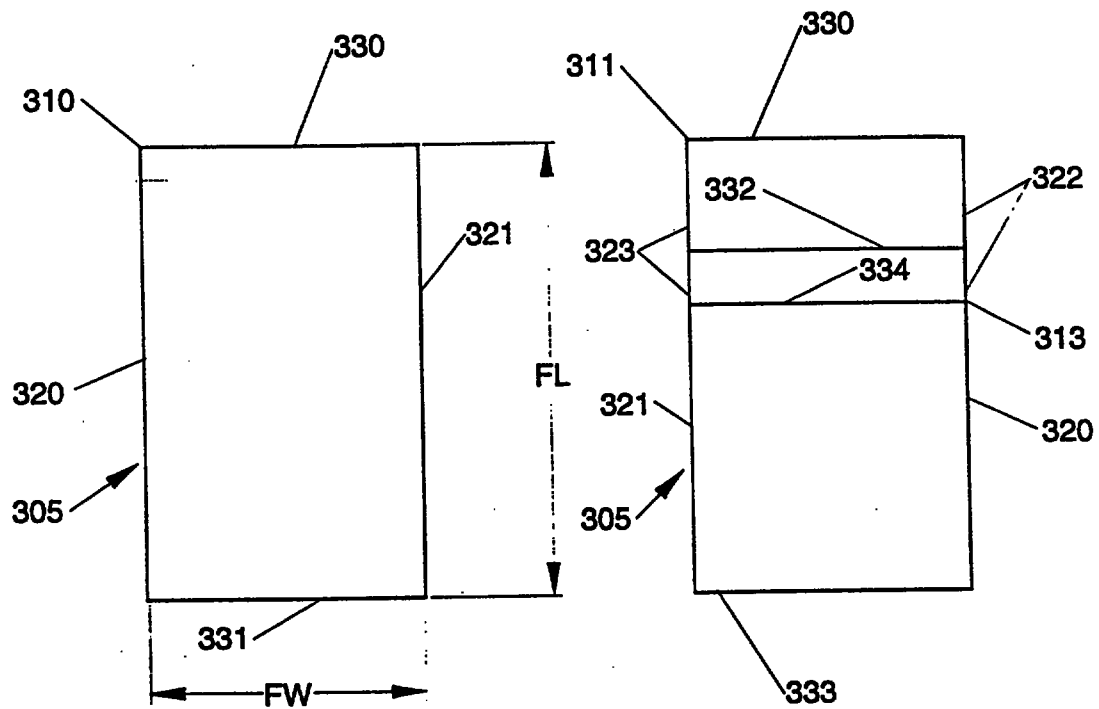


Fig. 13A

Fig. 13B

This is the replacement sheet

Date: 30 SEP 1996

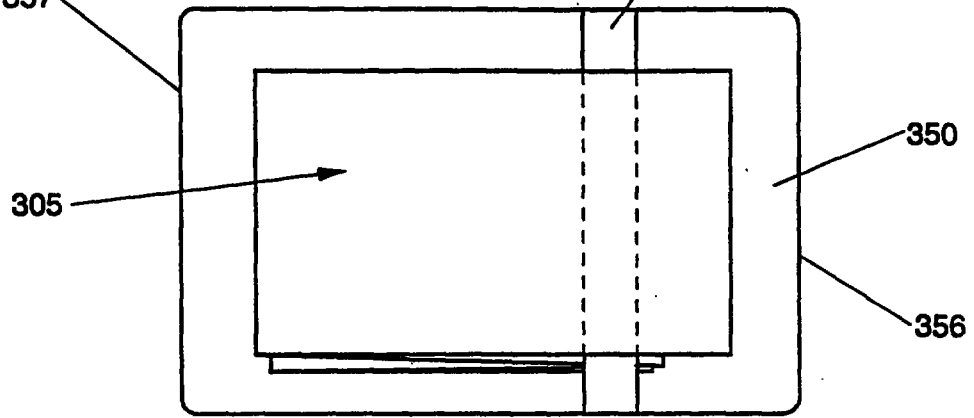


Fig. 14A

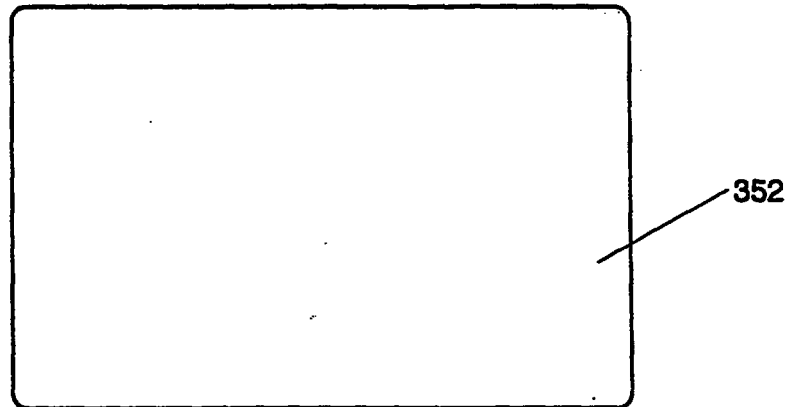


Fig. 14B

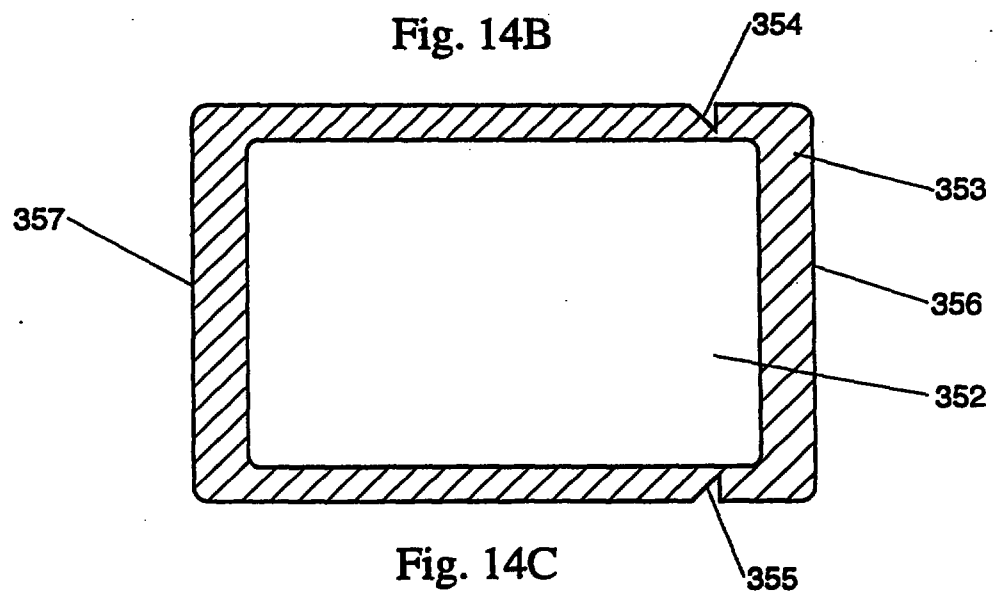


Fig. 14C

This is the replacement sheet

Date: 30 SEP 1996

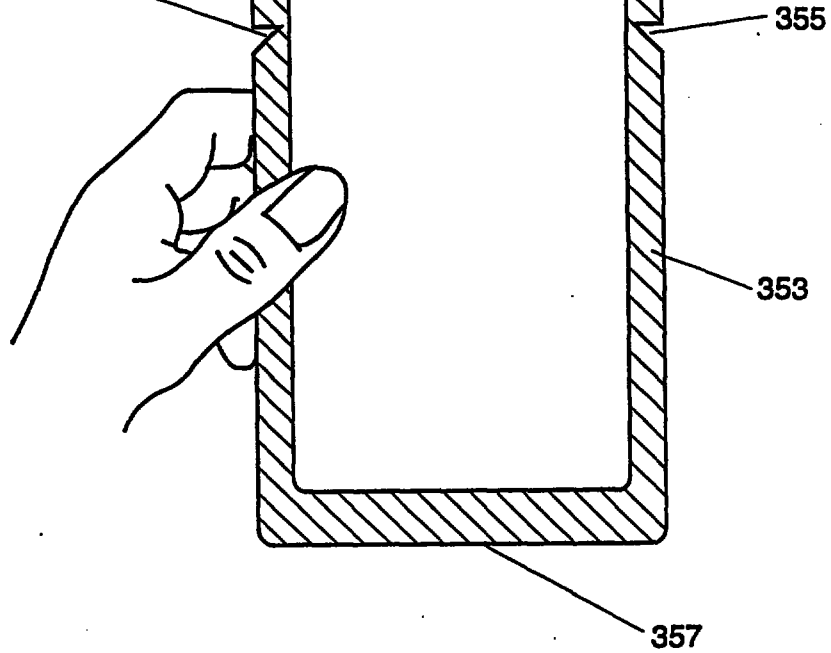


Fig. 15A

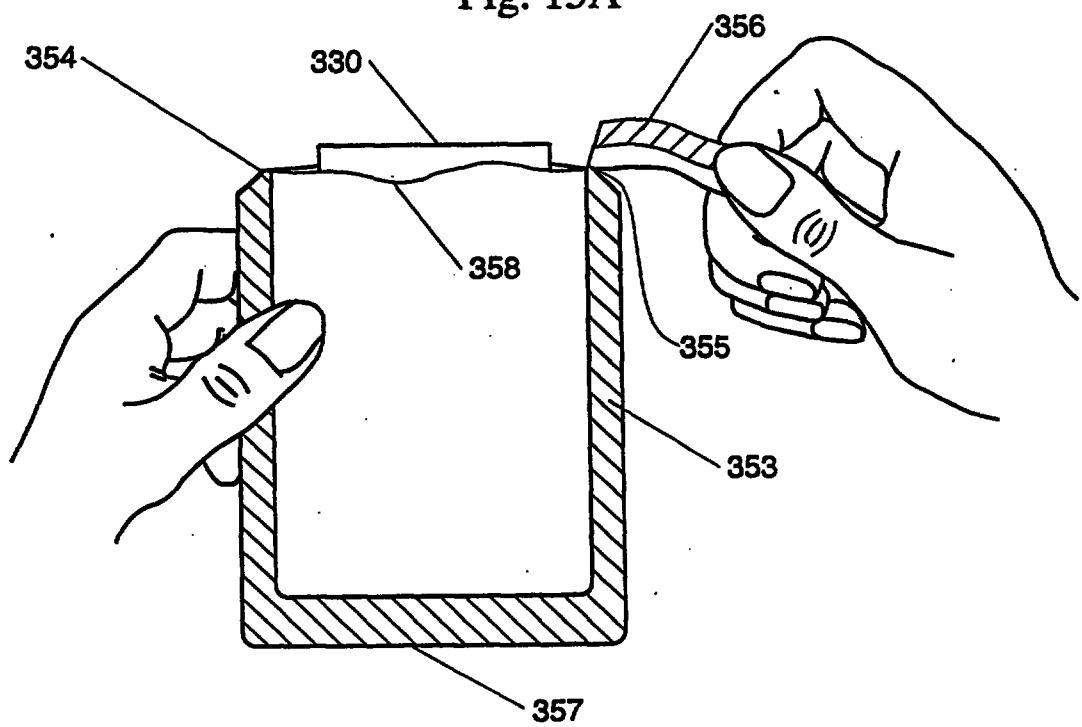


Fig. 15B

This is the replacement sheet

Date: 30 SEP 1996

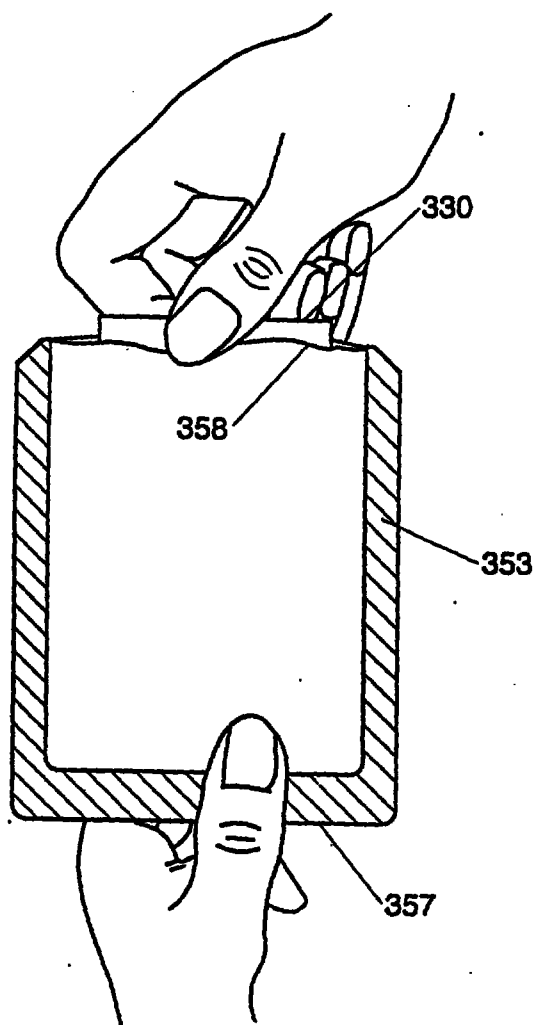


Fig. 15C

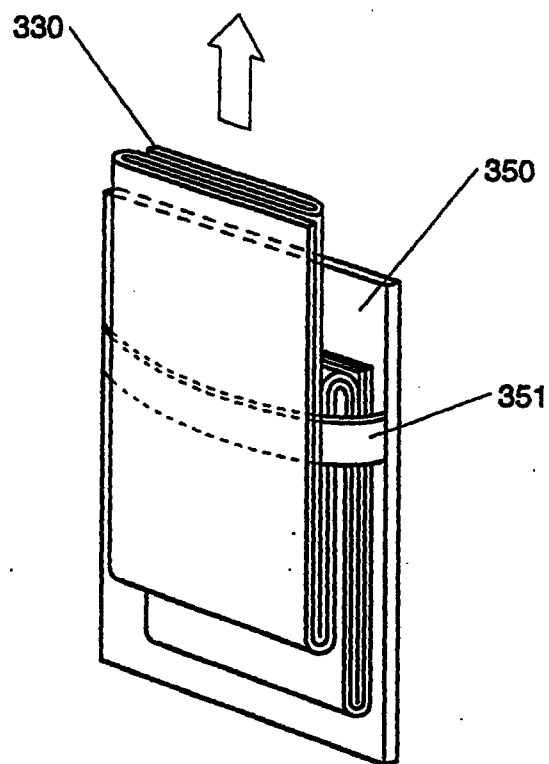


Fig. 15D

This is the replacement sheet

Date: 30 SEP 1996

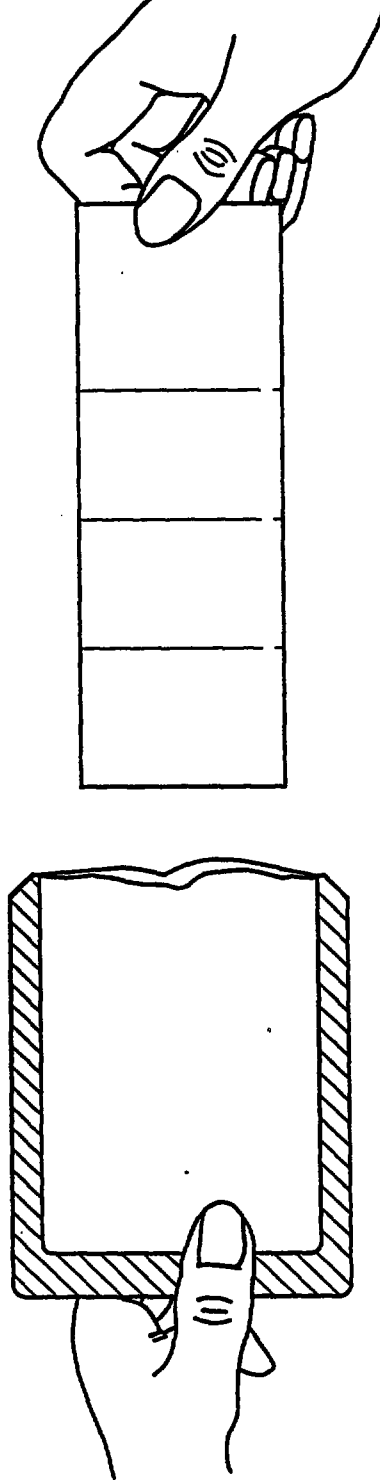


Fig. 15E

This is the replacement sheet

Date: 30 SEP 1996

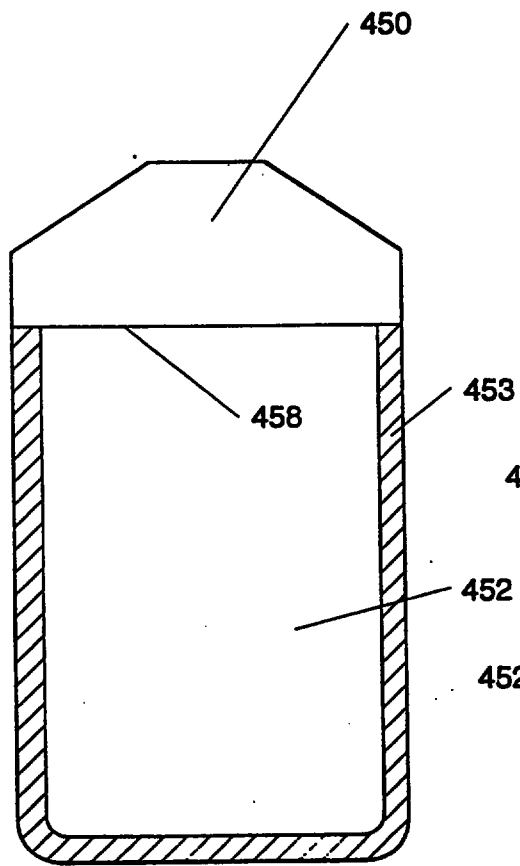


Fig. 16A

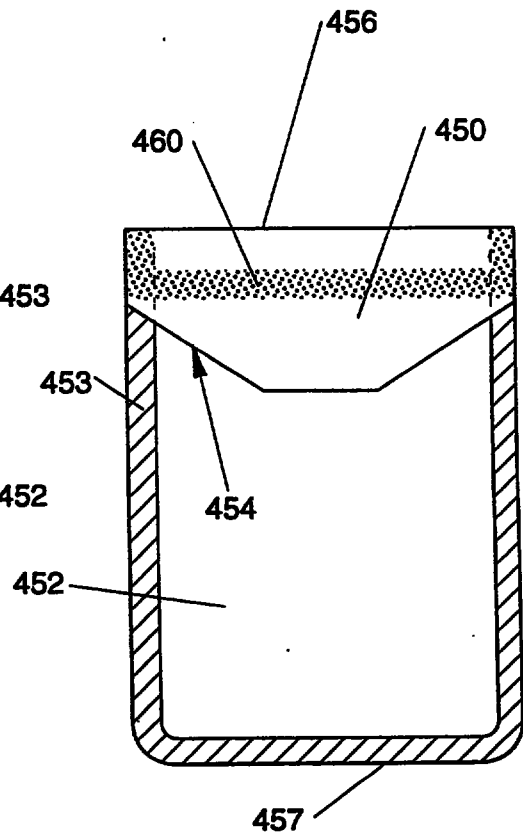


Fig. 16B

This is the replacement sheet

Date: 30 SEP 1996

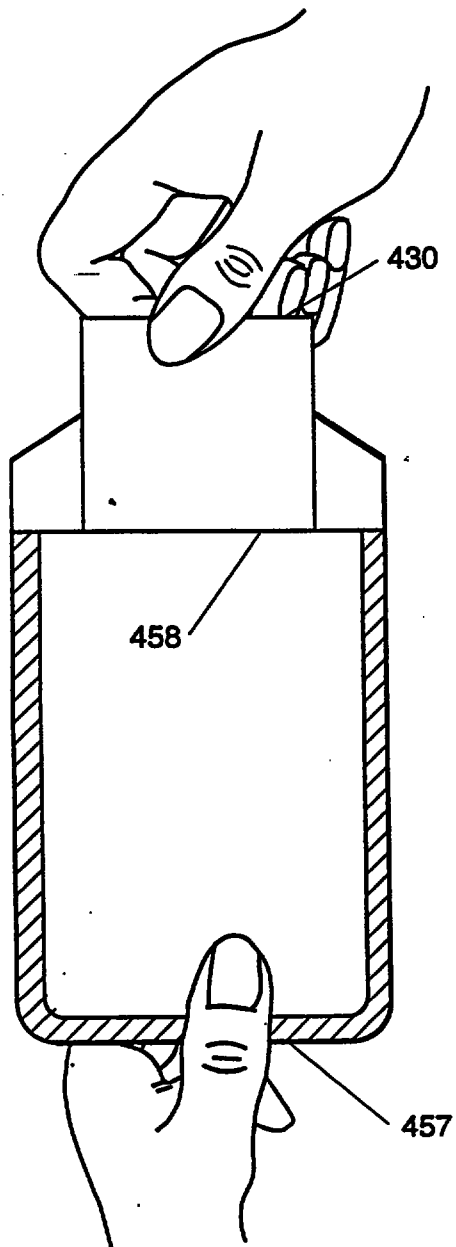


Fig. 17A

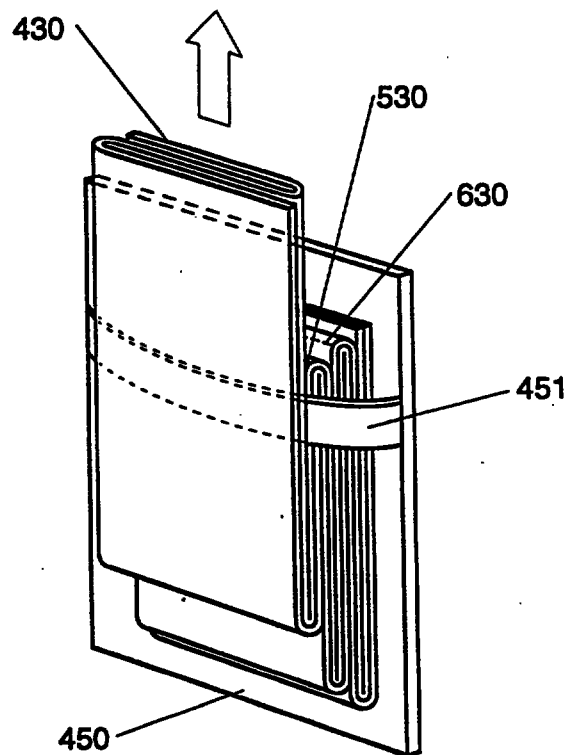


Fig. 17B

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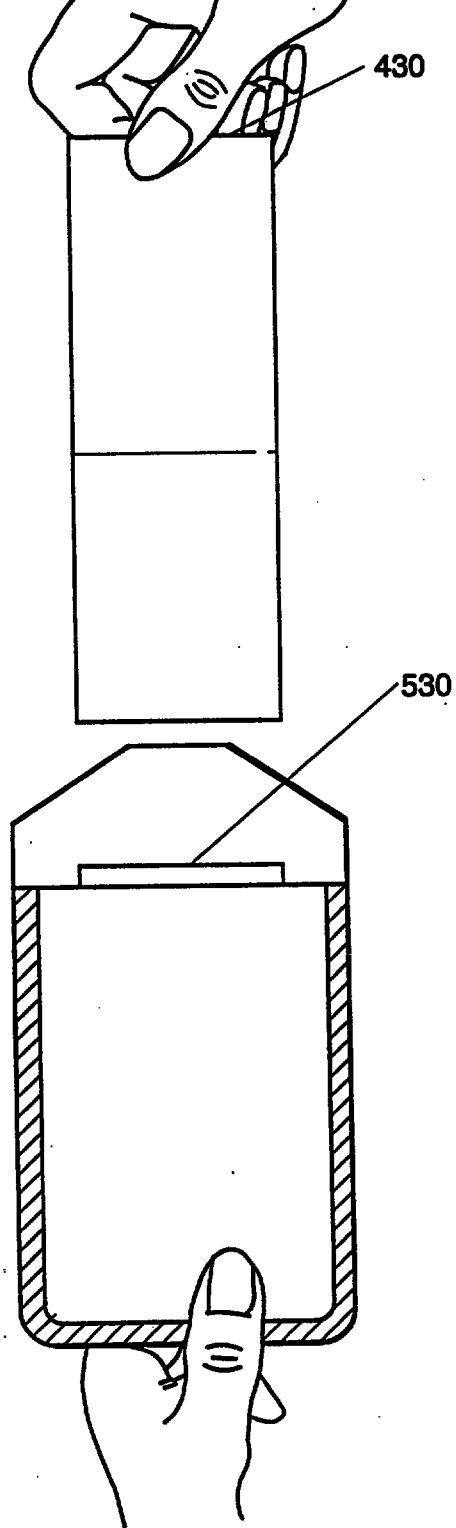


Fig. 17C

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Date:

0-11-1996

1. A flexible package for dispensing a folded sheet (105), said package comprises:

(a) at least one folded sheet (105), said sheet (105) being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet (105) has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said sheet (105) being folded zig-zag in both directions, said sheet (105) further having a grasping portion for grasping by a consumer, said grasping portion overlying a front surface of said folded sheet (105) and preferably comprising a free corner (110) folded diagonally downward over said front surface of said folded sheet (105).

(b) a package formed of a thin, flexible, and preferably liquid impervious material, said package entirely surrounding and containing said sheet (105), said package further having a front side (151) and a back side (150), said package further having two opposing side edges, a bottom edge, and a top edge opposing said bottom edge, each of said edges joining said front side (151) and said back side, said package having an elongated opening on said front side (151), said front surface of said sheet and said front side (151) of said package being in overlying spaced relation to one another, said elongated opening (152) being releasably sealed by a closure (154) and adapted to be opened by a consumer for access to said sheet, said elongated opening (152) further being disposed on said front side (151) such that said grasping portion of said folded sheet (105) is registered in underlying spaced relationship to said opening (152) and characterised by said second folded thickness of sheet (105) being greater than said first folded thickness;



REPLACEMENT SHEETS		SG
☐	Description	: paged to paged
☒	Claim(s)	: paged ~~..A.~~ to paged ~~..A.~~
☐	Drawing(s)	: paged to paged
☒	Abstract	: paged ~~..S.~~ to paged ~~..S.~~
DATE OF RECEIPT <u>20/9/99</u>		

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Date:

shape, said elongated opening (152) defining a minor dimension parallel to said folded length and a major dimension parallel to said folded width; said minor dimension of said elongated opening (152) having a maximum width which is between 1.0 and 3.0 times, preferably between 1.0 and 1.2 times, said second folded thickness, said major dimension having a maximum length which is between 0.8 and 1.3 times, preferably between 0.9 and 1.2 times, said folded width;

whereby when a consumer opens said closure (154) an exposes said elongated opening (152), said grasping portion is presented for grasping, and whereby grasping said grasping portion and withdrawing said sheet (105) from said package through said opening (152) automatically causes said longitudinal folds and said lateral folds of said sheet to substantially unfold.

2. The flexible package of claim 1, further characterised in that said closure (154) comprises a flap folded downward over said elongated opening (152).

3. A flexible package for dispensing a folded sheet (205), said package comprises:

(a) at least one folded sheet (205), said sheet (205) being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet (205) has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said sheet (205) being folded zig-zag in both directions, said sheet (205) further having a grasping portion for grasping by a consumer, said grasping portion extending lengthwise beyond a remainder of said folded sheet (205) and preferably comprising a free corner (210) of said folded sheet (205);



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material, said package entirely surrounding and containing said sheet (205), said package further having a front side (251) and a back side (250), said package further having two opposing side edges, a bottom edge, and a top edge (255) opposing said bottom edge, each of said edges joining said front side and said back side, and a dispensing edge (255) being adapted to be opened by a consumer for access to said sheet (205), said dispensing edge (255) and said grasping portion of said folded sheet (205) being adjacent to one another;

characterised by

said second folded thickness of sheet (205) being greater than said first folded thickness;

said top edge forming said dispensing edge (255) and being designed such that when dispensing edge (255) is opened by said consumer, an, elongated opening having a length which is shorter than said bottom edge is formed, said elongated opening defining a minor dimension parallel to said first folded thickness and a major dimension parallel to said folded width, said major dimension of said elongated opening having a maximum length which is between 0.5 and 0.9 times, preferably 0.6 times, said folded width at the time of opening said dispensing edge; and said grasping portion extending beyond said dispensing edge (255);

whereby when said consumer opens said dispensing edge (255) and forms said opening, said grasping portion is presented for grasping, and whereby grasping said grasping portion and withdrawing said sheet (205) from said package through said dispensing edge (255) automatically causes said longitudinal folds and said lateral folds of said sheet (205) to substantially unfold.

4. The flexible package of claim 3, further characterised in that said side edges are provided with opposed notches (253, 254) near said dispensing edge (255)



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5. A flexible package for dispensing a folded sheet (305), said package comprises:

(a) at least one folded sheet (305), said sheet (305) being first folded longitudinally to define a predetermined folded width and a first predetermined folded thickness and then folded laterally to define a predetermined folded length and a second predetermined folded thickness such that said sheet (305) has longitudinal folds generally parallel to its length and lateral folds generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said lateral folds having a zig-zag arrangement, said sheet (305) further having a grasping portion for grasping by a consumer;

(b) a package formed of a thin, flexible, and preferably liquid impervious material, said package entirely surrounding and containing said sheet (305), said package further having a front side (352) and a back side (350), said package further having two opposing side edges, a bottom edge, and a top edge (356) opposing said bottom edge, each of said edges joining said front side and said back side, and a dispensing edge (356) being adapted to be opened by a consumer for access to said sheet (305), said dispensing edge (356) and said grasping portion of said sheet (305) being adjacent to one another;

characterised by

said second folded thickness of sheet (305) being greater than said first folded thickness;

said package further comprising a flexible bar (351) formed of a flexible material, said flexible bar (351) being disposed inside said package between said front side and said back side, said flexible bar (351) being interleaved between said lateral folds (331, 332, 333) of said sheet (305) such that a portion of said sheet (305) between said grasping



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bar (351) from said remainder of said sheet (305), said flexible bar (351) having a width which is smaller than said folded length, said flexible bar (351) further having a length sufficient to fully extend from one of said side edges, said flexible bar (351) being located to up to one-half, preferably up to one-fourth, of said folded length from said grasping portion toward said first lateral fold, and said flexible bar being firmly affixed to said side edges;

whereby when said consumer opens said top edge forming said dispensing edge (356), said grasping portion extending beyond said dispensing edge (356); is presented for grasping, and whereby upon grasping said grasping portion extending lengthwise beyond a remainder of said folded sheet (305), and comprising full first folded thickness of said sheet (305); and withdrawing said sheet (305) from said package through said dispensing edge (356), said flexible bar (351) automatically causes said lateral folds of said sheet (305) to substantially unfold.

6. The flexible package of claim 5, further characterised in that said side edges are provided with opposed notches (354, 355) near said dispensing edge (356) to facilitate opening by said consumer.
7. A flexible package for dispensing folded sheets, said package comprises:
 - (a) a first folded sheet, said first sheet being first folded longitudinally to define a predetermined folded width and then folded laterally to define a predetermined folded length such that said first sheet has longitudinal folds generally parallel to its length and at least one lateral fold generally parallel to its width, said longitudinal folds and said lateral folds being generally orthogonal to one another, said lateral fold having a zig-zag arrangement, said first sheet further having a grasping portion (430) for grasping by a consumer and a trailing edge;



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folded longitudinally to a folded width substantially equal to said folded width of said first sheet and then folded laterally to a folded length substantially equal to said folded length of said first sheet, such that said additional sheet has longitudinal folds generally parallel to its length and at least one lateral fold being generally parallel to its width, said longitudinal folds and said lateral fold being generally orthogonal to one another, said additional sheet further having a grasping portion (530) for grasping by a consumer and a trailing edge, said grasping portion of said additional sheet being detachably joined to said trailing edge of said first sheet;

(c) a package formed of a thin, flexible, and preferably liquid impervious material, said package entirely surrounding and containing said sheets, said package further having a front side (452) and a back side (450), said package further having two opposing side edges, a bottom edge, and a top edge (456) opposing said bottom edge, each of said edges joining said front side and said back side, and a dispensing edge (456) being adapted to be opened by a consumer to form an open end for access to said sheets, said dispensing edge and said grasping portion (430) of said first sheet being adjacent to one another;

characterised by

said package further comprising a flexible bar (451) formed of a flexible material, said flexible bar (451) being disposed inside said package between said front side (450) and said back side (452), said flexible bar (451) being interleaved between portions of said first sheet such that a portion of said first sheet between said grasping portion and said lateral fold is on an opposite side of said flexible bar (451) from said remainder of said first sheet and said additional sheet, said flexible bar (451) having a width which is smaller than said folded lengths of said sheets, said flexible bar (451) further having a length sufficient to fully extend from one of said side edges to the other of said side edges, said flexible



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said folded length from said grasping portion of said first sheet, and said flexible bar being firmly affixed to said side edges; whereby when said consumer opens said top edge forming said dispensing edge, said grasping portion of said first sheet extending beyond said dispensing edge; is presented for grasping, and whereby upon grasping said grasping portion extending lengthwise beyond a remainder of said first folded sheet, and comprising full first folded thickness of said first sheet; and withdrawing said first sheet from said package through said dispensing edge (456), said flexible bar (451) automatically causes said lateral folds of said first sheet to substantially unfold and said grasping portion of said additional sheet is thus presented adjacent to said dispensing edge (456) for a subsequent use.

8. The flexible package of claim 7, further characterised in that said dispensing edge (455) is releasably sealed by a resealable closure (454), said closure (454) preferably comprising a resealable flap folded downward over said open end (458).
9. A flexible package of any one of claims 5 to 8, further characterised in that said flexible bar (451) is formed of a thin, flexible sheet material or a thin, flexible cord material.
10. A flexible package of any one of claims 1 to 8, further characterised in that said sheet is moistened with a cleansing agent.



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The present invention presents improved packages for single-use, disposable folded towels (105, 205, 305), and more particularly to single- and multi-towel packages which provide for readily grasping a defined portion of the towel upon opening the package and automatic unfolding of the towel upon removal from the package without a separate unfolding step requiring additional consumer action. Single-towel embodiments are disclosed which provide for complete unfolding of the towel by use of: (a) an opening (152, 257) bearing a particular geometrical relationship to the dimensions of the folded towel; or (b) a flexible bar (361, 451) within the package to provide unfolding of the towel in the longitudinal direction. A multi-towel embodiment which provides for the advantageous dispensing features and convenience of an improved single-towel package while providing the added capability of multi-towel transportation is also disclosed. These packages provide for complete containment and protection of the folded towel prior to use, while providing ease of dispensing and unfolding for the consumer at the time of use. Several methods of folding folded towels for use with packages according to the present invention are also disclosed, as well as various methods of fabricating the improved packages according to the present invention.

Figure 5b

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