

Description

Background

[0001] The disclosure is directed to food packaging and in particular to food packaging containers that prolong the shelf life of fresh cut fruits and produce.

[0002] In the food packaging industry, it is known that fresh cut produce exudes a fair amount of juice and liquid, which collects at the bottom of the package. The produce sitting in such liquid has a shorter shelf life as compared to produce that is above the liquids. Accordingly, separating the fresh cut produce from the liquid will increase the shelf-life of the product.

[0003] Apertured plastic films are well known and essentially comprise a planar film with holes in it. The problem with the use of such films in food packaging applications, however, is that the juices can flow equally well through the film in both directions. Thus, as the package is moved, turned, inverted, etc. during storage or transport, the liquid is splashed all over the produce.

[0004] Vacuum formed films typically have a plurality of apertures that allow liquids and gases to pass through the film. Such films may be incorporated into disposable personal care products (e.g., feminine hygiene products, diapers, incontinent products, hospital pads, etc.), as agricultural films (e.g., weed block fabrics) and in a variety of other uses.

[0005] In the vacuum forming process a film is placed on a rotating screen having a plurality of holes. The film passes over a vacuum chamber as the screen rotates creating a pressure differential on either side of the plastic film. The pressure differential causes the film to rupture at the holes in the screen to form the apertures. The holes in the screen may be in a specific pattern or shape that transfers onto the film in the process. The vacuum forming process may be practiced using a precursor film that is heated to a softening point prior to being subjected to vacuum (so-called reheat process) or is practiced using a molten sheet of polymer that is cast onto the screen immediately prior to the vacuum (so called direct cast process). In either case, the film is supported by the screen and a vacuum applied to the underside of the perforated screen. Film is pulled by the vacuum until it ruptures. In the process, the film is cooled as it is being pulled, such that the resulting product has a plurality of tapered, funnel-shaped structures with an aperture at the apex of the structure. These apertures in the structures lie in a plane spaced from the base plane of the film. As a result, these films are generally known as "three-dimensional" films in the art.

[0006] Many methods and apparatuses for preparing plastic films comprising apertures have been developed, examples include US Patent Nos. 4,155,693; 4,252,516; 3,709,647; 4,151,240; 4,319,868; 4,388,056; 4,950,511; 4,948,638; 5,614,283; 5,887,543; 5,897,543; 5,718,928; 5,591,510; and 5,562,932; 3,054,148; and 3,814,101, which are all hereby incorporated by reference.

[0007] Laminates of three-dimensional films are also known. For example, US 4,995,930 discloses a process in which a film is simultaneously apertured and bonded to a nonwoven web to form an apertured film laminate. Similarly, US 5,698,054 discloses a variety of laminates wherein an apertured film is bonded to another apertured film, a non-apertured (or "flat") film, and/or a nonwoven web. Both of these patents are incorporated herein by reference in their entirety.

[0008] One advantage of three-dimensional films is that the apertures tend to act as a one-way valve in that liquids tend to flow through the films better in one direction versus the other. There is a need for films and laminates that provide improved protection and increased shelf-life of fresh cut produce.

Summary

[0009] In one embodiment, the disclosure provides a package comprising a first section and a second section separated from one another by a web, the web comprising a three layer laminate wherein the first layer is a three-dimensional apertured film, the second layer is a three-dimensional apertured film, and the third layer is a non-woven web.

[0010] In some embodiments, at least one of the apertured films comprises a plurality of channels extending through the film, wherein the channels are oriented at an angle of greater than 70° with respect to a female side of the film.

[0011] A further understanding of the embodiments may be obtained upon reading of the following detailed description with reference to the accompanying drawings and the appended claims.

Brief Description Of The Figures

[0012]

Figure 1 is an illustration of a food packaging container in accordance with the disclosure.

Figure 2 is a cross-sectional view of an embodiment of a three-layer film laminate in accordance with the disclosure.

Figure 3 is a cross-sectional view of another embodiment of the three-layer laminate in accordance with the disclosure.

Description

[0013] With reference to Figure 1, a container 10 comprises four generally vertical walls 12 and a horizontal bottom surface 14. In most applications, the container 10 will also have a lid or top closure, which is not illustrated in Figure 1. The container is shown holding fresh cut produce, such tomato slices 16. Container 10 further comprises a web 18 that separates the container 10 into two sections 17, 19 and keeps the produce 16 in section 17

separated from the juices 20 exuded by the produce in section 19. While not seen in the Figures, it is to be understood that the bottom of container 10 may include various ribs or other embossed elements that separate section 19 into multiple compartments. The ribs or embossments may be desired for molding of the container 10 or for supporting the web 18.

[0014] Without the web 18, the produce 16 would be in contact with and, depending on the produce, may be submerged in the juices 20. Fruits and vegetables sitting in juice or other liquids are not appealing to the consumer because they connote a reduced freshness. In addition, produce sitting in juice of other exuded liquid can change texture over time. Moreover, the juice may contain or result in unwanted growth of undesired microorganisms or mold. Because the juice was released after storing the fruit, the fruit has not been pasteurized or other means have not been provided to prevent the growth of such undesirable microorganisms or molds. Accordingly, maintaining separation between the produce and the juice will increase the shelf-life of the product.

[0015] With reference to Figure 2, an embodiment of the web 18 is illustrated therein. In this embodiment, the web comprises a first three-dimensional apertured film 30 bonded to a second three-dimensional apertured film 32, which in turn is bonded to a nonwoven web 34. The web may be produced by laminating the first three-dimensional film 30 to the second three-dimensional film 32 in accordance with US 5,698,054, which is incorporated herein by reference. Alternatively, the films may be laminated together by any suitable technique known in the art, such as adhesive lamination, thermal lamination, ultrasonic bonding, etc. The film/ film bilaminate may then be laminated to the nonwoven web using any suitable technique, such as adhesive lamination, thermal lamination, ultrasonic bonding, etc.

[0016] Alternatively, the web 18 may be prepared by depositing the nonwoven web 34 onto a forming screen, extruding a molten polymer film onto the nonwoven web, applying the three-dimensional film 30, then subjecting the resulting structure to vacuum to form the three-dimensional film 32 and simultaneously bond the layers together. In yet another process, the web 18 may be constructed by making each three-dimensional film independently, laminating the films together with temperature and pressure, and then laminating the film/ film bilaminate to the nonwoven.

[0017] The first three-dimensional film 30 comprises a plurality of surface structures 36 in the form of tapered conical shaped structures terminating in an aperture 38. The film 30 has a base plane 40 and a secondary plane 42. The base plane 40 is defined by the land areas 44 between the surface structures 36 and the secondary plane 42 is defined by the plane formed by the apertures 38. As seen in Figure 2, the base plane 40 and the secondary plane 42 are generally parallel and spaced apart from one another plane by a distance 46, also known as the loft of the film.

[0018] Similarly, the second three-dimensional film 32 comprises a plurality of surface structures 48 in the form of tapered, conical shaped structures or protuberances. The protuberances 48 terminate in apertures 50. The second film 32, like the first film 30, also has two generally parallel, spaced apart planes 52, 54 which define the loft of the film.

[0019] Films 30, 32 may be made by the same or different processes, if desired. In a preferred embodiment, the films are made in a direct cast vacuum forming process, as described above. In the alternative, the films may be made by a reheat process or by a hydroforming process. In the hydroforming process, which is known in the art, a precursor film is heated to above the softening point but below the melting point of the film, placed on a perforated screen as in the vacuum forming processes, and then subjected to high pressure water streams which force the film material into the perforations in the screen to aperture and crystallize the film.

[0020] In the embodiment depicted in Figure 2, the loft 46 of the first film 30 is greater than the loft 56 of the second film 32. However, this need not be the case. The loft of each film may be the same, or the loft of the second film 32 may be greater than the loft of the first film 30.

[0021] Each of the films 30, 32 are made of thermoplastic resins. Most preferably, the films are made of polyolefin resins, such as polyethylene, polypropylene, low density polyethylene, high density polyethylene, or blends thereof. Use of polypropylene resin (up to about 30% by weight), particularly in the second three-dimensional film 32, may be advantageous to promote bonding with the nonwoven web as taught in EP 0930861. Other suitable thermoplastic resins and blends are known in the art. The nonwoven web 34 may be of any standard construction known in the art. As is known in the art, nonwoven webs are fibrous webs comprised of polymeric fibers arranged in a random or non-repeating pattern. For most of the nonwoven webs, the fibers are formed into a coherent web by any one or more of a variety of processes, such as spunbonding, meltblowing, bonded carded web processes, hydroentanglement, etc., and/or by bonding the fibers together at the points at which one fiber touches another fiber or crosses over itself. The fibers used to make the webs may be a single component or a bi-component fiber as is known in the art and furthermore may be continuous or staple fibers. Mixtures of different fibers may also be used for the fibrous nonwoven fabric webs.

[0022] The nonwoven web 34 can be produced from any fiber-forming thermoplastic polymers including polyolefins, polyamides, polyesters, polyvinyl chloride, polyvinyl acetate and copolymers and blends thereof, as well as thermoplastic elastomers. Examples of specific polyolefins, polyamides, polyesters, polyvinyl chloride, and copolymers and blends thereof are illustrated above in conjunction with the polymers suitable for the film layer. Suitable thermoplastic elastomers for the fibrous layer include tri- and tetra-block styrenic block copolymers,

polyamide and polyester based elastomers, and the like.

[0023] The thermoplastic fibers can be made from a variety of thermoplastic polymers, including polyolefins such as polyethylene and polypropylene, polyesters, copolyesters, polyvinyl acetate, polyamides, copolyamides, polystyrenes, polyurethanes and copolymers of any of the foregoing such as vinyl chloride/vinyl acetate, and the like. Suitable thermoplastic fibers can be made from a single polymer (monocomponent fibers), or can be made from more than one polymer (e.g., bicomponent fibers). For example, "bicomponent fibers" can refer to thermoplastic fibers that comprise a core fiber made from one polymer that is encased within a thermoplastic sheath made from a different polymer. The polymer comprising the sheath often melts at a different, typically lower, temperature than the polymer comprising the core. As a result, these bicomponent fibers provide thermal bonding due to melting of the sheath polymer, while retaining the desirable strength characteristics of the core polymer. Bicomponent fibers can include sheath/core fibers having the following polymer combinations: polyethylene/polypropylene, polyethylvinyl acetate/polypropylene, polyethylene/polyester, polypropylene/polyester, copolyester/ polyester, and the like. The bicomponent fibers can be concentric or eccentric, referring to whether the sheath has a thickness that is even, or uneven, through the cross-sectional area of the bicomponent fiber. Eccentric bicomponent fibers can be desirable in providing more compressive strength at lower fiber thicknesses.

[0024] In the case of thermoplastic fibers for carded nonwoven fabrics, their length can vary depending upon the particular melt point and other properties desired for these fibers. Typically, these thermoplastic fibers have a length from about 0.3 to about 7.5 cm long, preferably from about 0.4 to about 3.0 cm long. The properties, including melt point, of these thermoplastic fibers can also be adjusted by varying the diameter (caliper) of the fibers. The diameter of these thermoplastic fibers is typically defined in terms of either denier (grams per 9000 meters) or decitex (grams per 10,000 meters). Depending on the specific arrangement within the structure, suitable thermoplastic fibers can have a decitex in the range from well below 1 decitex, such as 0.4 decitex, up to about 20 decitex.

[0025] Term "meltblown fibers" refers to fibers formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries as molten threads or filaments into a high velocity gas (e.g., air) stream that attenuates the filaments of molten thermoplastic material to reduce their diameter, which may be to a microfiber diameter. The term "microfibers" refers to small diameter fibers having an average diameter not greater than about 100 microns. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting surface to form a web of randomly dispersed meltblown fibers.

[0026] The term "spunbonded fibers" refers to small

diameter fibers that are formed by extruding a molten thermoplastic material as filaments from a plurality of fine, usually circular, capillaries of a spinneret with the diameter of the extruded filaments then being rapidly reduced as by, for example, eductive drawing or other well-known spunbonding mechanisms.

[0027] The nonwoven webs may also be subjected to standard finishing techniques. In a preferred embodiment, the nonwoven web is a fully calendered web.

[0028] As seen in Figure 2, the protuberances 36 are oriented approximately 90 degrees relative to the plane 40 of the film. However, this need not be the case. With reference to Figure 3, another embodiment of the web 18 is depicted. In this embodiment, the web 18 comprises a first three-dimensional film 30, a second three-dimensional web 60, and a nonwoven web 34. The embodiment of Figure 3 is very similar to that of Figure 2, the obvious difference being with respect to the second three-dimensional film 60.

[0029] In the embodiment of Figure 3, the second three-dimensional film 60 comprises a plurality of surface protrusions 62 extending from the base plane 64 of the film 60. The surface protrusions 62 are hollow structures that terminate in an aperture 66. The apertures 66 define a secondary plane 68 of the film, which is generally parallel to and spaced from the base plane 64. The dimension between the base plane 64 and secondary plane 68 define the loft 70 of the film 60. The difference in the film 60 of Figure 3 and the film 32 of Figure 2 is with regard to the angle between the surface protrusions and the base plane of the film. In the embodiment of Figure 3, the angle 72 between the base plane 64 and the protrusions 64 is significantly greater than 90 degrees. Films having such angular protrusions are known in the art and disclosed, for example, in EP 1040801; WO 1997/003818; and WO 2000/016726, each of which is incorporated herein by reference.

[0030] Although not shown in the figures, the protuberances in both films may be angled as in film 60 in Figure 3.

[0031] The size and shape of the protrusions and apertures in the films is of no critical importance to the disclosure. Numerous shapes of apertures are known from the prior art, including circular, pentagonal, elliptical, boat shaped, oblong, 'cat eye" and others, any of which may be used to advantage. Larger diameter apertures provide less resistance to fluid flow and therefore enable better drainage of liquids away from the produce. However, larger apertures also are less resistant to preventing the liquids from flowing back into contact with the produce. This can be addressed by using angled protrusions as in Figure 3, or by increasing the loft of the film. Films with increased loft have longer protrusions which can more readily collapse, thus closing off the aperture when pressure is exerted on the protrusion. In this manner, the protrusions act as one-way valves allowing liquids to pass through from the base plane to the secondary plane, but resist fluid flow in the opposite direction.

Examples

[0032] Example 1: A 30 g/m² slanted cone film (as seen in Figure 3) was prepared using a vacuum forming process. The film comprised a blend of low density polyethylene, linear low density polyethylene, and a surfactant such that the resulting film was hydrophilic. This film was then laminated to a second 30 g/m² slanted cone film using a vacuum lamination process. The second film comprised a blend of low density polyethylene and linear low density polyethylene. The second film did not contain any surfactant. A 22 g/m² bicomponent carded, thermal bonded, fully calendered nonwoven web was ultrasonically bonded to the film at the time the films were vacuum laminated in a one step bonding process.

[0033] Example 2: A 30 g/m² slanted cone film (as seen in Figure 3) was prepared using a vacuum forming process. The film comprised a blend of low density polyethylene, linear low density polyethylene, and a surfactant such that the resulting film was hydrophilic. This film was then laminated to a second 30 g/m² slanted cone film using a vacuum lamination process. The second film comprised a blend of low density polyethylene and linear low density polyethylene. The second film did not contain any surfactant. A 22 g/m² bicomponent carded, thermal bonded, fully calendered nonwoven web was then ultrasonically bonded to the film/film laminate in a secondary process.

[0034] Example 3: A 30 g/m² slanted cone film (as seen in Figure 3) was prepared using a vacuum forming process. The film comprised a blend of low density polyethylene, linear low density polyethylene, and a surfactant such that the resulting film was hydrophilic. A second 30 g/m² slanted cone film was prepared using a vacuum forming process. The second film comprised a blend of low density polyethylene and linear low density polyethylene. The second film did not contain any surfactant. The first and second films were brought together along with a 22 g/m² bicomponent carded thermal bonded, fully calendered nonwoven web and all three sheets were ultrasonically bonded together.

[0035] In each of the Examples, the nonwoven web was placed on the plane defined by the apertures at the end of the protuberances of the films, as illustrated in the Figures. The laminates were then tested by pouring 60 ml of water over the laminate and recording the time required for the water to pass through the laminate. This test was repeated for the opposite side of the laminate to determine if there was a difference in the fluid flow rate. Multiple tests were run on each sample. The average times for each sample are reported in Table 1.

Table 1

Flow Rates (seconds)

Example	Film Side Up	Film Side Down
1	28.04	47.48
2	47.53	76.08

(continued)

Flow Rates (seconds)

Example	Film Side Up	Film Side Down
3	145.90	248.23

[0036] A number of embodiments of the invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the scope of the invention. Accordingly, other embodiments are within the scope of the following claims.

Claims

1. A container comprising a first section and a second section separated from one another by a web, said container being adapted to contain fresh cut produce, said web comprising a first three-dimensional apertured film, a second three-dimensional apertured film bonded to said first three-dimensional apertured film, and a nonwoven web bonded to said second three-dimensional apertured film.
2. The container of claim 1, wherein said web comprises means for maintaining separation of a solid material in said first section and a liquid material in said second section.
3. The container of claim 1, wherein each of said first three-dimensional film and said second three-dimensional film is independently selected from a vacuum formed film and a hydroformed film.
4. The container of claim 1, wherein each of said first three-dimensional film and said second three-dimensional film has a loft and wherein the loft of said films is not equal.
5. The container of claim 1, wherein each of said first and second three-dimensional films comprises a thermoplastic polymer selected from polyethylene, polypropylene, low density polyethylene, high density polyethylene and blends thereof.
6. The container of claim 1, wherein said nonwoven web is selected from spunbonded, carded, melt-blown, hydroentangled and airthrough bonded nonwoven webs.
7. The container of claim 1, wherein said nonwoven web comprises a bicomponent nonwoven.
8. The container of claim 1, wherein each of the first and second apertured films comprises angled protuberances.
9. The container of claim 1, wherein the nonwoven web

is ultrasonically bonded to the second film.

10. The container of claim 1, wherein the nonwoven web comprises a fully calendered web. 5
11. A method of increasing the shelf life of fresh cut produce comprising the steps of
 - a. providing a container comprises a first section and a second section separated from one another by a web, said web comprising a first three-dimensional apertured film, a second three-dimensional apertured film bonded to said first three-dimensional apertured film, and a nonwoven web bonded to said second three-dimensional apertured film 10
 - b. placing fresh cut produce into said first section of said container; 15
 - c. allowing juices exuded from said fresh cut produce to flow through said web from said first section to said second section 20
 - d. wherein said web comprises means for maintaining separation of said fresh cut produce from juices exuded therefrom, thereby increasing the shelf life of said produce. 25
12. The method of claim 11, wherein each of said first three-dimensional film and said second three-dimensional film is independently selected from a vacuum formed film and a hydroformed film. 30
13. The method of claim 11, wherein each of said first three-dimensional film and said second three-dimensional film has a loft and wherein the loft of said films is not equal. 35
14. The method of claim 11, wherein the nonwoven web is ultrasonically bonded to the second film.
15. The method of claim 11 wherein the nonwoven web is a fully calendered web. 40

45

50

55

Fig 1

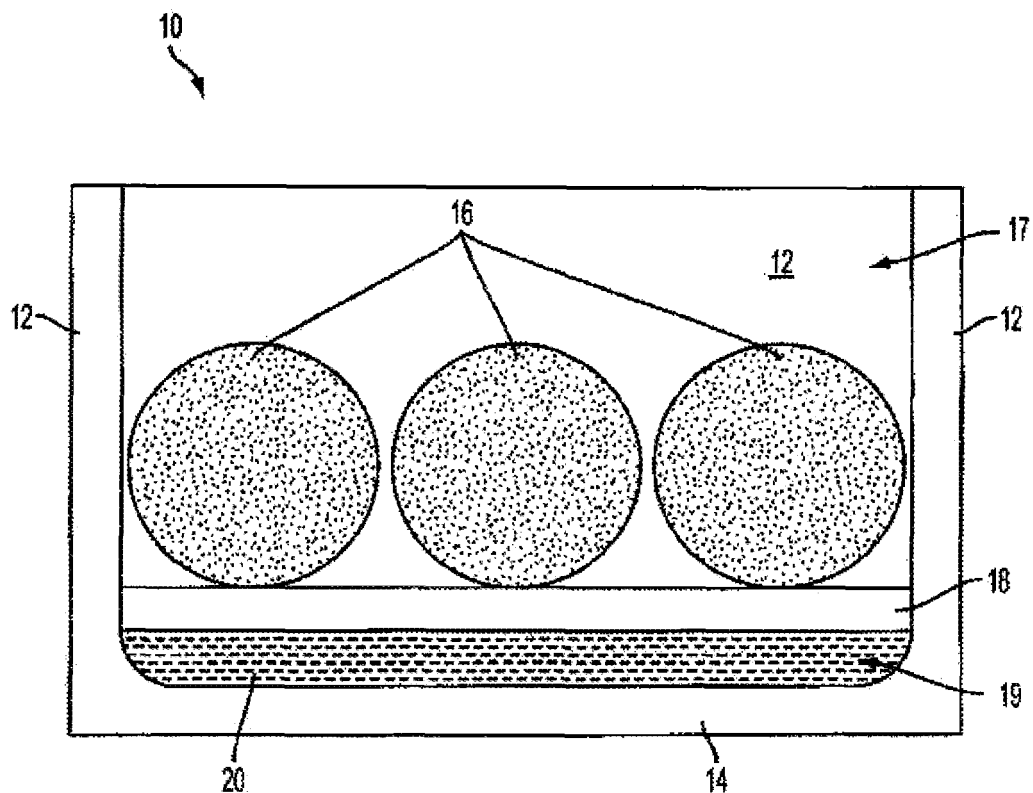


Fig 2

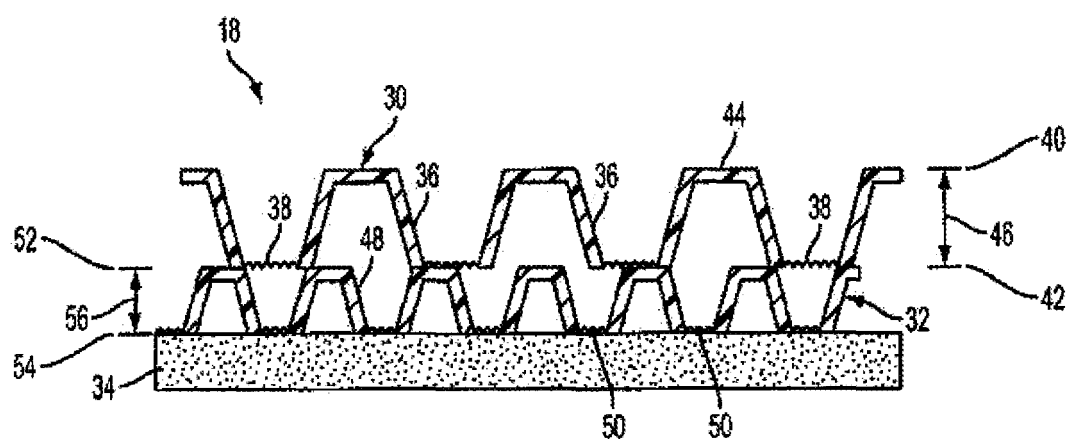
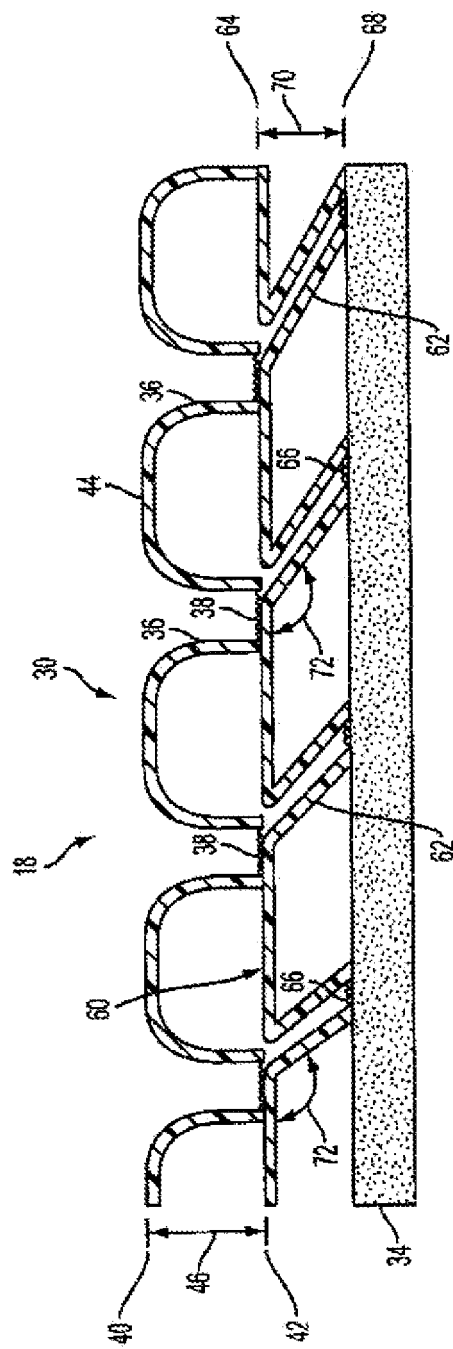


Fig 3





EUROPEAN SEARCH REPORT

Application Number
EP 11 16 2819

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 86/00275 A1 (GARWOOD JAMES VALENTINE HENRY [AU]) 16 January 1986 (1986-01-16)	11-15	INV. B65D81/26
Y	* pages 6-19; figures 1-5 *	1-10	
Y	WO 96/19173 A1 (TREDEGAR IND INC [US]) 27 June 1996 (1996-06-27)	1-10	
Y	* pages 1-10 *		
Y	US 4 839 216 A (CURRO JOHN J [US] ET AL) 13 June 1989 (1989-06-13)	3,8	
Y	* column 18, lines 54-69 *		
Y	US 4 995 930 A (MERZ WINFRIED [DE] ET AL) 26 February 1991 (1991-02-26)	3	TECHNICAL FIELDS SEARCHED (IPC) B65D
Y	* column 1, lines 34-38 *		
Y	US 6 019 511 A (THOMAS PAUL E [US] ET AL) 1 February 2000 (2000-02-01)	4	
Y	* figure 2 *		
A	DE 195 08 484 A1 (HORDIJK VERPAKKINGSIND BV [NL]) 19 October 1995 (1995-10-19)	1-15	
	* figures 1-3 *		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 August 2011	Examiner Jervelund, Niels
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 16 2819

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-08-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 8600275	A1	16-01-1986	DK 76786 A 19-02-1986
		EP 0222750 A1	27-05-1987
WO 9619173	A1	27-06-1996	AR 000368 A1 18-06-1997
		CA 2208409 A1	27-06-1996
		EP 0799007 A1	08-10-1997
		JP 3322884 B2	09-09-2002
		JP 10510743 T	20-10-1998
		TR 970012 A2	21-01-1997
		US 5614283 A	25-03-1997
US 4839216	A	13-06-1989	NONE
US 4995930	A	26-02-1991	DE 3521374 A1 18-12-1986
		DK 279086 A	15-12-1986
		EP 0209713 A2	28-01-1987
		ES 8800089 A1	01-01-1988
		GR 861322 A1	19-09-1986
		JP 61293835 A	24-12-1986
		NO 862369 A	15-12-1986
US 6019511	A	01-02-2000	NONE
DE 19508484	A1	19-10-1995	NL 9400389 A 02-10-1995

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4155693 A [0006]
- US 4252516 A [0006]
- US 3709647 A [0006]
- US 4151240 A [0006]
- US 4319868 A [0006]
- US 4388056 A [0006]
- US 4950511 A [0006]
- US 4948638 A [0006]
- US 5614283 A [0006]
- US 5887543 A [0006]
- US 5897543 A [0006]
- US 5718928 A [0006]
- US 5591510 A [0006]
- US 5562932 A [0006]
- US 3054148 A [0006]
- US 3814101 A [0006]
- US 4995930 A [0007]
- US 5698054 A [0007] [0015]
- EP 0930861 A [0021]
- EP 1040801 A [0029]
- WO 1997003818 A [0029]
- WO 2000016726 A [0029]