(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 340 692 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.09.2003 Bulletin 2003/36

(51) Int Cl.[7]: **B65D 77/02**, B65D 65/46

(21) Application number: **03075147.3**

(22) Date of filing: **17.01.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

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(54) Packaged product comprising liquid-filled pouches

(57) The invention relates to a packaged product comprising an outer container and a plurality liquid filled pouch contained within the outer container, wherein liquid filled pouches comprise a flexible side-walls which are sealed adjacent to opposing ends of the liquid filled pouch by cross-seals, and which further comprise a longitudinal seal extending between opposing cross-seals, characterised in that the liquid filled pouches are aligned within the outer container such that the longitudinal seals of adjacent liquid-filled pouches are substantially parallel to one another, with the proviso that the liquid-filled pouches are not packaged one-by-one within individually sealed compartments.

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Description

[0001] The present invention relates to a packaged product comprising an outer container and a plurality of liquid-filled pouches, for example water-soluble liquid detergent pouches in unit dose form.

Background of the Invention

[0002] Liquid-filled pouches are known as a convenient form of packaging consumer products as well as agrochemical and industrial products. The liquid can be provided in pre-measured quantities intended for use as "unit doses". The film enveloping the liquid product, which forms the wall of the pouch, may optionally be soluble in water. A particularly suitable water-soluble film for this purpose is made from polyvinyl alcohol, and, in this context, this invention is particularly suited to packaging unit doses of liquid detergent.

[0003] In packaged products which are currently commercially available, liquid-filled pouches are packed in a random orientation within a plastic bag, and often the plastic bag is in turn packaged within a more rigid outer container such as a cardboard box. However a problem arises because one or more pouches may leak or break open thereby releasing liquid contents which contaminates all of the other pouches within the plastic bag.

[0004] EP-A-0 347 219, published on 20th December 1989, discloses a package for liquid concentrates which comprises an outer container and an inner water-soluble envelope containing the concentrate. The outer container has a shock-absorbing base formed by joining the base-part to the main body-part with an S-shaped or corrugated strip.

[0005] However, the prior art does not address the problem that arises when a plurality of liquid-filled pouches are packed in an outer container such as a box, carton or tub. If the outer container is subjected to a shock, the pouches are likely to tear, split or burst. The present invention provides a solution to such problems encountered with a packaged product comprising a plurality of flexible liquid-filled pouches and an outer container for containing the pouches.

[0006] The problem remains to provide an economical package wherein the problem of at least one pouch breaking open or leaking its liquid contents in such a way that other liquid pouches are contaminated is avoided or at least is much reduced.

[0007] The liquid-filled pouches of the present invention comprise a flexible side-walls which are sealed adjacent to opposing ends of the liquid filled pouch by cross-seals, and which further comprise a longitudinal seal extending between opposing cross-seals. Such liquid-filled pouches may be made by various processes, one example of which is "vertical form fill seal", VFFS.

Summary of the Invention

[0008] The problem is addressed by aligning the liquid filled pouches within the outer container such that the longitudinal seals of adjacent liquid-filled pouches are substantially parallel to one another. It has been found that the shock absorbing properties of liquid-filled pouches aligned in this way are improved.

Detailed Description of the Invention

[0009] By liquid-filled it is meant that the pouches contain at least some liquid. In almost all cases there will also be an air bubble within the sealed pouch. Furthermore the invention is intended to cover embodiments in which both liquids and other product forms, such as granules, are packed either together within the same pouch or within adjacent pouches or adjacent sections of the same pouch.

[0010] A preferred water-soluble film is made from polymers, copolymers or derivatives thereof selected from polyvinyl alcohols, polyalkylene oxides, acrylic acid, cellulose, cellulose ethers, cellulose esters, polyvinyl acetates, polycarboxylic acids and salts, polyaminoacids or peptides, polyamides, copolymers of maleic/acrylic acids, polysaccharides including starch and gelatine, natural gums such as xanthum and carragum. More preferably the polymer is selected from polyacrylates and water-soluble acrylate copolymers, methylcellulose, carboxymethylcellulose sodium, dextrin, ethylcellulose, hydroxyethyl cellulose, hydroxypropyl methylcellulose, maltodextrin, polymethacrylates, most preferably polyvinyl alcohols, polyvinyl alcohol copolymers and hydroxypropyl methyl cellulose (HPMC). Preferably, the level of a type polymer (e.g., commercial mixture) in the film material, for example PVA polymer, is at least 60% by weight of the film. The polymer can have any weight average molecular weight, preferably from about 1000 to 1,000,000, or more preferably from 10,000 to 300,000, or even more preferably from 15,000 to 200,000, or most preferably from 20,000 to 150,000. Mixtures or blends of polymers may be used.

[0011] Highly preferred is polyvinyl alcohol formed by extrusion, blow-extrusion, blow-molding or casting into a thin film. Such a film is preferably 10 to 200 micrometers thick, more preferably from 40 to 100 micrometers thick.

[0012] Most preferred material for making the flexible pouch is water-soluble polyvinyl alcohol, preferably wherein the polymer present in the film is from 60 to 98% hydrolysed, more preferably 80% to 90% hydrolysed, to improve the

dissolution of the material. An example of a particularly suitable water-soluble polyvinyl alcohol film is sold under the trade reference M8630 by Mono-Sol of Gary, Indiana, US. This particular film has a tensile strength of 281 kg/cm^2; modulus of 105 kg/cm^2; elongation of 465%; tear resistance of 41 kg/mm; and impact strength of 800g. It is commercially available in thicknesses of 38, 50 and 76 micrometers.

[0013] The water-soluble film herein may comprise other additive ingredients than the polymer or polymer material. For example, it may be beneficial to add plasticisers, for example glycerol, ethylene glycol, diethyleneglycol, propylene glycol, propane diol, sorbitol and mixtures thereof, additional water, and/or disintegrating aids. It may be useful that the pouch or water-soluble film itself comprises a detergent additive to be delivered to the wash water, for example organic polymeric soil release agents, dispersants, dye transfer inhibitors. Optionally the surface of the film of the pouch may be dusted with fine powder to reduce the coefficient of friction. Sodium aluminosilicate, silica, talc and amylose are examples of suitable fine powders.

[0014] The term liquid is used herein to broadly include, for example, mixtures, solutions, dispersions and emulsions, from low to very high viscosities including gels and pastes. The preferred viscosity may be up to 10,000 mPa.s, but it is more preferably from 100 to 1000 mPa.s, and most preferably from 300 to 500 mPa.s. The liquid may contain active ingredients suitable for various applications. Examples of such applications are agrochemicals, e.g. pesticides, herbicides, fungicides, insecticides; industrial chemicals, e.g. materials used in construction industries, materials used in photography, printing and textile industries; chemicals for treating water, e.g. swimming pools, water heating systems, sewage and drainage systems; health and beauty care products, e.g. pharmaceutical and cosmetic applications; domestic and consumer products, e.g. laundry cleaning and treatment, dish and hard surface cleaning, shampoo, bath additives. Particularly preferred liquids are suitable for use as liquid detergents in the cleaning of clothes, dishes, and other household surfaces.

[0015] The liquid-filled pouches are not packaged one-by-one within individually sealed compartments, and preferably at least two or more of the liquid-filled pouches are in mutual contact. Such executions prevent cross-contamination in case one liquid-filled filled pouch ruptures, but only at the expense of extra packaging material which provides the individually sealed compartments.

[0016] The outer container of the present invention may be any carton, box, tub or similar container having, typically, side-walls, a base-wall and a top. The outer container preferably comprises a closure, such as a lid, to provide some protection from changing atmospheric conditions, humidity etc.. to the liquid-filled pouches inside. A lid may be of the tear open kind, but more preferably the lid is suitable for opening and reclosing the outer container. A recloseable lid permits the liquid-filled pouches to be removed one at a time, and permits the outer container to be reclosed between each use. Preferably the lid is at the top of the outer container. A particularly preferred outer container is provided by a thermoforming or by an injection-molding process a plastic material. The most preferred outer container may be a plastic tub provided with either a hinged lid or a completely removable lid, such as a snap-fitting lid. Suitable plastics for the container include polyethylene, polyethylene terephthalate, polypropylene, polystyrene as well as other plastics commonly used in the packaging field. Tubs of this kind are well-known for packaging foodstuffs, especially ice cream.

[0017] The problem with packing of somewhat fragile flexible liquid-filled pouches in outer containers of the type described above, is that the pouches may be damaged when the outer container is subject to mechanical shock. Such shocks are likely to occur during the packing process and the distribution chain from manufacturer to retailer, as well as when the outer container reaches the hands of the ultimate consumer. Such shocks may cause the pouches to be ruptured. Herein the term "ruptured" encompasses torn, burst or split, or any other occurrence which has the consequence that the liquid product is free to be distributed around the inside of the outer container. In the event of this happening

the freed liquid product contaminates the surfaces of other pouches within the outer container and also contaminates the inside of the outer container. The result is unsightly, messy and inconvenient. In the worst case, if the liquid product contains toxic chemicals, the user is exposed to toxic hazards.

[0018] The present invention overcomes such problems by aligning the liquid filled pouches within the outer container such that the longitudinal seals of adjacent liquid-filled pouches are substantially parallel to one another.

[0019] Optionally, insert or cushioning material may also be placed within the outer container. The insert or cushioning material may be foam, e.g. a polymeric foam; or a cellulose-based paper or board. Packaging material commonly known as "bubble wrap" may also be used as the cushioning material. Particularly preferred insert or cushioning materials are polyethylene foam or corrugated cardboard. Different cushioning materials may also be used together and in combination. The insert or cushioning material may be placed between adjacent liquid-filled pouches, or the insert or cushioning material may have dimensions substantially corresponding to the base of the outer container, and may be placed into the base of the outer container before the flexible, liquid-filled pouches are placed therein.

[0020] Alternatively, but also optionally, the liquid-filled pouches may be tightly wrapped within a further wrapping material before the pouches are placed into the outer container. The further wrapping material could be, for example, a bag, film or net. In order to achieve the constraint of tightly wrapping, a preferred process with a film or bag is shrink-wrapping or stretch-wrapping; a preferred process with a bag is vacuum-packing; and a preferred process with a net

is stretch-wrapping hereby the elastic properties of the net constrain the contents, in this case the liquid-filled pouches, within it. It is envisaged that the ultimate consumer will remove or open the further packing material before using the first liquid-filled pouch. A line of weakness such as a tear-strip or perforated line may facilitate the removal or opening of the further packing material. In such a case the tightly wrapped pouches are much less likely to rupture during the packaging and distribution processes, although clearly they are not so protected after the further packaging material has been removed by the ultimate consumer. The liquid-filled pouches could be tightly-wrapped in the further wrapping material and sold in this form as refills for consumers who already have a suitable outer container.

[0021] However in the preferred embodiment of the present invention the outer package consists only of carton, box, tub or similar container, and there is no intermediate packaging material. This provides the most economic package, and minimizes the burden of disposed packaging upon the environment.

[0022] Preferred processes for forming the liquid-filled pouch include vertical-form-fill-sealing, often referred to as VFFS. The VFFS process involves continuously forming a strip of film into a vertically running tube by forming the longitudinal seal. The liquid is filled into the tube which is pinched and sealed horizontally at spaced intervals thereby forming the cross-seals. The general state of the art of forming pouches is described in "Packaging of Pesticides and potentially Hazardous Chemicals for Consumer Use", Edwards, David B., 1995, published by PIRA (ISBN 1 85802 102 2), page 14 et seq., incorporated herein by reference.

Compression Testing

[0023] In the following examples compression testing was carried out using an Instron® 4467. A pouch is placed between the two compression plates of the Instron® testing machine. On starting the test, the top plate moves towards the bottom plate at a speed of 60mm/s so that an increasing force is exerted on the pouch. The Instron® testing machine measures and records the highest force that is withstood by the pouch, i.e. just before leakage occurs, is the value quoted for pouch strength.

[0024] In the case of VFFS pouches, "horizontal compression" means that the pouch body lies flat and horizontal between the horizontal compression plates, so that the longitudinal seal and the cross-seals all lie substantially parallel to the plane of the compression plates. This orientation results in no direct pressure being applied to the two cross-seal ends. "Vertical compression" means that the pouch stands vertically between the compression plates, so that the longitudinal seal is perpendicular to the plane of the compression plates. This orientation results in the direct pressure being applied to the cross-seals.

[0025] In the cases of both horizontal compression and vertical compression the direction of maximum internal stress lies parallel to the plane of the compression plates.

Example

[0026] In a preferred embodiment of the present invention the liquid is a liquid detergent for use in the cleaning of clothes, dishes, and other household surfaces. Specific examples of such liquid detergent compositions are given in US-A-4,929,380, issued on 29th May 1990 and assigned to Henkel KgaA and in US-A-4,973,416, issued on 27th November 1990 and assigned to The Procter & Gamble Company, both of which are incorporated by reference. Another specific example of a liquid detergent composition is given below in Table 1:

Table 1

	% by weight
Linear alkyl benzene sulphonate	22%
Nonionic surfactant	18.7%
C_8-C_{10} amido propyl dimethyl amine	1.8%
Propane diol	15.7%
Monoethanolamine	11%
Citric acid	1.6%
Fatty acid	16.6%
Brightener	1.2%
Enzymes	1.0%
Perfume	1.2%

Table 1 (continued)

	% by weight
Polymers	3.2%
Phosphonate chelant	0.9%
Formic acid	1.1%
Water	To balance (~4%)

[0027] The composition in Table 1 was made into flexible liquid-filled pouches using a vertical form fill seal process. Each pouch contained about 50ml of liquid product at viscosity of 300 mPa.s (measured at 20°C and a shear rate of $21s^{-1}$). Each pouch was 60mm long excluding the 5mm cross-seal at each end (length in direction parallel to the longitudinal seam; 50mm wide (width parallel to the cross-seams); and about 25mm thick when laid flat on a surface. The film used was M8630®, supplied by Mono-Sol LLC, having a thickness of 76 micrometers.

[0028] When pouches were subjected to horizontal compression testing the average stress to rupture was 400 Newtons. Similar pouches subjected to vertical compression testing ruptured at an average stress of 1600 Newtons. It was observed that in the case of horizontal compression testing the mode of rupture was frequently a failure at or immediately adjacent to the cross-seal. In the case of vertical compression testing the mode of failure was generally bursting of the material of the side-wall. Without wishing to be bound by theory it is suggested that different modes of failure which are dependant upon the way in which stress is applied result in quite different stress at failure. According to the present invention the liquid-filled pouches are aligned so that most frequently applied stresses will be withstood by the pouches without breakage.

[0029] Example 1: Outer containers in the form of plastic tubs with snap-fit lids, slightly tapered from top to bottom, having average inner dimensions of 160mm long x 65mm wide x 140mm high, were provided. A 12mm thick polyethylene foam cushion, of density $20kg/m^3$ and surface dimensions 50 x 145 mm, was placed in the bottom of the tub before pouches were added. Ten liquid-filled pouches (as defined above) were packed within the plastic tub in a lower row comprising six pouches, and an upper row comprising a further four pouches. With the tub standing upon its base each of the packed pouches was vertically orientated such that all of the cross-seals were horizontal and all of the longitudinal seals were vertical. The snap-fit lid was fitted to close the tub and the tub was subjected to stress by means of dropping it repeatedly from a height of 1 metre on to a hard surface. The equipment was the Gaynes Drop Test machine used according to ISO2248. For each test, ten replicates (ten tubs) were dropped.

[0030] Comparative Example A: The same outer containers and cushions used in Example 1 were filled with ten liquid-filled pouches in random orientation. The same drop test method as carried out in Example 1 was repeated ten times.

[0031] Results: The pouches of packaged product of example 1 was found to be between two and ten times more resistant to failure than the pouches of packaged product of comparative example A, depending upon the age of the samples tested. (N.B. A "failure" is considered to have occurred if one or more of the pouches has ruptured).

Claims

1. A packaged product comprising an outer container and a plurality liquid filled pouch contained within the outer container, wherein liquid filled pouches comprise a flexible side-walls which are sealed adjacent to opposing ends of the liquid filled pouch by cross-seals, and which further comprise a longitudinal seal extending between opposing cross-seals, **characterised in that** the liquid filled pouches are aligned within the outer container such that the longitudinal seals of adjacent liquid-filled pouches are substantially parallel to one another, with the proviso that the liquid-filled pouches are not packaged one-by-one within individually sealed compartments.

2. A packaged product according to claim 1 wherein the flexible side-walls of the pouch are made from a material which is soluble in water.

3. A packaged product according to claim 2 wherein the water-soluble material of the flexible side-wall comprises polyvinyl alcohol.

4. A packaged product according to any of claims 1 to 3 wherein at least two or more of the liquid-filled pouches are in mutual contact.

5. A packaged product according to claim 1 wherein the outer container has side-walls, a base-wall and a top, and

wherein the longitudinal seals of the liquid-filled pouches are aligned substantially perpendicularly to the plane of the base-wall.

6. A packaged product according to claim 5 wherein the outer container is a thermoformed or an injection molded plastic tub.

7. A packaged product according to either of claims 5 or 6 wherein the outer container is provided with a openable lid.

8. A packaged product according to claim 7 wherein the top of the outer container comprises the openable lid, and preferably wherein the openable lid is also recloseable.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 07 5147

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	US 3 367 489 A (SCHNEIDER) 6 February 1968 (1968-02-06) * column 1, line 11 - column 2, line 59; figures *	1	
Y	US 2002/123444 A1 (FISHER) 5 September 2002 (2002-09-05) * page 1, paragraph 2 * * page 2, paragraph 33 * * column 4, paragraph 46 * * page 4, paragraph 59 - paragraph 60 *	2,3	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B65D
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 May 2003	Newell, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 07 5147

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
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82