



(51) International Patent Classification:
B65D 33/16 (2006.01)

(21) International Application Number:
PCT/CN2011/000038

(22) International Filing Date:
10 January 2011 (10.01.2011)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant (for all designated States except US): **THE PROCTER & GAMBLE COMPANY** [US/US]; One Procter & Gamble Plaza, Cincinnati, Ohio 45202 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **BHATTACHARJEE, Gautam** [IN/CN]; Room #3553, Captial Paradise Apartment, Housayu, Shnyi District, Beijing 101318 (CN).

(74) Agents: **THE PROCTER & GAMBLE COMPANY** et al.; c/o Eileen L. Hughett, Global Patent Services, 299 East Sixth Street, Sycamore Building, 4th Floor, Cincinnati, Ohio 45202 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: POUCH WITH CONCAVE-CURVED CORNER.

(57) Abstract: A pouch (100) with a sheet (120) containing at least one layer of a film material is provided. The sheet forms a tube (142) which is closed with a seal (122) to form a volume (144). The seal (122) contains a first edge (128) and the sheet contains a second edge (130) in connected relation to the first straight edge (128). A curved seal (132) joins the first edge (128) with the second edge (130). A sealing jaw (150) and a method for forming the pouch are also described.



POUCH WITH CONCAVE-CURVED CORNER

FIELD OF THE INVENTION

The present invention relates to pouches. Specifically, the present invention relates to
5 sealed pouches formed from a film material.

BACKGROUND OF THE INVENTION

Pouches are typically formed of a laminate or a film and may be used for holding many
types of items such as food, shampoos, detergents, medicines, etc. In order to prevent them from
10 leaking, they are often sealed on all sides to form a fixed volume to contain a product, for
example a granular detergent. However it is always a challenge to balance pouch waste and
strength against bursting and leakage. The strength of a seal is directly proportional to the
sealing area itself. If the pouch is sealed with too much sealing area on the sides, then the given
volume per area of film is smaller, leading to wasted film. However, if the sealing area is too
15 narrow, then the pouch will easily burst if dropped.

Typically a pouch is sealed with a straight seal forming approximately a 90° angle.
While this is an efficient means of sealing the top, it has now been found that this leads to easy
puncture of the pouch's corner in response to a sudden impact, such as when the pouch is
dropped, when something else is dropped onto the pouch, etc. Such a sudden impact could occur
20 at any time prior to opening for use, such as during the filling/manufacturing process, shipping,
storage, transportation, etc. Such an undesirable puncture leads to waste, messiness, product loss,
etc. and in some cases, a customer may even refuse to purchase a product in a punctured pouch.

Existing methods to solve this problem employ stronger sealing techniques and adhesives,
stronger films and pouch materials, and/or different laminate layers within a film material.
25 However, all of these methods typically increase complexity, and require special capability
beyond that available at the machine where the forming, filling and sealing takes place.

Accordingly, the need exists for an improved pouch which is more resistant to puncture
at the corners, especially while employing existing film materials, sealing processes, and sealing
machinery.

30

SUMMARY OF THE INVENTION

The present invention relates to a pouch having a sheet containing at least one layer of a
film material. The sheet forms a tube that is closed with a seal to form a volume. The seal

CONFIRMATION COPY

contains a first edge and the sheet contains a second edge in connected relation to the first edge. A curved seal joins the first edge with the second edge.

A sealing jaw contains a sealing arm and a receiving arm. The sealing arm contains a sealing area further containing a first edge-forming element and a curved seal-forming element adjoining the first edge-forming element. The first edge-forming element forms a curved seal adjacent to the first edge-forming element.

A method for sealing a pouch includes the steps of providing a sheet, forming a tube having a leading edge, sealing the leading edge to form a leading edge seal, filling the tube with a predetermined amount of a product, sealing the tube to form a trailing edge seal, and cutting the tube after the trailing edge seal to form a pouch. The leading edge seal and the trailing edge seal form a volume therebetween and the volume contains the product. At least one of the leading edge seal or trailing edge seal contains a first edge and a curved seal adjoining the first edge.

It has now been found that the invention can significantly reduce puncturing at the corners by blunting the force when, for example, the filled pouch is dropped.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the invention will be better understood from the following description of the accompanying figures in which like reference numerals identify like elements, and wherein:

Fig. 1 is a front view of an embodiment of the pouch herein;

Fig. 2 is a cut-away view of the pouch of Fig. 1, as seen along line 2-2;

Fig. 3 is a front view of an existing comparative pouch;

Fig. 4 is a front view of an existing comparative pouch;

Fig. 5 is a front view of an existing comparative pouch;

Fig. 6 is a front view of an embodiment of the sealing arm according to the invention herein;

Fig. 7 is a front view of an embodiment of the receiving arm according to the invention herein;

Fig. 8 is a front view of an embodiment of the pouch herein;

Fig. 9A is a partial front view of an embodiment of the pouch herein; and

Fig. 9B is a partial front view of an embodiment of the pouch herein.

The figures herein are not necessarily drawn to scale.

DETAILED DESCRIPTION OF THE INVENTION

All temperatures herein are in degrees Celsius (°C) unless otherwise indicated. As used herein, the term "comprising" means that other steps, ingredients, elements, etc. which do not adversely affect the end result can be added. This term encompasses the terms "consisting of" and "consisting essentially of".

As used herein, the term "fabric enhancer" includes a composition intended to provide an improved scent, softness, anti-static benefit, and/or shape-retention benefits to a fabric, such as a fabric conditioner, and/or a fabric softener. Such a fabric enhancer is typically intended to function in the rise cycle of a laundering process.

This disclosure relates to a pouch having a sheet containing at least one layer of a film material. The sheet forms a tube that is closed with a seal to form a volume. The seal contains a first edge and a second edge adjoining the first edge. The first edge forms a curved seal with the second edge. This disclosure also relates to methods and equipment for making such a pouch.

Referring to the Figures herein, Fig. 1 is a front view of an embodiment of the pouch, 100, containing a sheet, 120, formed into a tube (see Fig. 2 at 142). The pouch is formed of a sheet which is in turn formed from at least one film material typically selected from the group consisting of polyamide (nylon), polyethylene, polypropylene, ethyl-vinyl-acetate, poly-4-methylpentene-1, a microporous membrane, and a combination thereof; or polyamide (nylon), linear low-density polyethylene, an oriented polypropylene, polyethylene terephthalate, and a combination thereof. Generally, softer and more stretchy film materials also may reduce rupturing, and therefore extrusion lamination, co-extrusion lamination, and blends of film materials, such as polyethylene and polyethylene terephthalate are useful herein.

The film material may also be affixed to and/or contain a metal therein, and/or be a metalized film. Film materials are well known in the art and may further contain resins, laminates, printed artwork, additives (i.e., UV blockers, antimicrobials, dyes, pigments, etc.), etc. Suitable film materials are available from various suppliers worldwide such as 3M Company (St. Paul, Minnesota, USA), Du Pont Co. (Wilmington, Delaware, USA), Toppan Insatsu Co. (Tokyo, Japan), Gelman Sciences Company (Ann Arbor, Michigan, USA), and many other suppliers worldwide. The sheet herein may contain either a single layer or contain multiple layers of the same, or different film material(s), so long as it remains sealable. The sheet is typically from

about 15 μ to about 220 μ , or from about 20 μ to about 200 μ , or from about 25 μ to about 160 μ thick. Each individual film material may be oriented, or random as desired.

Multiple layers of film materials may be joined together to form a sheet with multiple properties and/or benefits. In such cases, it is known in the art to join the multiple layers together by, for example, lamination, heat sealing, ultrasonic sealing, gluing, pressure sealing, etc.

The sheet, 120, may then be formed into a pouch, 100, by pulling and/or stretching the sheet, 120, around a forming tube (not shown) to form a tube out of the sheet, 120. The tube is formed by sealing the edges of the sheet, 120, in any direction such as the machine direction at any point or continuously, and/or by sealing the edges in the cross direction at either the leading edge and/or the trailing edge. The forming tube doubles as a filling tube, through which the product to be contained in the pouch is then filled into the tube (see Fig. 2 at 142). The sheet is pulled or advanced in the machine direction (A), and the sealing jaw (see Fig. 6 at 150) simultaneously seals and cuts the trailing portion of the tube (see Fig. 2 at 142) in the cross direction (B). This simultaneously releases the filled pouch and forms a new seal, 122, at the leading edge, 124. Machinery and techniques for forming such filled pouches are often referred to as "autopacking machines" and are well known in the art and are available from multiple suppliers around the world. Autopacking machines are also often described in the industry as in-line packing and sealing machines, and/or form-fill-seal (FFS) machines.

Thus, in Fig. 1, the sheet, 120, is sealed in the machine direction (A) to form a fin seal, 126, resulting in the continuous production of a tube (see Fig. 2 at 142). The leading edge, 124 is then sealed by a sealing jaw (see Fig. 6 at 150), typically in the cross direction (B), to form the volume (see Fig. 2 at 144) closed at the seal, 122.

In Fig. 1, the seal, 122, is a leading edge seal, 122', and contains a first edge, 128, and a second edge, 130. The first edge, 128, and the second edge, 130, form a curved seal, 132, therebetween. In Fig. 1, all of the 4 corners of the pouch contain a curved seal, 132, and the curved seal has a radius, r , which defines the curvature of the curved seal. The radius, r , of the curved seal is typically greater than about 3 mm, or from about 5 mm to about 20 cm, or from about 5 cm to about 20 cm. Without intending to be limited by theory, it is believed that too small of a radius is effectively the same as a right angle, whereas too large of a radius ends up reducing the effective volume that is able to contain the product in the pouch. Thus, the ranges above are believed to balance the puncture resistance with the effective use of the film material. The curved seal, 132, is concavely-curved, meaning that the center, c , of the radius, r , is in the

volume, 134, that contains the product (not shown), rather than the center, c, being located in the seal, 120 (compare, for example, Fig. 5), or even outside of the pouch, 100. In an embodiment herein, the pouch contains a plurality of corners, or from about 3 corners to about 6 corners, or from about 4 corners to about 5 corners, or about 4 corners, and each corner contains a curved seal. In an embodiment herein the radius of each curved seal is about the same. In an alternative embodiment herein, the radius of at least 2 corners, or from about 2 corners to about 4 corners, is different.

Without intending to be limited by theory, it is believed that typical pouches contain a right angle, or even an acute angle at the corners where the leading edge seal and/or the trailing edge seal meets the edge of the standard pouch (see, Figs. 3-5). It is now believed that many punctures of standard pouches (see Figs. 3-5), such as those containing granular laundry detergents, is caused by a small amount of granular product that accumulates in the corner of the pouch, and may contain a little air or other granular products behind it – which forms a dart like sharp corner and when the pouch receives an impact, from, for example, dropping, falling, another pouch hitting it, etc. the small amount of granular product is forced at a relatively high velocity towards the corner. As the angle formed by the sides and seal are either acute or a right angle, the force of the plurality of moving granules is concentrated to a single point in the corner. These multiple, high-velocity impacts may weaken the film material and/ or even cause the body or surface taking the impact to burst. Thus, even though the individual granules are themselves quite light, the cumulative impacts to the material in the corner potentially result in a tearing of the film from within, and cause the film material at the pouch body to fail, resulting in a pouch that leaks from the body.

In contrast, the pouch herein contains a corner area, 134, where the sheet, 120, is sealed with a curved seal, 132. Without intending to be limited by theory, it is believed that the curved seal blunts the force of the plurality of moving granules. It is also believed that the curved seal distributes this force over a greater area, instead of concentrating it like a right or acute angle may do. As a result, the film material maintains its integrity and is less prone to bursting or failure. A typical pouch has approximately a rectangular or square 2-dimensional face, and therefore the pouch edges, 136, will still typically form right angles, β . Such pouches (see also Figs. 3-5) are the most common and the easiest to make. As the curved seal, 132, is adjacent to a first edge, 128, formed by the seal, 122, this means that for a typical pouch, 100, herein as shown in Fig. 1 the second edge, 130, is typically formed by the edge, 136, of the pouch, 100. The leading edge, 124 and the trailing edge, 138, may contain similar seals, 120, including similar

curved seals, 132. In an embodiment herein as seen in Fig. 1, the trailing edge seal, 122", contains a first edge, 128, a second edge, 130, and a curved seal, 132. One skilled in the art will understand that in some VFFS machines, the order of the trailing edge and the leading edge may be reversed, as compared to Fig. 1.

5 In Fig. 1, the trailing edge, 138, also contains a plurality of handle holes, 140, to allow easier carrying of the pouch, 100. In an embodiment herein the pouch contains at least 1 handle hole, or from about 1 handle hole to about 5 handle holes; or from about 2 to about 3 handle holes, or about 2 handle holes. The handle holes are typically centered above the pouch's center of gravity in order to make carrying easier. Without intending to be limited by theory, it is
10 believed that a single handle hole is typically most convenient for the user; Thus in an embodiment herein the pouch contains 1 handle hole. However, if a fin seal, 126, is present, then cutting such a single handle hole increases the wear and tear of the cut blade(s) on the sealing arm (see Fig. 7 at 160). Having an even number of handle holes can reduce the need to cut through the fin seal, however, having 4 or more handle holes is confusing to the user.
15 Accordingly, in an embodiment herein the pouch contains 2 handle holes.

Fig. 2 is a cut-away view of the pouch, 100, in Fig. 1, as seen along line 2-2. One can clearly see that the sheet, 120, has been formed into a tube, 142, by joining the sheet, 120 to itself at the fin seal, 126. This tube, 142, is also sealed at the far end by the seal, 122, that then defines a volume, 144. The volume, 144, can contain a product (not shown) therein to protect it
20 from spillage, moisture, the outside atmosphere, etc. Thus, in Fig. 2, the pouch is formed in what is commonly known in the art as a "pillow pouch" or a "pillow bag". While the pouch may be formed into other pouches such as gusset bags, wicket bags, standup bags, etc., it is believed that the puncture problem described herein is particularly prominent in pillow bags. Accordingly, in an embodiment of the invention, the pouch is a pillow bag.

25 The product (not shown) to be filled into the pouch typically has a bulk density of at least 250 g/L, or from about 300 g/L to about 1.3 kg/L, or from about 450 g/L to about 1.1 kg/L. The product is typically a granular product; or a fine granular product, such as a granular product having a number-median particle size of from about 10 μ to about 5 mm. In an embodiment herein, the fine granular product is a granular detergent, a granular fertilizer, a granular fabric
30 enhancer, a granular mineral, and/or a granular medicine; or a granular laundry detergent, and/or a granular fabric enhancer.

The volume, 144, may be either airtight or may allow air to flow into and or out of the volume, 144. In an embodiment herein the volume is airtight (or substantially airtight) once all

the seals are in formed and place; only upon puncture thereof is air and/or the granular product easily let into or let out of the volume. Such an airtight pouch is typical of current bags containing, for example, a granular laundry detergent, as described in the examples. In another embodiment herein, the pouch may allow air to pass out of the volume, by, for example having a valve, a seal design allowing air to pass therethrough (see, e.g., US Patent Publication No. 2009/226573 A1 to Gonzales, et. al., published on September 10, 2009), and/or having small holes purposely formed into the pouch. However, in such cases, air typically can escape from the volume only relatively slowly, and therefore the puncturing problem at the corners due to a sudden impact still exists. Without intending to be limited by theory, it is believed that in pouches where air is allowed to quickly exit the pouch, then the bursting and/or puncturing problem does not significantly exist.

The volume typically ranges from (when sealed) at least 500 mL, or from about 500 mL to about 100 L, or from about 800 mL to about 60 L, or from about 1 L to about 30 L, or from about 1.5 L to about 20 L. Typically the pouch will contain both the product as well as air (or another type of gas) therein, because without air in the package (i.e., a vacuum-packed package), the product does not move, and therefore problem does not exist. Thus, in an embodiment herein, the pouch comprises air therein, and the product in the pouch is not vacuum-packed.

Fig. 3 shows a front view of an existing pouch, 100', lacking a curved seal at each volume corner, 146. The pouch, 100', is a typical pillow bag having a fin seal, 126, and seals, 122, at the leading edge, 124, and the trailing edge, 138. The edge, 136, and the seal, 122, form a typical angle, δ , of substantially 90° . Typically, this angle is repeated at each of the 4 volume corners, 146.

Similarly, Fig. 4 shows a front view of an existing comparative pouch, 100', having a substantially continuous seal, 122, all around the perimeter thereof. Such a pouch, 100', is typically formed of two separate sheets, 120, 120', of film material, sealed at all the edges, 136, to form a volume, 144, therein. Such a pouch, 100', also typically has an angle, δ , of substantially 90° where the seal, 122, forms a volume corner, 146. Typically, this angle is repeated at each of the 4 volume corners, 146.

Fig. 5 shows a front view of an existing comparative pouch, 100', with a convexly-curved seal, 148, at each of the volume corners, 146. This embodiment was allegedly created to solve a similar puncture problem as described herein; however, it was not successful. In Fig. 5, the center, c, of the radius, r, is located on the seal, 122, and not on the volume, 144.

Fig. 6 shows a front view of an embodiment of a sealing arm, 150, of the present invention. The sealing arm, 150, and the receiving arm (see Fig. 7, at 170), are opposed to each other, either permanently or temporarily, to form a sealing jaw (not shown). The sealing arm, 150, contains a sealing area, 152, for forming the seal (see Fig. 1 at 122). The sealing area, 152, further contains a first edge-forming element, 154, connected to a curved seal-forming element, 156. The curved seal-forming element, 156, .

In the embodiment of Fig. 6, the sealing arm, 150, contains a heating element, 158, on the back side of the sealing arm, 150, that keeps the sealing area, 152, hot enough to melt the sheet (see Fig. 1 at 120). One skilled in the art will understand that many methods and apparatuses to seal the sheet(s) together to make the seal (see Fig. 1 at 122), are applicable, such as, heat sealing, ultrasonic sealing, pressure sealing, adhesive sealing, etc. In an embodiment herein, the seal is formed by heat sealing and/or ultrasonic sealing; or heat sealing.

In Fig. 6, the sealing area, 152 terminates in a cut blade, 160, that cuts the pouch (see Fig. 1 at 100) at the same time the sealing area, 152, seals the sheet(s) (see Fig. 1 at 120) together. Where one does not want to actually separate individual pouches, but instead wants to make them continuous, such as, for example, in a streamer, the cut blade, 160, may be replaced with a line of needles or a line of intermittent cut blades, to make, for example, a perforation. Other methods and elements for making a line of weakness are also known in the art. Furthermore, as one skilled in the art would realize, the cut blade(s) should be of sufficient structural integrity, and durability to both penetrate all layers of the pouch completely, and also be oriented to easily release the finished pouch after the seal and perforation is made. In an embodiment herein, the cut blade is from about 1 cm to about 10 μ , or from about 5 mm to about 20 μ , or from about 2 mm to about 40 μ in height, as measured perpendicularly from the surface of the sealing arm, 150. The cutting blade may be straight, jagged, curved, etc. as desired. In an embodiment herein the cut blade may be perpendicular to the surface of the sealing arm, or may be angled in the machine direction. Without intending to be limited by theory, it is believed that if the cut blade is perpendicular to the surface of the sealing arm, then at slower machine speeds the cut blade will more effectively form the cuts. However, it is believed that at faster autopak machine speeds, a cut blade that is angled in the direction of the package flow may more quickly release the finished pouch, so as to reducing jamming of the autopak machine caused by a failure of the finished pouch to drop away from the sealing arm.

In an embodiment herein, a plurality of sealing jaws may be used such that, for example, a sealing jaw may be present to seal the top of the pouch and cut it away, while a separate but adjacent sealing jaw may simultaneously seal the bottom of the next pouch.

5 The sealing arm, 150, also contains optional sealing ridges, 162, which may provide textured seals. Such textured seals may be desirable in some instances to produce, for example, an easier to grip seal, to enhance seal strength, aesthetic reasons, etc.

In an embodiment herein, the sealing jaw is designed so that it can cut a handle in the seal by, for example including a handle cutting element. Such a handle cutting element may also be formed by, for example, one or more cut blades.

10 Fig. 7 is a front view of an embodiment of a receiving arm, 170, of the present invention. The receiving arm, 170, complements the sealing arm (Fig. 6 at 150), and is a mirror image thereof, containing a complementary sealing area, 152, which matches with the sealing arm's sealing area, 152 (see Fig. 6). The receiving arm, 170, contains a cut channel, 172, which is typically a concave indentation or depression in the surface of the receiving arm, 170, that allows
15 the cut blade(s) (Fig. 6 at 160), etc. to punch through the sheets and form the respective cut, perforation, etc. The receiving arm, 170, also contains sealing ridges, 162, to complement those on the sealing arm (Fig. 6 at 150).

In an embodiment herein, the cut blade(s) is releasably attached to the sealing arm, so that when it wears out it may be removed, sharpened and/or replaced without having to fabricate
20 an entire new sealing arm.

The sealing arm, 150, the receiving arm, 170, or both actively interact to form the seal by, for example, heat sealing, ultrasonic sealing, pressure sealing, etc. as desired, and therefore contains the appropriate sealing technology therein or thereupon, such as, for example, a heater, an ultrasonic generator, a pressure clamp, etc. The sealing arm and the receiving arm are
25 typically each independently formed of an appropriate durable material for their uses herein, such as, for example, a metal, a ceramic, a plastic, and a combination thereof. A sealing jaw intended for heat sealing should be both strong and conduct heat well and may be formed of, for example, copper, brass, steel, or iron, aluminum, etc. Impulse and induction sealing methods are known in the art and are useful herein. Based on this disclosure, a sealing arm and a receiving
30 arm according to the present invention may be custom made by various suppliers and/or machine shops around the world.

One skilled in the art will recognize that the sealing jaw herein may be used on an autopak machine.

Fig. 8 shows a front view of an embodiment of the pouch, 100, herein containing a single curved seal, 132, having a relatively large radius, r , across the entire leading edge, 124, and a single curved seal, 132, having a relatively large radius, r , across the entire trailing edge, 138.

In an alternate embodiment (not shown) a single curved seal having the same center and radius also forms both the curved seal of the leading edge and the trailing edge.

Fig. 9A shows a partial front view of an embodiment of the pouch, 100, containing multiple curved seals, 132, 132', at the same volume corner, 146. The seal, 122, forms a first curved seal, 132, having center, c , and radius, r , at the pouch edge, 136. The seal also forms a second curved seal, 132', having a different center, c' , and radius, r' . Both curved seals, 132, and 132', are convex, as their centers, c and c' , are in the volume, 144.

Fig. 9B shows a partial front view of an embodiment of the pouch, 100, containing multiple curved seals, 132, 132', at the same volume corner, 146. The seal, 122, forms a first curved seal, 132, having center, c , and radius, r , at the pouch edge, 136. The seal also forms a second curved seal, 132', having a different center, c' , and radius, r' . Between the first curved seal, 132, and the second curved seal, 132', is a convexly-curved seal, 148, having a center, c'' , and a radius, r'' . The center, c'' , of the convexly-curved seal, 148, is located on the seal, 122.

In an embodiment herein the invention is combined with additional techniques known in the art, such as a laser-cut, a half-cut, a score line, embossing, etc. and the known methods and machinery therefor. In an embodiment herein, a reclosing technology is combined with the invention herein, to allow easy and efficient reclosing of the pouch after opening. Such reclosing technologies are also especially beneficial with larger-sized pouches. Typical reclosing technologies are known in the art and include plastic pressure-sensitive zippers, hook and loop fastening systems, zipper systems, adhesive strips and patches, clips and snaps, locking systems, etc. For additional technologies useful in combination with the present invention, see, EP Patent No. 1 409 366 B1 to Camargo-Parodi, et al., granted on June 21, 2006; and EP Patent Application No. 07119454.2 To Rogers, filed on October 29, 2007.

EXAMPLE 1

Pouches according to Fig. 1 and Fig. 2, are formed on a VFFS machine from a sheet using sealing jaws similar to that of Figs. 6-7. The VFFS machine creates all seals by heating up the sealing jaw to create thermal bonding between the separate sheets. The sheet is a three layer laminate of the film materials polyethylene terephthalate, a metallic film (like MYLAR®), and polyethylene. The sheet is provided on a roll which feeds into the FFS machine and is stretched

onto an area where the tube is formed by sealing a fin seal in the machine direction. The tube has a leading edge which is sealed to form a leading edge seal using the sealing jaws according to Figs. 6-7. A predetermined weight (~1.7 kg) of a granular laundry detergent is filled into and flows down the tube and the tube is sealed using the sealing jaws of Figs. 6-7 to form a filled pillow pouch containing granular laundry detergent. The process then repeats itself for the next pouch.

Comparative pouches according to Fig. 3 using similar materials are formed on a standard VFFS machine, employing a standard set of sealing jaws. These comparative pouches have substantially 90° angles at all of the volume corners.

Bursting is tested by dropping individual bags from a height of 1.2 m 3 times on three different sides and then also by dropping then from a height of 1.2 m 3 times packed in poly woven bags on 3 different faces. The bag is also dropped on another bag keeping the corner landing on the face of the other bag lying on ground. The observations were also made when one bag free falls from conveyer belt height to the Poly woven bag at the end of line.

The number of ruptures at the volume corners of the bags are counted, and divided by the number of total bags to determine the defect rates shown below:

TABLE 1

	Example 1	Comparative Pouch A	Comparative Pouch B
Defect rate in %	0.7%	1.9%	1.8%

One skilled in the art would understand that the minor differences in the materials between the Example and the comparative pouches would not significantly affect the results of these tests. Given the unexpectedly significant reduction in rupturing.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

All documents cited in the Detailed Description of the Invention are, in relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it is prior art with respect to the present invention. To the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the

same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

5 While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

1. A pouch comprising:
 - a. a sheet comprising at least one layer of a film material, the sheet forming a tube;
and
 - b. a seal forming the tube into a volume,
wherein the seal comprises a first edge, wherein the sheet comprises a second edge in connected relation to the first edge, and wherein a curved seal joins the first edge with the second edge.
2. The pouch according to Claim 1, wherein the curved seal forms a volume corner, and wherein the pouch comprises a plurality of volume corners.
3. The pouch according to Claim 1, wherein the pouch is formed by an autopacking machine.
4. The pouch according to Claim 1, comprising a granular product therein.
5. The pouch according to Claim 1, wherein the film material is from about 15 μ to about 220 μ thick.
6. The pouch according to Claim 1, wherein the curved seal has a radius of curvature of greater than about 3 mm.
7. The pouch according to Claim 1, wherein the volume is substantially airtight.
8. The pouch according to Claim 4, wherein the granular product is a granular laundry detergent.
9. A sealing jaw comprising:
 - a. a sealing arm comprising a sealing area, the sealing area comprising:
 - i. a first edge-forming element; and
 - ii. a curved seal-forming element adjoining the first edge forming element;
and
 - b. a receiving arm,
wherein the sealing arm and the receiving arm are complementary and wherein the sealing arm and the receiving arm may interact to seal a sheet therebetween.
10. The sealing jaw of Claim 9, wherein the sealing arm comprises a heating element.
11. The sealing jaw of Claim 9, wherein the receiving arm comprises a heating element.
12. An autopacking machine comprising the sealing jaw according to Claim 9.
11. A method for sealing a pouch comprising the steps of:

- a. providing a sheet;
- b. forming a tube having a leading edge;
- c. sealing the leading edge to form a leading edge seal;
- d. filling the tube with a predetermined amount of a product;
- e. sealing the tube to form a trailing edge seal; and
- f. cutting the tube after the trailing edge seal to form a pouch comprising a volume between the leading edge seal and the trailing edge seal, wherein the volume comprises the product,

wherein at least one of the first seal or the second seal comprises a first edge and a curved seal adjoining the first edge.

1 / 3

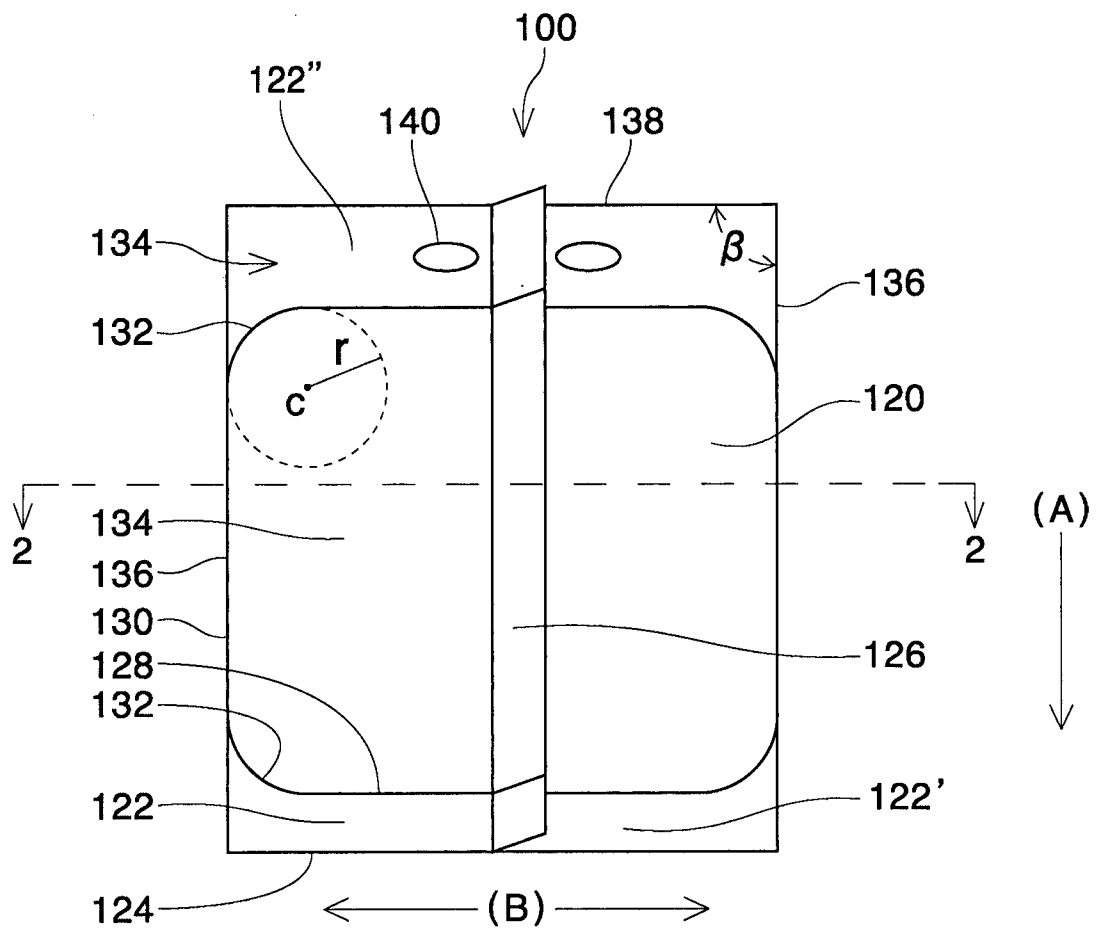


Fig. 1

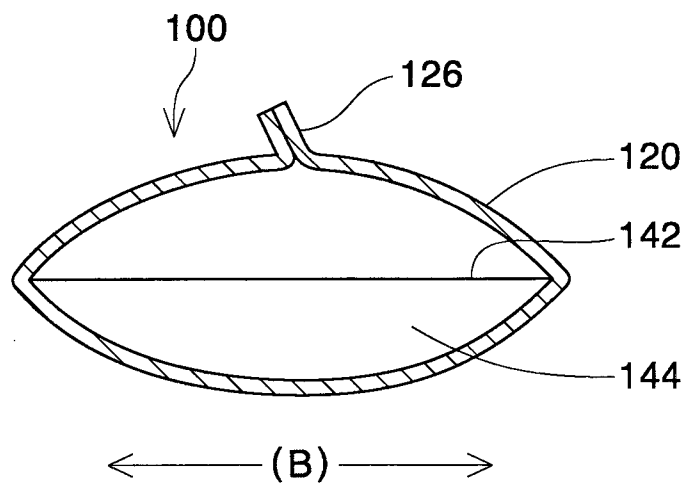


Fig. 2

2 / 3

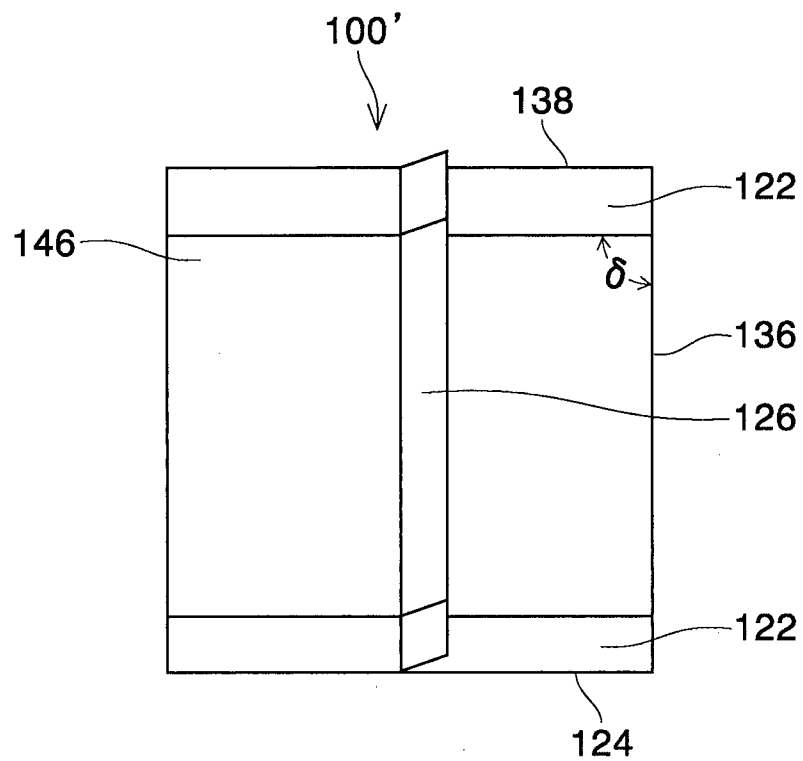


Fig. 3

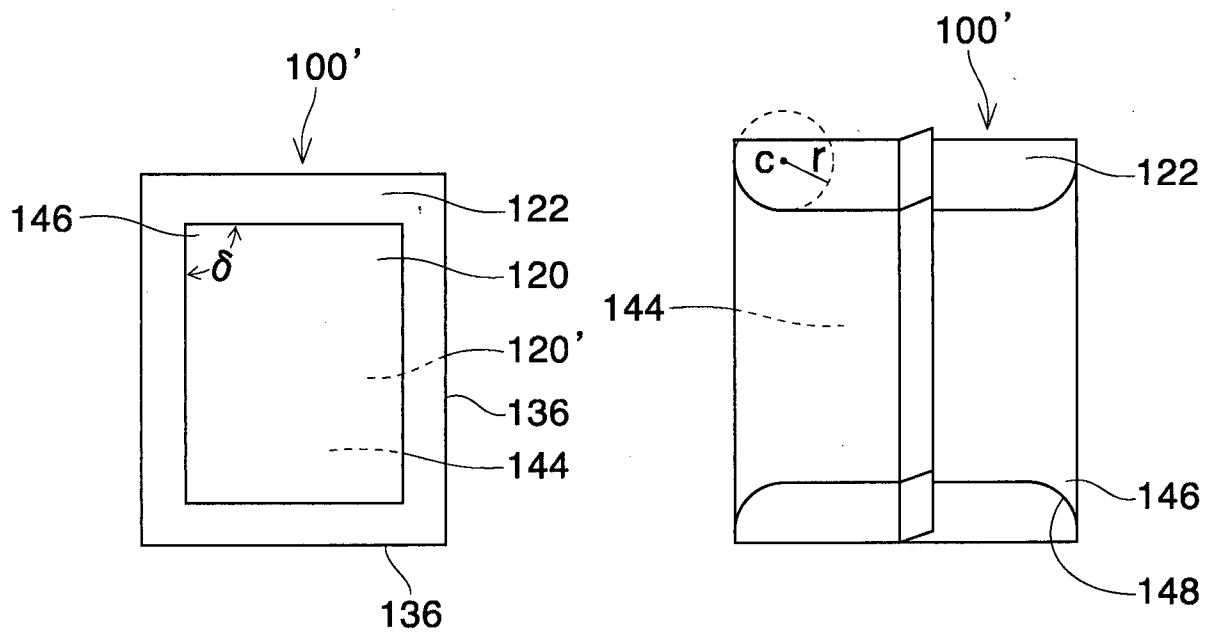


Fig. 4

Fig. 5

3 / 3

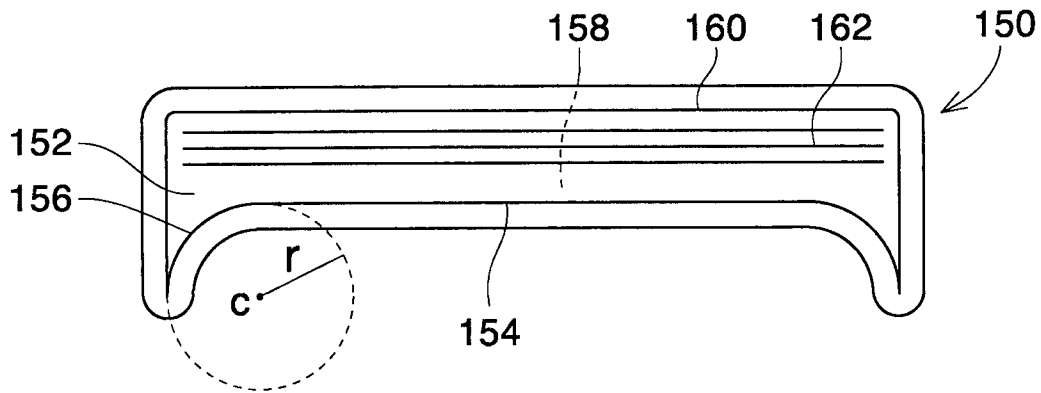


Fig. 6

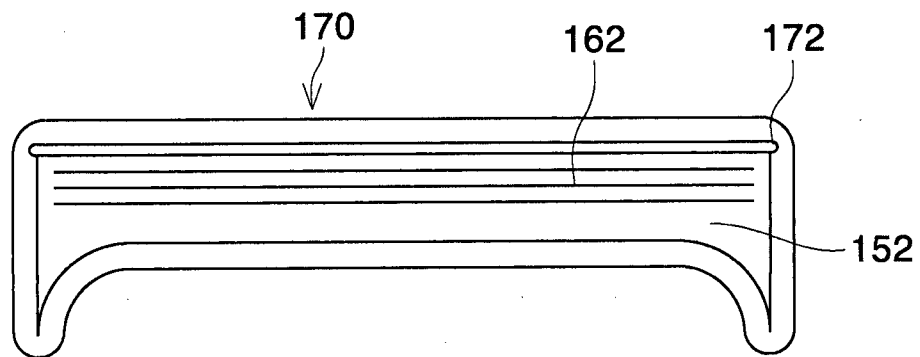


Fig. 7

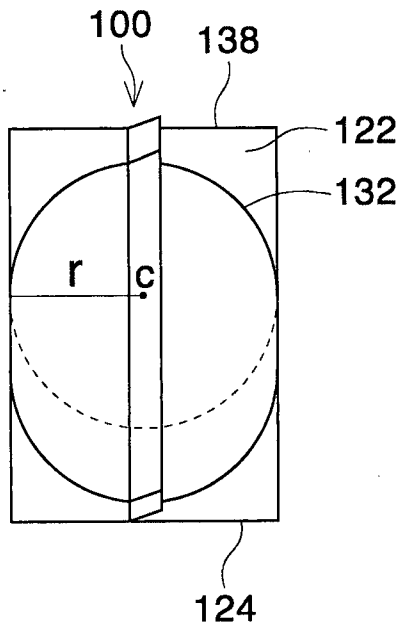


Fig. 8

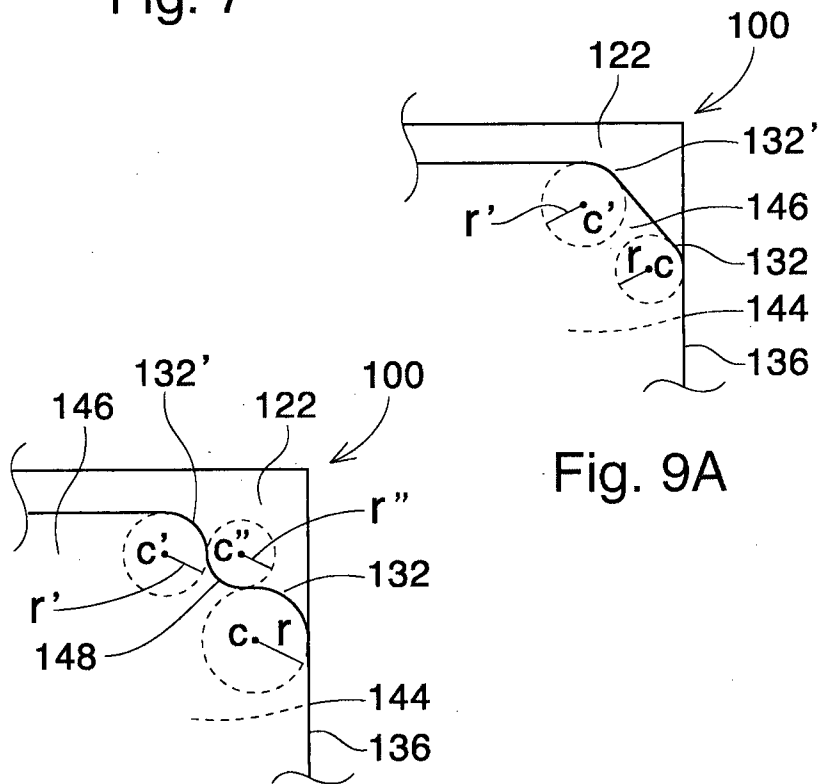


Fig. 9A

Fig. 9B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2011/000038

A. CLASSIFICATION OF SUBJECT MATTER

B65D33/16 (2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B65D33/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPLEPODOC,CNABS,CNKI: pouch, seal, sealing, edge, curved, volume, straight, jaw, autopacking

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN2446068Y (ZHONGJI PACKING MATERIAL PLANT PINGHU CITY) 05 Sept. 2001	1-3,7
Y	(05.09.2001) lines 14-26 page 1 of the description, figs. 1-2	4-6,8,13
X	US2009/0238502A1 (GAUTAM BHATTACHARJEE et al.) 24 Sept. 2009 (24.09.2009)	9-12
Y	paragraphs 7-8,23-45 of the description, figs. 1-10	4-6,8,13
Y	EP1669300A1 (AJINOMOTO CO INC) 14 Jun. 2006 (14.06.2006) paragraphs 11-37 of the description, figs. 1-3	1-13
Y	JP2002193275A (DAINIPPON PRINTING CO LTD) 10 Jul. 2002 (10.07.2002) paragraphs 21-47 of the description, figs. 1-6	1-13

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
“E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“L” document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&” document member of the same patent family
“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 29 Sept. 2011 (29.09.2011)	Date of mailing of the international search report 20 Oct. 2011 (20.10.2011)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer XU, Lingyun Telephone No. (86-10)62085775

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2011/000038

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN2446068Y	05.09.2001	NONE	
US2009/0238502A1	24.09.2009	WO2009115939A1	24.09.2009
		EP2259986A1	15.12.2010
		MXPA10010200A	31.10.2010
		CA2715820A1	24.09.2009
		CN101977825A	16.02.2011
		AR070989A	19.05.2010
		MX2010010200A	04.10.2010
EP1669300A1	14.06.2006	WO2005030596A1	07.04.2005
		US2006165927A1	27.07.2006
		JP2005514270T2	15.11.2007
JP2002193275A	10.07.2002	NONE	